AFRICA AGRICULTURE STATUS REPORT




FOCUS ON STAPLE CROPS

2013

AGRA
Growing Africa's Agriculture

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FOREWORD

The world faces a major agricultural challenge. We must, over the next few decades, find ways to deliver nutritious, safe, and affordable food to a growing global population that is projected to reach 9 billion people by 2050. Stress on our land and water, increase in soil degradation, salinization of irrigated areas, migration of youth to urban areas, climate changes, are among the many risks that are negatively affecting the agricultural production potential in many countries around the world. The need for a comprehensive solution to global food and nutritional security is urgent.

Our progress in ensuring a sustainable and equitable food supply chain will be determined by how coherently the persistent challenges are tackled. This will also determine our progress in reducing global poverty and achieving a uniquely African Green Revolution. Fortunately, Africa is endowed with abundant natural resources, including about 60% of the world's arable land, some of it still virgin land. These resources, if effectively and efficiently harnessed, could reduce the threat of food insecurity. Increased agricultural productivity, combined with viable agribusiness that adds value to farmers' production and improved access to markets, can drive broader economic growth across the continent and vastly improve food security.

In recent years, a renewed focus on agriculture has been evident in policy and development agendas across the African continent. Yet, little knowledge has been generated on the inter-linkages of research and development, agricultural production, and markets, as well as the potential for developing them. This report outlines the status of agriculture in 16 African countries, paying attention to agricultural land and labour productivity and the potential to achieve rapid growth and development on the continent. The report adopts a new thinking in agriculture, one that reflects a value chain approach. The authors cover such issues as input availability and access, the need for an enabling policy environment, and access to output markets. The report also pays special attention to the crosscutting issues of gender equity, strengthening of farmer organizations and collective action, and the need to improve access to high quality extension and advisory services.

Encouragingly, African countries are giving greater priority to agricultural development. The African Union (AU), through its New Partnership for Africa's Development (NEPAD), is providing leadership and support via NEPAD's Comprehensive Africa Agriculture Development Programme (CAADP). Through this program AU is encouraging countries to develop investment plans and to allocate at least 10% of their annual national budgets to agriculture. Clearly, recent sharp increases in international food prices are contributing to increased food import bills in the short run. However, improved performance in Africa's agriculture sector through increased public and private investment and targeted interventions can help offset those short-term effects and, over the longer term. Achieving the African Agenda of attaining an average of 6% growth rate in agriculture will not only support sustained overall economic growth, but will also open up major opportunities for African farmers in domestic, regional and international markets. We need to enhance our collective efforts to achieve both food and nutritional security in Africa and we urge all the stakeholders in agriculture to sustain the momentum through collaboration to push forward the African agriculture agenda.

Kofi A. Annan
Board Chairman

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The African Agriculture Status Report 2013, focusing on staple crops, received support and guidance from many contributors whom I acknowledge here. David Sarfo Ameyaw provided the overall leadership for the development and production of the Report. A Steering Committee comprising Aboubacar Diaby, Joseph DeVries, Augustine Langyintuo (now with IFC), Sylvia Mwichuli, Fadel Ndiame, Jane Njuguna and Marie Rarieya, coordinated the overall framework and structure of the report. The project coordinators were Jane Njuguna, Aboubacar Diaby, and Susan Ndung'u. Special thanks are extended to AGRA staff in the Monitoring and Evaluation, and Communication units for providing input as well as logistical support for production and launching of the report.

As the President of AGRA, I thank all the people who provided support in various ways.

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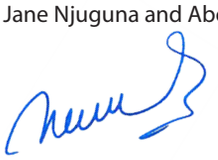


Jane Karuku
President

PREFACE

The Africa Agriculture Status Report: Focus on Staple Crops was inspired by the need to have an accessible and reliable resource depicting the status and trends of African agriculture. Given the crucial role agriculture plays in African economic growth and development, it is critical to have such a resource—compiled with current and accurate information on key indicators—as a reference when designing policies and strategies that guide future growth and development of agriculture in Africa.

The 2013 Report has taken more than one and half years to produce. During this period we consulted a number of Government Agriculture Ministries, Bureaus of Statistics, bilateral and multilateral organizations, NGOs, and other research institutions who have done extensive work and are involved in the collection and publication of relevant Sub-Saharan Africa agriculture statistical reports and data on staple crop production, distribution, and marketing. We have attempted to consolidate and condense the relevant staple crops statistical reports and data in one publication and to provide a contextual narrative to these data to inform Africa's agriculture stakeholders and decision makers.

Our aim is to produce an annual series of the *Africa Agriculture Status Report* that will provide an in-depth and comprehensive analysis of emerging issues and challenges being faced by African smallholder farmers and allow African scholars and professionals to contribute practical and evidence-based solutions. The publication also offers a platform to share relevant and current knowledge and experiences that can contribute to improving Africa's food security. The Report is also an opportunity to promote open access to Africa's agriculture data. Another complementary objective of this Report is to develop a common platform where national agricultural surveys/censuses, data from national and international research institutions, data from bilateral and multilateral funded projects and programs can be readily accessible to all the stakeholders interested in agriculture and food security in Africa.

This report is divided into two sections. The first section is a collection of comprehensive and well-focused articles on agriculture in Africa guided by the uniqueness of the African Green Revolution Concept. The topics focus on factors that trigger smallholders' agricultural transformation across the staple crop value chain; discussing factors of production, technology adoption, input-output markets, access to finance, policy environment, and institutional and human capacity building. The collection also considers partnership and leveraging of resources. The second section is a collation of both macro and micro data from 16 Sub-Saharan Africa countries that AGRA currently operates in. The micro data were provided by the ministries of agriculture and bureaus of statistics in the respective countries. The macro data came from institutions that track key indicators on a regular basis such as the World Bank and the Food and Agriculture Organization. The Report aims to foster an on-going data collection effort on key agriculture indicators that are tracked on a regular basis and reported on in subsequent publications moving forward.

The 16 countries were selected based on the size of rural population, the potential of increased production estimated by comparing average productivity with best practices in the region, the presence of key threshold conditions for a successful transformation, including existence of hard infrastructure, overall governance and leadership, and interest of other partners/donors/private sector. The rural population of these countries is estimated to represent about 60% of the rural population in Sub-Saharan Africa excluding South Africa and Sudan. These countries also reflect regional representation, and the likelihood of regional spill-over effects.

It is our hope that this first edition of the *Africa Agriculture Status Report* will be the beginning of a series of many such reports that will highlight and examine the challenges and opportunities that smallholder farmers in Africa currently face. It is also our fervent hope that the featured topics will contribute to the solutions and innovations needed to trigger the unique approaches and methodologies contextualized in Africa for Africans to achieve a uniquely African Green Revolution. We will continue to improve and expand the scope of the macro and micro data coverage and the countries and regions represented in Sub-Saharan Africa as we move forward in subsequent publications and as data become available. We welcome collaborators and contributors to future publications.

Dr. David S Ameyaw
Director, Strategy, Monitoring and Evaluation
Alliance for a Green Revolution in Africa (AGRA)

ACRONYMS

ADI	Africa Development Indicators
ADP	Agro-dealer Development Program
AECF	Africa Enterprise Challenge Fund
AFAAS	African Forum for Agricultural Advisory Services
AFAP	African Fertilizer Agribusiness Partnership
AFnet	African Network for Biological Management of Soil Fertility
AFORNET	African Forestry Research Network
AFRICRES	Africa Investment Climate Research
AfSIS	Africa Soil Information Service
AGOA	African Growth and Opportunity Act
AGRA	Alliance for a Green Revolution in Africa
AICAD	African Institute for Capacity Development
AIS	Agricultural Innovation System
ANAFE	African Network for Agriculture, Agroforestry and Natural Resources
ARPPIS	African Regional Postgraduate program in Insect Science
ASARECA	Association for Strengthening Research in Eastern and Central Africa
ASTI	Agriculture Science and Technology Indicators
AU	African Union
AusAID	Australian Agency for International Development
AUC	African Union Commission
BioEARN	Eastern Africa Regional Programme and Research Network for Biotechnology
BWFCU	Becho Woliso Farmers' Cooperative Union
CAADP	Comprehensive Africa Agricultural Development Programme
CFC	Common Fund for Commodities
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Center for Tropical Agriculture
CIDA	Canadian International Development Agency
CIP	International Potato Center
CMAAE	Collaborative Master's Program in Agricultural and Applied Economics
COMESA	Common Market for Eastern and Southern Africa
DAAD	German Academic Exchange Service
DFID	Department for International Development
DUS	Distinctness, Uniformity and Stability
EACI	Education for African Crop Improvement
EAGC	Eastern Africa Grain Council
EAPGRTC	East African Plant Genetic Resources Training Consortium
EASCOM	Eastern Africa Seed Committee
ECA	Eastern and Central Africa
ECOWAS	Economic Community of West African States
ECX	Ethiopia Commodity Exchange
EFSA	European Food Safety Authority
EU	European Union
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FARA	Forum of Agricultural Research in Africa
FDI	Foreign Direct Investment
FFS	Farmer Field Schools
FIACC	Fund for the Improvement and Adoption of African Crops
FOSCA	Farmer Organizations Support Centre in Africa

FTE	Full Time Equivalent
GDP	Gross Domestic Product
GEM	Gender Entrepreneurship Markets
GFRAS	Global Forum for Rural Advisory Services
GM/GMO	Genetically modified
GOR	Government of Rwanda
IAC	Inter Academy Council
IARC	International Agriculture Research Centers
IAU	International Association of Universities
ICT	Information Communication Technology
IFAD	International Fund for Agriculture Development
IFC	International Finance Corporation
IFDC	International Fertilizer Development Center
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILO	International Labour Organization
ISFM	Integrated Soil Fertility Management
ISTA	International Seed Testing Association
JSE	Johannesburg Stock Exchange
KACE	Kenya Agricultural Commodity Exchange
KARI	Kenya Agricultural Research Institute
KDGCBP	Kenya Dairy Goat and Capacity Building Project
KENFAP	Kenya National Federation of Agricultural Producers
KIRSAL	Kenya Incentive- Based Risk Sharing System for Agricultural Lending
LBC	Licensed Buying Company
MDG	Millennium Development Goal
MIS	Market information systems
MSc	Master of Science
NAMC	National Agricultural Marketing Council
NARI	National Agricultural Research Institutes
NARS	National Agricultural Research Systems
NCPB	National Cereals and Produce Board
NEPAD	New Partnership for Africa's Development
NGOs	Non-Governmental Organizations
NPT	National Performance Trial
NRI	Natural Resources Institute
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
OSCA	One Stop Centre Association
PASS	Program for Africa's Seed Systems
PhD	Doctor of Philosophy
PVP	Plant Variety Protection
R&D	Research and Development
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SACAU	Southern African Confederation of Agricultural Unions
SACCO	Savings and Credit Cooperative
SADC	Southern Africa Development Community
SAFE	Sasakawa Africa Fund for Extension Education
SAFEX	South Africa Futures Exchange
SAP	Structural Adjustment Program
SARUA	Southern Africa's Regional University Association
SEPA	Seed Production for Africa
SIDA	Swedish International Development Cooperation Agency
SSSN	SADC Seed Security Network

UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPOV	Union for the Protection of New Varieties of Plants
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WFP	World Food Programme
WRS	Warehouse receipt systems
WSSD	World Summit on Sustainable Development
ZIMACE	Zimbabwe Agricultural Commodities Exchange
ZNFU	Zambia National Farmers Union

CHAPTER 01
INTRODUCTION

By Willis Oluoch- Kosura, University of Nairobi

Background

Agriculture in Sub-Saharan Africa still provides a relatively large share of the gross domestic product (GDP), but productivity in the sector lags considerably behind that of other continents, as well as the region's potential. On average, about 65% of Africa's labor force is employed in agriculture, yet the sector accounts for about 32% of GDP, reflecting relatively low productivity. Africa's rural population, therefore, has been unable to move out of poverty principally because of inability to transform their basic economic activity—agriculture—to high productivity levels. Because of its contribution to the economy, the agriculture sector's poor performance is one of the major barriers to development on the African continent. Some formidable challenges in Sub-Saharan Africa have contributed to erratic agricultural growth patterns. Several studies have noted that meeting the target of the Millennium Development Goals (MDGs) requires consistent and broad-based growth (with agriculture taking the lead), accompanied by dramatic improvements in infrastructure, governance, and other social indicators.

Agriculture remains the key sector for food security, employment, and growth, despite diversified agroecological zones, production, and consumption patterns. Agriculture-led growth has the largest impact on reducing the depth and breadth of poverty (International Food Policy Research Institute [IFPRI], 2012), and focusing on staples is justified because food staples have strong growth linkages. Export crops may have higher value and growth potential. But initially, before the value chains develop, food crops are more effective for economy wide growth and poverty reduction. Growth in food staples is considered generally to be pro-poor. Africa's big development agenda is to achieve an agriculture sector annual growth rate of at least 6% and meet the time-bound targets set in the MDGs. This agenda will not be achieved if there is no rapid agricultural transformation through increased productivity, income growth, and competitiveness with good natural environment stewardship for sustainable development.

The purpose of this report is to provide a synthesis of the current status and trends of African agriculture to agriculture development practitioners, national and international organizations, non-governmental organizations (NGOs), and other stakeholders in one volume. The goal is to highlight insights gained from experiences in the diverse agricultural landscapes in Africa and act as a platform for engagement for all stakeholders within the agriculture sector in Sub-Saharan Africa. In this manner, stakeholders can address the key areas that require scaling-up and replication, as well as the types of interventions and level of investment support the agriculture sector requires fulfilling Africa's Green Revolution objectives and in the region's development agenda.

In considering the agenda, attention should be given to:

- Investment in people, infrastructure, incentive structures, technologies, input and product markets, weak institutions, financial and credit markets, and production uncertainties and risks
- Measures to empower farmers—especially women—to exploit the powerful value chains of globally integrated markets (i.e., addressing supply and demand constraints)
- Innovative institutional arrangements that offer adequate access to markets and productive resources

This publication is designed to be comprehensive in addressing the immediate priorities and laying the foundations for further development of Africa's agriculture sector. It focuses on the status and trends of the following key areas in agriculture:

- Productivity, growth, and competitiveness
- Policies and research
- Use of factors of production
- Markets
- Cross-cutting issues

Methodology

Existing data from World Development Indicators, Food and Agriculture Organization of the United Nations (FAO), Agriculture Science and Technology Indicators (ASTI)/ International Food Policy Research Institute (IFPRI), and relevant secondary information from the literature on Sub-Saharan Africa and national agriculture surveys were used. Descriptive statistics and trend analyses were used to describe the agriculture status in 16 selected countries.[1] In addition, the report presents, where appropriate, some case studies that can shed light on the status of agriculture in the individual countries.

This report covers Sub-Saharan Africa as a whole, but with particular attention to Burkina Faso, Ethiopia, Ghana, Kenya, Liberia, Mali, Malawi, Mozambique, Niger, Nigeria, Sierra Leone, Rwanda, South Sudan, Tanzania, Uganda, and Zambia (Figure 1).

Countries in the region pursue a wide range of crop and livestock enterprises that vary across and within the major agroecological zones. Food production and food security depend on many different production systems. While acknowledging the importance of livestock in the agricultural and rural economies of the region,[2] this report focuses largely on staple crop production. Table 1 gives the major crops grown in 15 of the 16 countries. South Sudan is missing due to unavailability of data.

[1] The 16 countries are the ones in which the Alliance for a Green Revolution in Africa (AGRA) currently operates.
[2] Livestock play a vital role in the agricultural and rural economies of the developing world, producing food directly and providing key inputs to crop agriculture.

FIGURE 1. MAP OF AFRICA SHOWING THE 16 SELECTED COUNTRIES HIGHLIGHTED IN THIS REPORT

Key

1 Kenya
2 Ethiopia
3 Tanzania
4 South Sudan
5 Mozambique
6 Uganda
7 Malawi
8 Zambia
9 Burkina Faso
10 Niger
11 Mali
12 Nigeria
13 Ghana
14 Sierra Leone
15 Liberia
16 Rwanda

TABLE 1. MAJOR CROPS IN SELECTED COUNTRIES

COUNTRY	MAJOR CROPS PRODUCED (CEREALS)
Burkina Faso	Sorghum, millet, maize, rice
Ethiopia	Teff, maize, wheat, barley, sorghum, millet, oats
Ghana	Rice, cassava
Kenya	Maize, wheat, rice
Liberia	Rice, cassava
Malawi	Maize, potatoes, cassava, sorghum
Mali	Millet, rice, maize
Mozambique	Cassava, maize
Niger	Millet, sorghum, cassava , rice
Nigeria	Maize, rice, sorghum, millet, cassava, yams
Rwanda	Sorghum, potatoes
Sierra Leone	Rice
Uganda	Cassava, potatoes, maize, millet
Tanzania	Maize, wheat, cassava
Zambia	Maize, sorghum, rice

Source: The World Fact Book (https://www.cia.gov/library/publications/the-world-factbook/).

The importance of the crops in the food security needs of the population in each of the countries varies, according to the cultural underpinnings of their consumption patterns.

Of all the commodities, cereal grains—including sorghum, millet, rice, and maize—form an important component of crop production in these countries. Production of cereal grains has been increasing for the most part as more and more lands are cleared for agriculture (i.e., area expansion). However, as the population grows, greater attention will need to be shifted to agricultural intensification and real progress will be revealed via increased agricultural yields. For that reason, production discussions in this report are focused on agricultural yields of the most important crops produced in the 16 countries.

Organization of the Report

The report gives a synopsis of the agricultural outlook to drive home the key messages. It is divided into two parts. The first part comprises of 13 chapters: **Chapter 01** – Introduction; **Chapter 02** – Agricultural Productivity, Growth, and Competitiveness; **Chapter 03** – Securing Land for Agricultural Production; **Chapter 04** – Improving Soil Health in Africa: Challenges and Promising Solutions; **Chapter 05** – Status of Seed Systems Development in Sub-Saharan Africa; **Chapter 06** – Financing African Agriculture: An Imperative for Inclusive Innovative Financing; **Chapter 07** – Transforming African Agriculture by Improving Output Markets; **Chapter 08** – Enabling Policy Environment; **Chapter 09** – Farmers' Organizations as Key Actors in Agricultural Development; **Chapter 10** – Capacity Development in Agriculture in Africa; **Chapter 11** – The Role of Women In Africa's Smallholder Agriculture: Status, Trends, and Opportunities; **Chapter 12** – Extension and Advisory Services for Facilitating Sharing of Agricultural Innovations; **Chapter 13** – Conclusion. The second part comprises a narrative on the status of agriculture statistics and data on key agriculture indicators.

"The importance of agriculture to Africa's economic development has never been so widely accepted. And there is consensus on what smallholder farmers need to succeed: supportive policies, access to better seeds, fertilizers, markets, finance, and extension support; effective national research systems, and better rural infrastructure."

Jane Karuku
President
Alliance for a Green Revolution in Africa (AGRA)

CHAPTER 02

AGRICULTURAL PRODUCTIVITY, GROWTH, AND COMPETITIVENESS

By Willis Oluoch- Kosura, University of Nairobi; and Geophrey Sikei, EfD-Kenya

Main Drivers of Trends in African Agriculture

Agricultural productivity, growth, and competitiveness are the products of physical environmental, technology, policy, and micro- and macroeconomic factors pertaining to each country. The external factors such as world prices of inputs and outputs, and internal trade policies within countries in international markets also play a part. The way these factors are managed influences the performance of the agriculture sector. The supply and demand factors for the various agricultural outputs, especially food, are crucial in the African context.

Agricultural Production

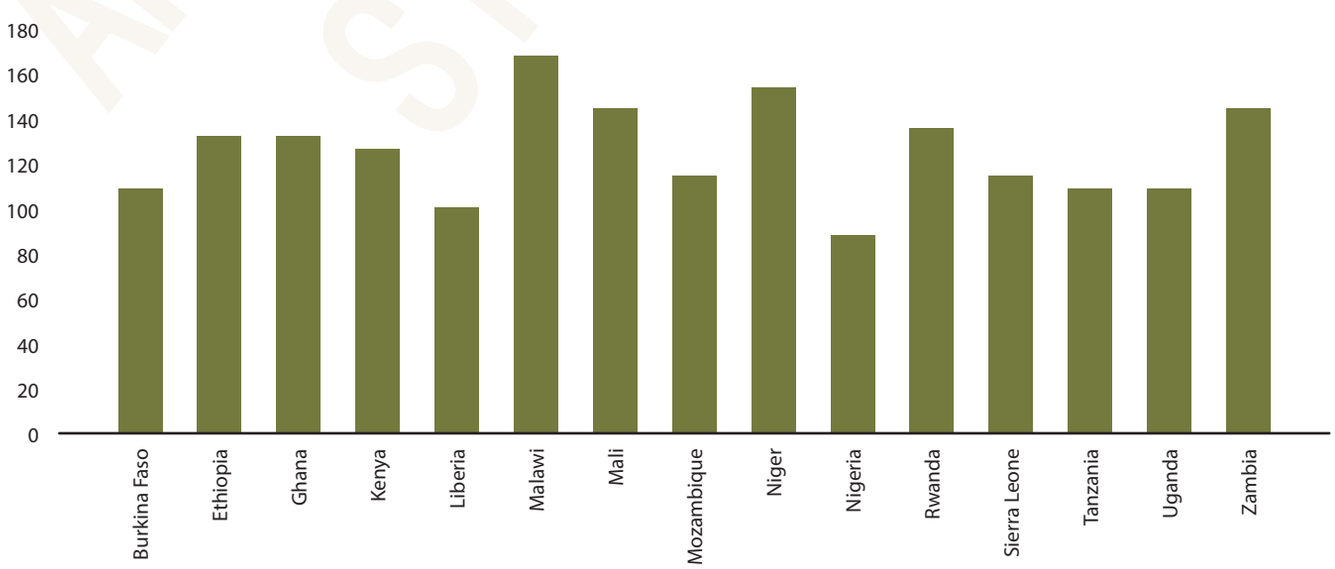
Productivity of Sub-Saharan Africa agriculture depends on climate; efficient and effective use of the factors of production (farmland, water, and labor); agricultural inputs (fertilizers, irrigation, seeds, and capital equipment); and farmers' skills. The region's agriculture involves diverse crops and livestock but productivity is particularly important for cereals and starchy roots, which provide two-thirds of the total energy intake for the population (three-quarters for the poor) (Diao, Thurlow, Benin, & Fan, 2012).

According to the Africa Human Development Report 2012 (United Nations Development Programme [UNDP], 2012), more than 75% of cereals and almost all root crops come from domestic agriculture and not imports. Farm incomes continue to be crucial to the survival of the 70% of the extremely poor population living in rural areas. This is because rural non-farm activity (accounting for 30%–40% of earnings) tends to prosper when farm incomes are rising. As in the rest of Sub-Saharan Africa, nearly two-thirds of the economically active populations in the selected countries are involved in agriculture; in some countries, such as Burkina Faso, that proportion exceeds 90%.

Data obtained from national statistics offices in the selected countries depict erratic cereal production patterns—plausibly due to overreliance on the natural weather and low adoption of technology. With the exception of Nigeria, most countries recorded steady increases in cereal production. This can be attributed to the numerous productivity-enhancing initiatives, such as increased use of agricultural inputs, modern farming techniques, and reduced market inefficiencies. The huge growth potential of the region's agriculture is continuing to attract the private sector. Public–private partnerships are emerging to mobilize new resources and develop new agricultural technologies throughout the agricultural value chains.

Agricultural output has increased steadily over the past decade. This appears to be in line with FAO projections, also indicating that output trends are likely to continue into the next decade, reflecting the potential for further gains in productivity (Fuglie & Rada, 2011). Figure 2 shows the cereal production index for the 15 AGRA countries in 2010 (South Sudan is missing due to unavailability of data).

FIGURE 2. AGRICULTURAL PRODUCTION INDEX FOR CEREALS, 2010



Source: Africa Development Indicators (ADI) http://data.worldbank.org/

Countries whose agricultural production indices have shown steady increases include Kenya, Ghana, Mali, Tanzania, Uganda, Zambia, and possibly Mozambique. Other countries, including Sierra Leone and Liberia, experienced reversals in agricultural production correlated with periods of civil unrest or macroeconomic mismanagement.

Grain output in 2011 fell below the bumper crop of 2010 as several countries—including Angola, Burkina Faso, Chad, Madagascar, Mali, Niger, and South Sudan—had below-average production (United States Department of Agriculture [USDA], 2012). Historically, countries including Liberia, Rwanda, Niger, Ethiopia, and Sierra Leone have suffered low production levels due to political instability. However, following the introduction of stable governments, they have experienced stable production patterns. Notably, Ethiopia has more than doubled its domestic grain production (from 8 million metric tons in 2000 to 15.6 million metric tons in 2010) and is now Sub-Saharan Africa's second largest grain producer behind Nigeria (USDA, 2012). Kenya, on the other hand, in the past decade has witnessed slow growth in its grain output, which has even declined in per capita terms due to frequent droughts. Production growth, however, is projected to accelerate over the coming years, triggered by stronger yields. Increasingly, Kenya has relied on imports to satisfy its food needs; in the early 2000s grain imports accounted for about 27% of grain supplies, but this has jumped to more than 40% (Chauvin, Mulungu, & Porto, 2012).

Yields and Yield Gaps

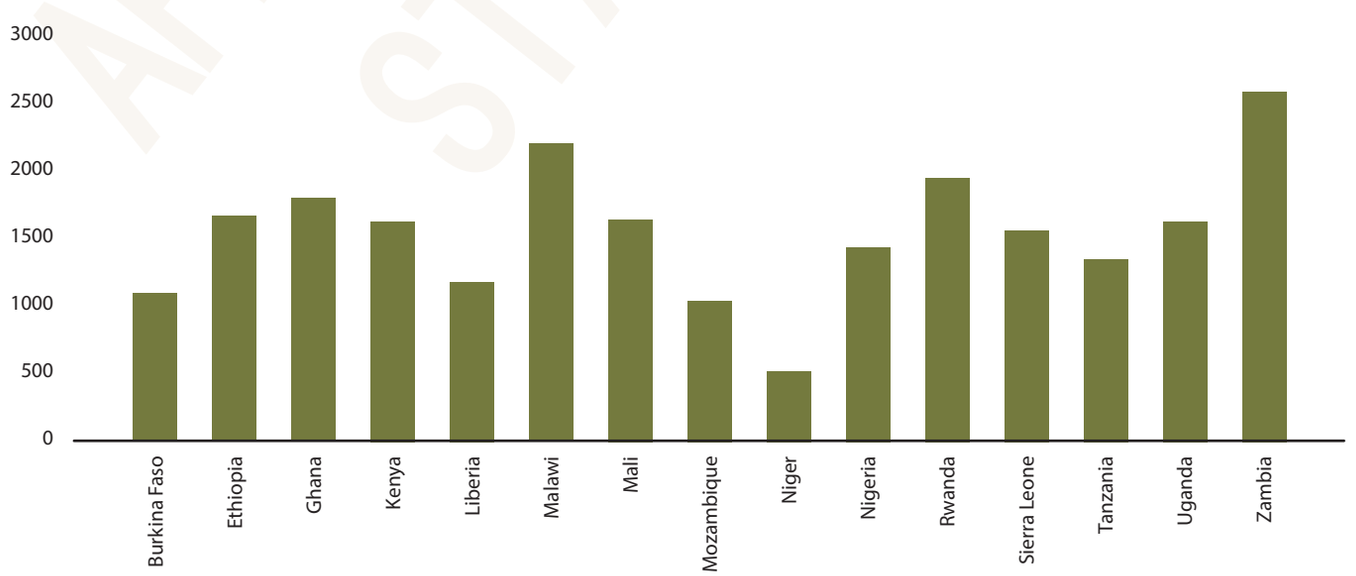
Cereal yields have recorded steady increases in the past 10 years. Figure 3 shows the average yield in the selected Sub-Saharan African countries.

Though there are increasing cereal yield trends in most Sub-Saharan Africa countries, these yield levels remain low compared to other regions of the world (Chauvin, et al., 2012).

Generally, cereals and pulses are important food and cash crops for farmers and rural households in Sub-Saharan Africa. Despite the economic and food-security importance of these crops, several studies suggest a yield gap. The smallholder farm yields fall short of the estimated potential for most food crops (cereals and pulses). In addition, prices of these commodities fall between import and export parity prices, limiting their international trading prospects.

The average grain yields remained at around one-third to one-half of the world's average (1.1–1.5 metric tons per hectare verses 3.2 metric tons per hectare) between 2000 and 2010. Only Mozambique and Niger recorded average grain yields of less than 1 metric ton per hectare. Zambia and Malawi had the highest average yields, about 2 metric tons per hectare during the period 2008–2010. Plausible explanations for the low yields include lack of access to quality resources such as water, inputs and low use of new technologies that require money—such as fertilizer, machinery, and irrigation technology. The development

FIGURE 3. CEREAL YIELDS (KG/HA) IN SELECTED COUNTRIES, 2010



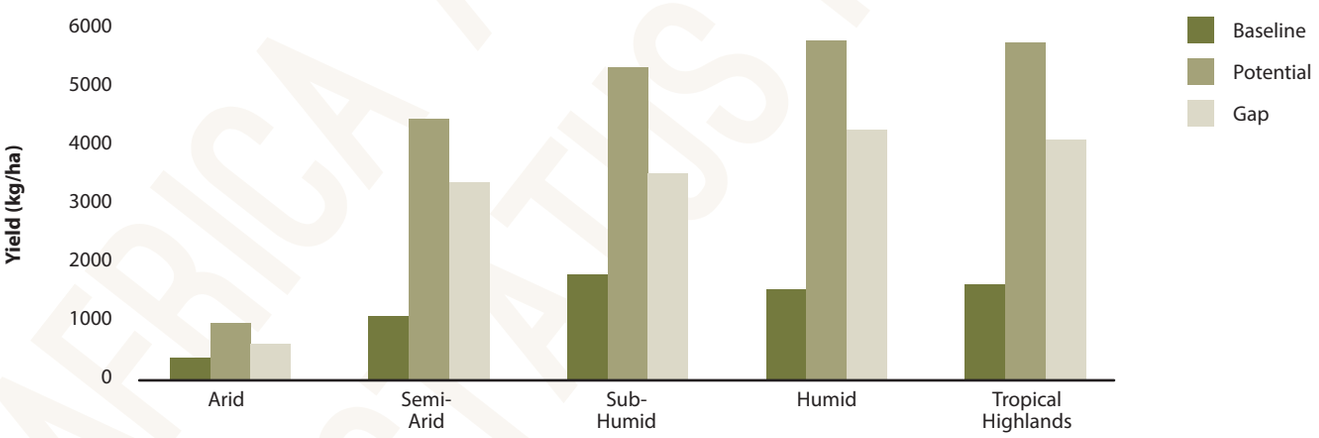
Source: Africa Development Indicators (ADI) http://data.worldbank.org/

and dissemination of new technologies and practices that increase yield potential for a particular area depend on a country's ability to make needed investments and farmers' skills and willingness to adopt the technologies. Technology adoption also depends on land characteristics such as soil quality and access to water, and other factors such as land tenure, income/wealth, access to credit, and access to output markets (USDA, 2012).

Evidently, the potential to experience a two- to threefold yield increase for some of the basic food staples in Sub-Saharan Africa is enormous if more farmers can access and efficiently use the available stock of knowledge and productivity-enhancing technologies. Nin-Pratt et al. (2011) observed there is vast potential to expand agricultural production. Yield gap for most crops could be reduced by appropriate use of improved crop varieties; recommended application levels of appropriate fertilizers; and adequate management of nutrients, water, pests, and diseases.

Yield improvements of the various cereals have been hampered by low technology adoption; poor rural infrastructure development, in particular roads and irrigation; high prices for fertilizers; and a host of climatic and demographic factors. The extent to which farmers have addressed these factors is what determines the level of yield gaps for the crops at the farm level. Sub-Saharan Africa displays the greatest gaps between potential yields and realized yields for a number of crops, particularly maize and rice (Licker et al., 2010; Neumann, Verburg, Stehfest, & Muller, 2010). Figure 4 shows the size of maize yield gaps in different agroecological zones in Sub-Saharan Africa. The humid areas seem to have the largest gaps while the arid areas have the smallest. In the arid and semi-arid areas, lack of water, soil loss, and land degradation are among the causes of low productivity. As such, these areas generally are considered unsuitable for cereal production.

FIGURE 4. MAIZE YIELD GAPS BY AGROECOLOGICAL ZONE IN SUB-SAHARAN AFRICA

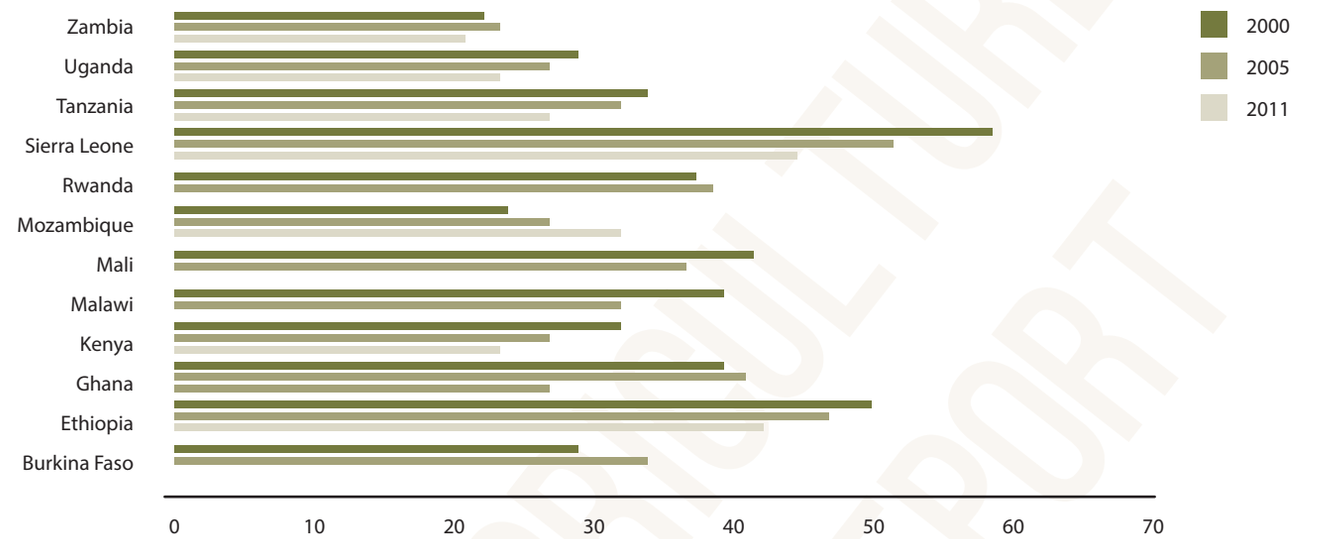


Source: Pingali, Gingerich, & Wood (2010).

Agricultural GDP Trends

The contribution of agriculture to the GDP of countries in Sub-Saharan Africa countries varies widely but relatively predictably, with the relative importance of agriculture declining as GDP per capita increases and the economies undergo structural transformations. Data available for 12 of the 16 countries (Figure 5) shows that agriculture accounts for 25%–40% of total GDP, though this share has been declining over the past decade. For example, the agriculture value added (% of GDP) for a few countries, including Kenya, Uganda, Zambia, and Nigeria, shows a declining trend—29.03% to 23.13%, 26.15% to 23.42%, 22.57% to 20.72%, and 42.71% to 32.71%, respectively—from 2000 to 2011 (ADI).

FIGURE 5. AGRICULTURE VALUE ADDED OF SELECTED COUNTRIES (% OF GDP)



Source: Africa Development Indicators (ADI) http://data.worldbank.org/

Agricultural GDP Growth

Despite the obvious challenges facing Sub-Saharan African countries with respect to agricultural productivity, recent successes recorded in Kenya, Malawi, Zambia, Uganda, Tanzania, Ethiopia, Mali, Burkina Faso, among other countries, have shown it is possible to achieve sustained agricultural growth in Sub-Saharan Africa (Figure 6). This growth is attributable to several factors, as noted by Binswanger-Mkhize, Byerlee, McCalla, Morris, & Staatz (2011). First, price incentives for producers have improved as a result of unified exchange rates, lower industrial protection, and sharply reduced export taxation. Second, the higher international commodity prices are creating growing opportunities for import substitution and regional agricultural trade. Finally, African governments, the regional institutions, and development partners are showing strong commitment to agricultural and rural development. Regional governments, through the Comprehensive Africa Agriculture Development Programme (CAADP) Maputo Declaration in 2003, pledged to achieve 6% annual growth rate of agriculture productivity as Public Agricultural Expenditure (PAE) increased from the then typical level of about 4%–5% to 10%. Figure 6 shows the real agricultural GDP growth achieved by selected countries in 2010. Kenya, Tanzania, and Uganda were below the 6% target, whereas Zambia, Mozambique, Malawi, Liberia, and Ethiopia experienced growth rates higher than the target.

Because Sub-Saharan African countries are heavily dependent on agriculture, the sector has a positive relationship to national GDP, to the extent that the growth of a country's GDP and that of its agriculture sector have tended to follow similar patterns. This is depicted in Figure 7; a higher growth rate in the agriculture sector triggers a higher growth rate in GDP.

Science, Technology, and Innovation

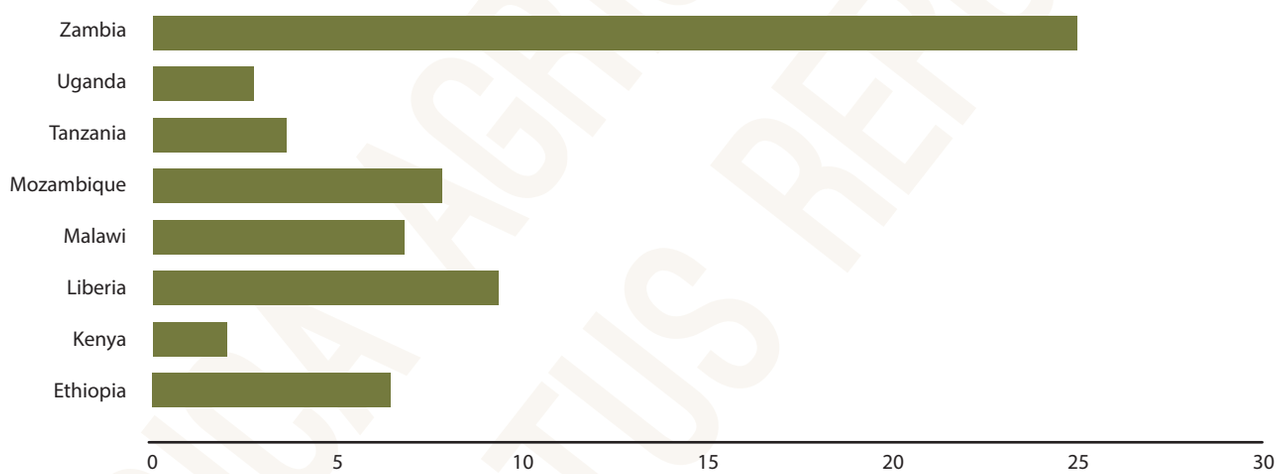
It is evident from literature that agriculture will remain important for food security in Africa. At the same time, building productive capacities in agriculture and identifying linkages between agriculture and other sectors will be important to support sustainable economic development in the countries. The onus, therefore, lies in the identification and support of processes and linkages that promote technological change, productivity increases, and innovation. In fact, the role of innovation and technology development has increased substantially over the past decade. Rwanda, which used to rely mainly on subsistence farming, is investing in improved agricultural techniques, developing centers of science and technology,

and attempting to move up the value chain in terms of the quality and certification of such products as coffee and tea. Likewise, Kenya's technological advancement spreads across enterprise clusters ranging from cut flowers, to auto parts, and to information and communication technology (ICT). In Uganda, technology is having a considerable impact on aquaculture and organic farming.

Despite the success of technological advancement in those countries, numerous limitations still persist. Poor infrastructure and lack of human skills and institutions to support the use of technology are important factors in explaining the relatively slow progress in countries such as Sierra Leone, Liberia, Niger, Mali, and Burkina Faso, among others. The status of capacity building efforts for agricultural development is discussed in Chapter 7.

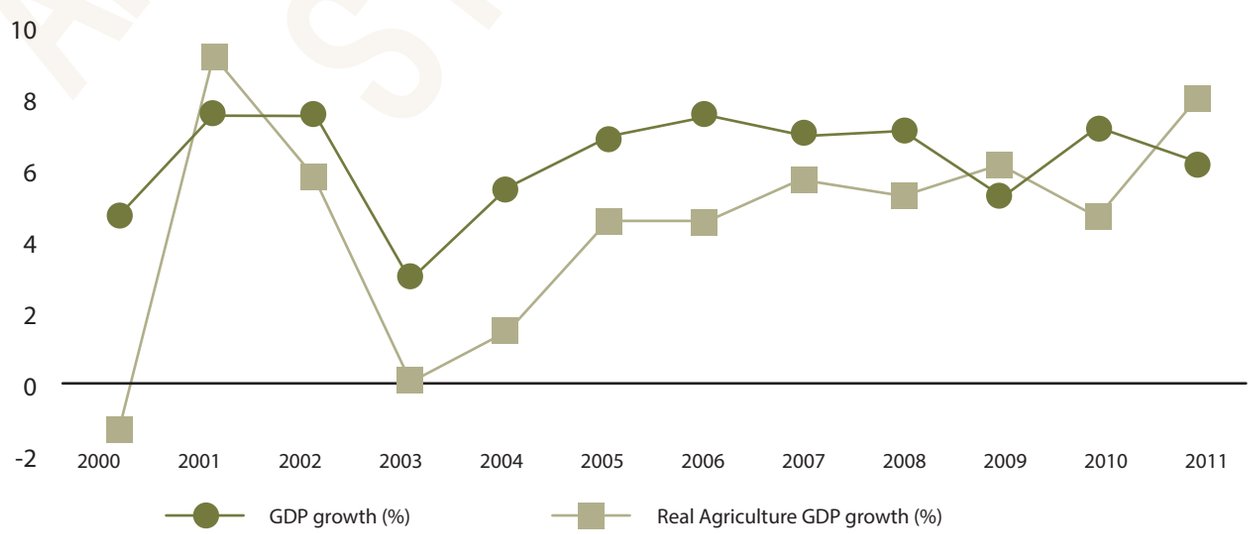
Individual countries have variations in their efforts toward agricultural research and development (R&D) and staffing. Generally, the past few years have witnessed a marginal increase in resources devoted to research. Figure 8 shows the trend of public agricultural R&D expenditures as a percentage of agricultural GDP for selected countries. While Sub-Saharan Africa appears to have done relatively well, devoting about 1% of agricultural GDP to R&D, most of the selected countries are spending below that average.

FIGURE 6. REAL AGRICULTURAL GDP GROWTH RATES IN SELECTED COUNTRIES, 2010



Source: Africa Development Indicators (ADI) http://data.worldbank.org/

FIGURE 7. GDP AND REAL AGRICULTURAL GDP GROWTH RATES IN SELECTED COUNTRIES, 2000–2011



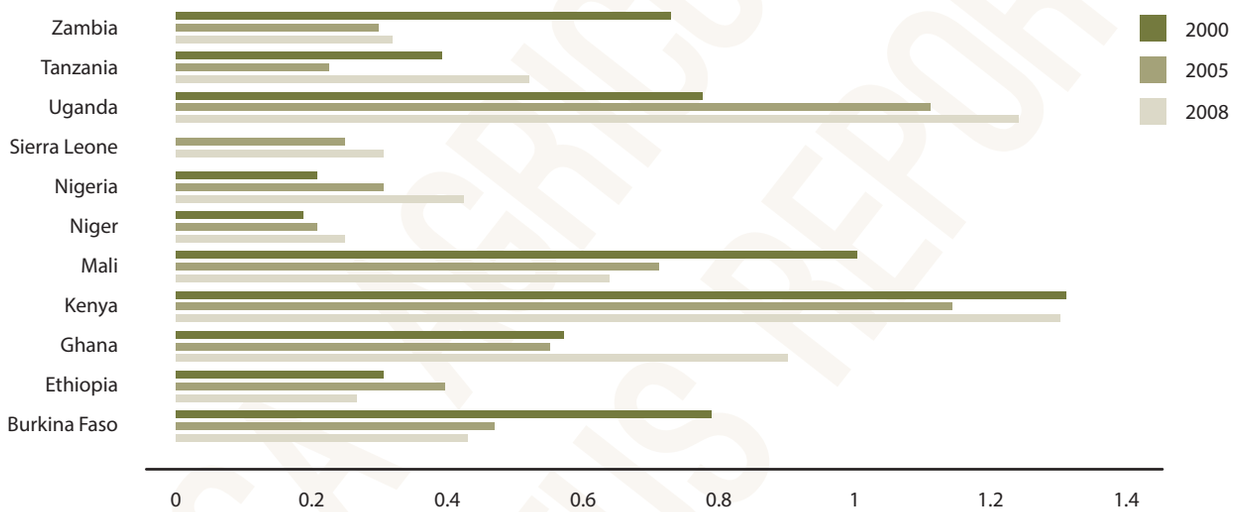
Source: Africa Development Indicators (ADI) http://data.worldbank.org/

However, Kenya and Uganda consistently spend more than 1% of their GDP on agricultural R&D.

There is a need to pay attention to shifting the expenditure pattern for R&D, because achieving the desired productivity and growth in agriculture will hinge on the increased outputs of R&D. Increasing the budget allocation to R&D by each country to attain at least 1% of agricultural GDP is recommended.

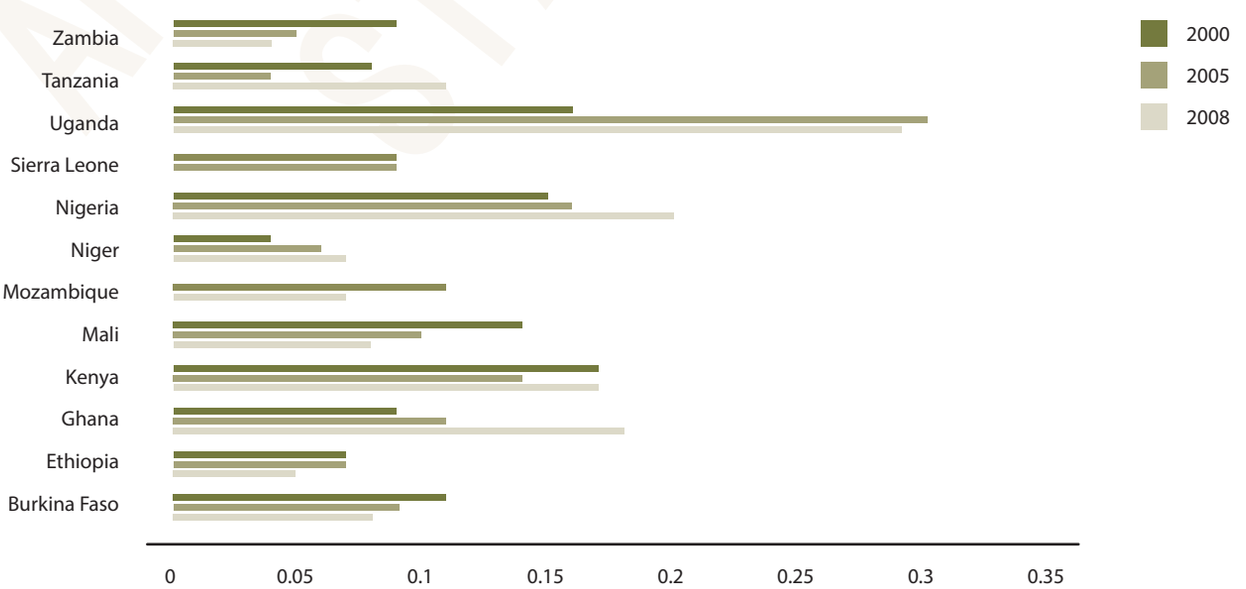
Other indicators of levels of investment and capacity for research in Africa are shown in Figures 9 and 10. Figure 9 shows the trend in agricultural R&D spending per researcher in millions 2005 PPP US$[3] while Figure 10 shows the agricultural R&D spending per million population for selected countries from 2000 to 2008. The R&D per researcher is generally low, between US$0.12 and US$0.14 million.

FIGURE 8. PUBLIC AGRICULTURAL R&D EXPENDITURES AS PERCENTAGE OF AGRICULTURAL GDP



Source: ASTI/IFPRI (n.d.).

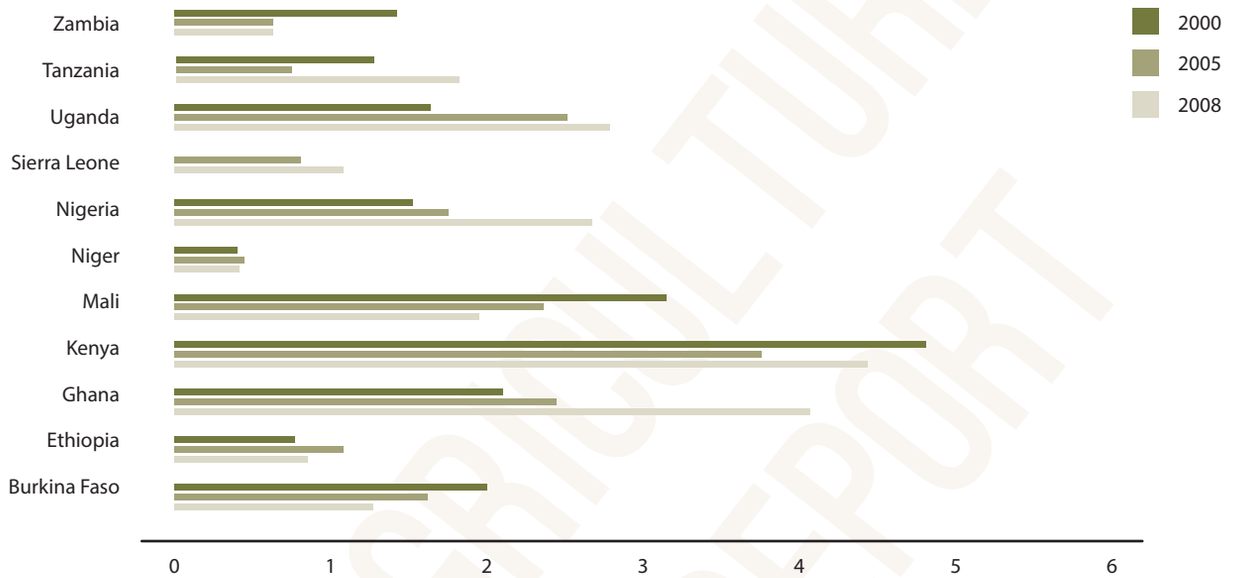
FIGURE 9. AGRICULTURAL R&D SPENDING PER RESEARCHER (MILLION 2005 PPP US$) IN SELECTED COUNTRIES



Source: ASTI/IFPRI (n.d.)

[3] Purchasing power parity.

FIGURE 10. AGRICULTURAL R&D SPENDING PER MILLION POPULATION (MILLION 2005 PPP US$) IN SELECTED COUNTRIES

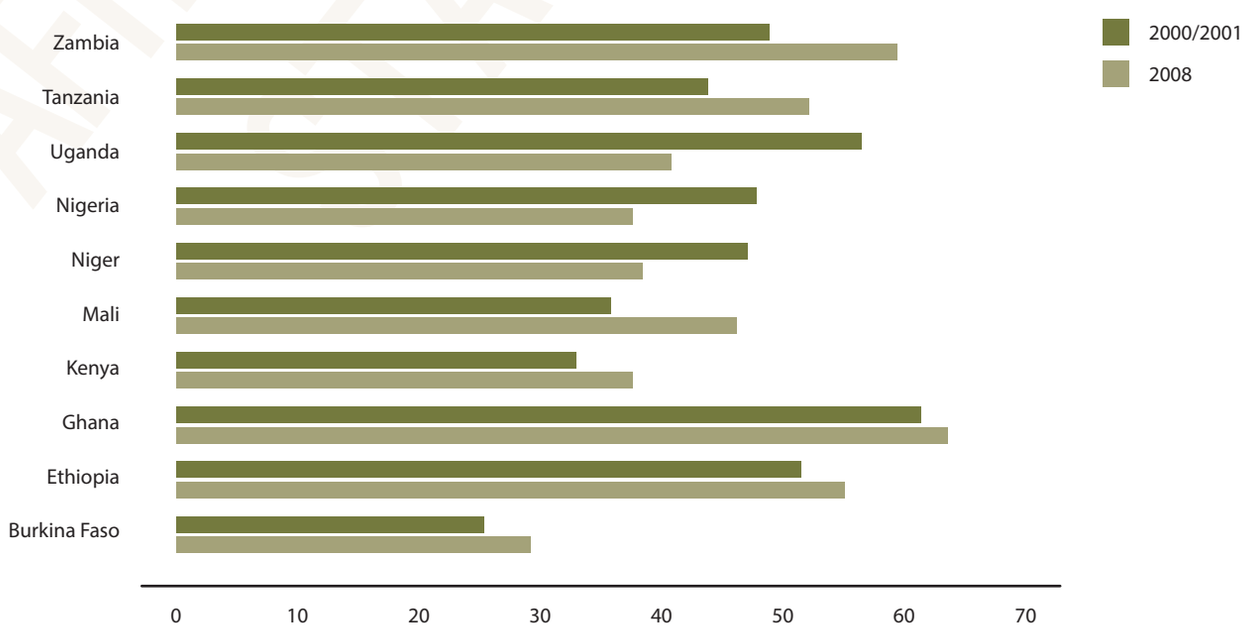


Source: ASTI/IFPRI (n.d.).

The trend for agricultural R&D spending per million population is similarly low for most of the countries, varying from US$1.5 million to US$2.4 million. Although there has been evidence of increases in the recent past, sustained and increasing levels of per capita spending in R&D are necessary to boost the agricultural intensification to achieve the desired African Green Revolution.

Figure 11 shows a steady increase in the share of crop research. This share increased in 7 out of 10 selected countries between 2000/2001 and 2008. In 2008, Ghana, Ethiopia, and Zambia dedicated more than 50% of their agricultural research expenditures to crop research. However, for three of the selected countries (Nigeria, Niger, and Uganda) the ratio decreased over the same period.

FIGURE 11. SHARE OF CROP RESEARCH IN TOTAL AGRICULTURAL RESEARCH EXPENDITURE



Source: ASTI/IFPRI (n.d.).

Value Chain Approach for Development

Many agricultural development initiatives in Africa are now supporting value chain approaches. As countries industrialize and seek to strengthen their positions in global markets, modern agricultural value chains grow and become more sophisticated. In nearly all the countries, the private sector is involved in driving the value chains, with the public sector just providing supportive roles. Of particular concern, though, has been how to ensure that scaled-up chains benefit the rural population, especially women involved in primary production. Most chains typically favor better-off farmers, processors, and traders while poor actors get squeezed out (Hartmann, 2012). The selected countries, with the exception of Sierra Leone, Liberia, Niger, and Mali, have well-developed value chain systems for different agricultural commodities. Kenya, for instance, has one of the best horticultural value chains in the region, which has enabled it become a major player in the global market. Kenya's success mainly hinges on market segmentation, servicing niche markets, and investing in marketing (Webber & Labaste, 2010). Such best practices should be scaled up or replicated to guarantee growth, competitiveness, and prosperity.

CASE STUDIES: BOX 1

KENYA:
A Farmgate-to-Consumer Value Chain Analysis of a Maize Marketing System

Maize is the most important cereal crop in Kenya. It forms an important part of the food and feed system and contributes significantly to income generation for rural households. The movement of maize grain from the farm gate to the consumer involves a series of stages. Production comes mainly from small- and large-scale farmers. For the small-scale farmers, their produce is sold mainly to small-scale assemblers or brokers, who collect and bulk product for onward sale to large wholesalers with buying depots in the towns of major production areas. Large-scale farmers sell both to wholesale traders and the National Cereals and Produce Board (NCPB). Large-scale millers are the next major link in the chain, buying grain primarily from the large wholesalers, NCPB, and smaller traders. The large-scale millers sell mainly to a decentralized system of informal retailers (street kiosks, dukas, multipurpose retail shops, and traditional retail markets); and, to a lesser extent, to the higher-end consumers who shop at supermarkets. Posho millers who operate in retail markets are important players in some areas. Consumers buy grain and pay a fee to custom-mill their grain into posho meal. This option provides the means to produce maize meal relatively inexpensively and is preferred by the urban poor and most rural households, especially in the western parts of the country. The maize value chain has been characterized by three major challenges. First is the classic food price dilemma — how to keep farm prices high enough to provide production incentives for farmers while at the same time keeping them low enough to ensure poor consumers' access to food. Second is how to deal effectively with food price instability, which is identified frequently as a major impediment to smallholder productivity growth and food security. Third, in attempting to cope with these interrelated challenges, policy makers grapple with issues of the appropriate role of the state in marketing and pricing, as well as the extent to which variable import tariffs and trade controls can promote the achievement of national policy objectives.

Source: Kirimi et al., (2010)

NIGERIA:
Cassava value chain analysis

Cassava is one of the most important crops for Nigerian farmers; it is the most widely cultivated crop in the country and provides food and income to more than 30 million farmers and large numbers of processors and traders. From the producers, the raw cassava is either purchased by the consumers directly or sent to the processors for value chain addition via private collectors or cooperatives and even by the farmer and/or households. Traders in turn collect processed products from rural markets and transport to rural, semi-urban, and urban markets for sales. Medium-

and large-scale processors collect raw produce and products to further process and refine for industrial and export markets. The cassava value chain is plagued by numerous challenges including: (1) low productivity, which leads to high cost per unit of production; (2) little or no use of fertilizers in production and manual-labor farming; and (3) inelastic markets leading to wide price swings every other harvest time, based on the absence of minimum price guarantee schemes by the government. Other challenges are policy inconsistencies; for example, a lack of enforcement of the 10% inclusion of cassava flour in bread flour has left two large and hundreds of small processors with unsold inventories and farmers with nowhere to sell their cassava harvest. The government is putting in place a strategy to deal with these problems. The Action Plan for Cassava Transformation in Nigeria is a key strategy document to spearhead this process. It is intended to create reliable demand and help strengthen cassava value-added chains still very much in their infancy. The plan includes provision of incentives for users of cassava products, cash-back incentives to exporters, and a levy on imports of competing products. Lastly, government policies that ensure reliable supply, such as fertilizer availability and credit to farmers to purchase the fertilizer, also need to be promulgated.

Source: Adesina et al., (2011)

Summary and Conclusions

The performance of Africa's agriculture is at the heart of its food security and economic well-being. With the agriculture sector mainly dominated by smallholder farmers, the success of agriculture is at the core of addressing development challenges facing these farmers. Productivity-related issues addressed in this section show varied success levels on a country-by-country case. Overall, cereal production in most of the selected countries still falls way below their potential and could partially explain why production in the entire Sub-Saharan Africa region still falls short of global averages. On a country-by-country basis, there are significant variations in yield levels. Sub-Saharan Africa has largely tried to keep up with the growing population's demand for more food by significantly expanding the area under production. Technological advancement also seems to have gained momentum, albeit slower than what was experienced during the Green Revolution in Asian countries. The region is still facing numerous challenges, including poor infrastructural services, low human skill development, and few institutions to support use of technology.

Moving forward, it is evident that the interventions pursued by the countries are not misguided. However, much more still needs to be done to assure success of the unique Green Revolution in Sub-Saharan Africa. Increasing agricultural productivity often is a multifaceted and multistaged intervention. Limited access to natural resources and mismanagement of the very resources in the countries has been cited often as the primary source of agricultural strife; and in turn, the primary focus of agricultural change. Therefore, increasing productivity in a sustainable way must be a priority in the region. Access to natural resources—and water—must remain a focus of policy makers; production capabilities are dependent on the availability of these inputs to grow in tandem. Increasing environmental shocks such as droughts, floods, and other natural disasters make this even more of a priority.

The lack of sufficient infrastructure, including rural access roads, irrigation, and land management capabilities, has resulted in the small amount of land available not being used at full potential. This problem is amplified by the common lack of capital and available funds to finance additional capital acquisition. Insufficient financing continues to manifest in several ways, often equating to lack of dependable farm inputs such as high-yielding varieties of seeds, appropriate fertilizers, or cheap credit (FAO, 2009). Efforts need to be stepped up in this area.

Even if, in rare circumstances, smallholder farmers access irrigation, financing, technology, and adequate inputs, the lack of market access often lead to production failures. Market access problems persist in many areas, often resulting in many farmers not being able to sell their produce and hence resorting to subsistence production for their livelihoods. Ultimately, this is not sustainable. With no way to generate income from trade, there is no financial backing to support further agricultural endeavors. Efforts need to be stepped up to strengthen local avenues for selling and buying commodities, a change that can be self-propelling with consistent demand encouraging consistent supply. It is important to address both the supply and demand sides of the commodity value chains to assure productivity and income growth for farmers and the countries as well.

References

Adesina, A., M. Adetunji, T. Odunlami, J. Odeyemi, J. Awoniyi, A. Egba, A. Oredipe, and M. Fregene (2011). Transforming the Cassava Sector in Nigeria. DATCO, Shareholders Meeting, December 15, 2011

Agricultural Science and Technology Indicators/International Food Policy Research Institute. (n.d.). Available at www.asti.cgiar.org.

Africa Development Indicators (ADI) http://data.worldbank.org

ASTI/IFPRI. See Agricultural Science and Technology Indicators/International Food Policy Research Institute.

Binswanger-Mkhize, H. P., Byerlee, D., McCalla, A., Morris, M., & Staatz, J. (2011). *The growing opportunities for African agricultural development.* Prepared for the Agricultural Science and Technology Indicators/International Food Policy Research Institute–Forum for Agricultural Research in Africa (ASTI/IFPRI-FARA) Conference, Accra, Ghana.

Breisinger, C., X. Diao X., J. Thurlow, J., B. Yu, B., & and S. Kolavalli, S. (2008). *Accelerating growth and structural transformation: Ghana's options for reaching middle-income country status.* IFPRI Discussion Paper 750. Washington, DC: International Food Policy Research Institute.

Chauvin, N. D., Mulangu, F., & Porto, G. (2012). *Food production and consumption trends in Sub-Saharan Africa: Prospects for the transformation of the agriculture sector.* Working Paper 2012-011. New York, NY: United Nations Development Programme.

Diao, X., Thurlow, J., Benin, S., & Fan, S. (Eds.). (2012). S*trategies and priorities for African agriculture: Economy wide perspectives from country studies.* Washington, DC: International Food Policy Research Institute.

FAO. See Food and Agriculture Organization of the United Nations.

Food and Agriculture Organization of the United Nations. (2009). *Food security and agricultural mitigation in developing countries: Options for capturing synergies.* Rome, Italy: Author. Retrieved from http://www.fao.org/docrep/012/i1318e/i1318e00.pdf.

Fuglie, K. O., & Rada, N. (2011). *Policies and productivity growth in African agriculture.* Conference Working Paper 19. Prepared for the ASTI/IFPRI-FARA Conference, Accra, Ghana.

Hartmann, A. (2012). Scaling up Agricultural Value Chains for Pro-poor Development. IFPRI Publication. Focus 19 Brief 7 June 2012

Licker, R., M. Johnston, M., Foley, J. A., C. Barford, C., Kucharik, C. J., C. Monfreda, C., et al., (2010). Mind the gap: How do climate and agricultural management explain the "'yield gap"' of croplands around the world? *Global Ecology and Biogeography, 19*(6), 769–782.

Kirimi, L., Sitko, N., Jayne, T.S., Karin, F., Muyanga, M., Sheahan, M., Flock, J and G. Bor (2010). A Farm Gate-to-Consumer Value Chain Analysis of Kenya's Maize Marketing System. Tegemeo Publication

Neumann, K., Verburg, P. H., Stehfest, E., & Muller, C. (2010). The yield gap of global grain production: A spatial analysis. *Agricultural Systems, 103*(5), 316–326.

Nin-Pratt, A., Johnson, M., Magalhaes, E., You, L., Diao, X., & Chamberlin, J. (2011). *Yield gaps and potential agricultural growth in West and Central Africa.* Washington, DC: International Food Policy Research Institute.

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

The World Fact Book (https://www.cia.gov/library/publications/the-world-factbook/).

UNDP. See United Nations Development Programme.

United Nations Development Programme. (2012). *Africa human development report 2012: Towards a food secure future.* New York, NY: United Nations Development Programme.

United States Department of Agriculture. (2012). *International Food Security Assessment, 2012–22*. GFA-23 (Report from the Economic Research Service). Washington, DC: Author.

USDA. See United States Department of Agriculture.

Webber, C. M., & and P. Labaste, P. (2010). *Building competitiveness in Africa's agriculture: A guide to value chain concepts and applications.* Washington, DC: World Bank Publications., Agriculture and rural development. World Bank.

World Bank. (n.d.) *Agriculture; value added (% of GDP) in Kenya.* Washington, DC: Author. Available at http://www.tradingeconomics.com/kenya/agriculture-value-added-percent-of-gdp-wb-data.html.

World Bank. *Africa Development Indicators*. http://databank.worldbank.org/data/home.aspx. 2011.

CHAPTER 03

SECURING LAND FOR AGRICULTURAL PRODUCTION

By Evelyn Namubiru-Mwaura, AGRA; and Frank Place, ICRAF

Introduction

Land is a critical resource for agriculture. It is well documented that most people in Sub-Saharan Africa are rural based and rely on agriculture for their livelihood (United Nations Economic Commission for Africa [UNECA], 2004). Availability of land for smallholder farmers is crucial, not only for food production but also for household incomes (Jayne et al., 2003). There is no doubt that land is a key asset for rural poverty alleviation. Policy makers are also concerned with the productivity of land. Although few studies compare productivity of large commercial farms with smallholder farmers, studies of the smallholder sector overwhelmingly find that yields are higher on smaller farms (Eastwood, Lipton, & Newell, 2010). However, some recent studies have found the opposite, especially when input and outputs markets improved and opportunities for mechanization increased (Ali & Deininger, 2013). These findings have important implications for land policies aimed at balancing urban food requirements, and rural food security, and poverty alleviation.

Land Availability and the Farm Holdings in Africa

Only Africa and Latin America have significant areas of suitable land that is uncultivated—about 70% in each case (Alexandratos & Bruinisma, 2012). Currently, 183 million hectares of land are under cultivation in Sub-Saharan Africa, and approximately 452 million hectares of additional suitable land are not being cultivated. Smallholder farmers account for most of the cultivated land and a sizable share of agricultural production. For example, more than 75% of the total agricultural outputs in Kenya, Tanzania, Ethiopia, and Uganda are produced by smallholder farmers with average farm sizes of about 2.5 ha (Salami, Kamara, & Brixova, 2010).

In the past decade, there have been significant changes in the structure and character of African farming. Land access and size of holdings have been affected by growing rural population; changes in infrastructure and market access; rapid urbanization; diversification of rural incomes and activities; investment in new crops and species; and, in some countries (e.g., Ethiopia and Rwanda), new land policies.

In most of the selected countries, population pressure has resulted in two trends: (1) an expansion of cultivated land, and (2) a reduction in the average farm size. While rural population growth in Sub-Saharan Africa has declined over the past decades—from 2.2% around 1980 to 1.7% in 2010—positive growth still contributes to increased demand for land (World Bank, 2013). Data from FAO (FAOSTAT, 2013) indicate that area under cultivation has expanded in all selected countries. Between 1990 and 2011, the area under annual or perennial crops expanded by about 50% or more in many of the countries, including Mali, Sierra Leone, Burkina Faso, Ghana, Malawi, Niger, Ethiopia, and Mozambique (Table 2). While a significant amount of suitable but uncultivated land remains, the FAO baseline scenario to 2050 (Alexandrato & Bruinisma, 2012) predicts an expansion of a modest 50 million hectares under cultivation, mainly to take place in the larger countries of Sudan, Democratic Republic of Congo, Angola, and Mozambique. There may be scope for more expansion, but in some countries (e.g., Rwanda and Kenya), the land frontier has largely been reached.

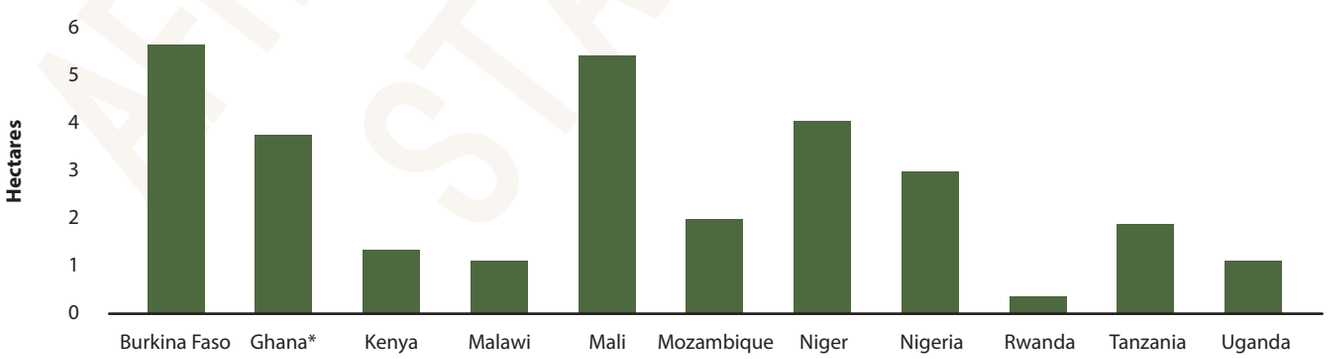
On average, farms are very small in most parts of Sub-Saharan Africa; see, for instance, the data presented in Figure 12 for Kenya, Malawi, Mozambique, Rwanda, Tanzania, and Uganda. In these countries, the average farm sizes are less than 3 ha. In West Africa, the sizes are relatively bigger, with average size of at least 3 ha, but households often are larger there. Although data on farm sizes have not been collected consistently over time, data assembled by AGRA show a reduction in average farm size between 2000 and 2012 in five of seven countries for which data were available.

TABLE 2. LAND AND LAND ACCESS INDICATORS FOR SELECTED COUNTRIES

COUNTRY	ALL AGRICULTURAL LAND 2011 (ANNUAL AND PERENNIAL CULTIVATION AND PASTURES, HA)	CULTIVATED LAND 2011 (ANNUAL AND PERENNIAL, HA)	CHANGE IN CULTIVATED AREA 1990–2011 (ABSOLUTE HA, %)	LAND RIGHTS AND ACCESS SCORE
Burkina Faso	11,765,000	5,765,000	2,190,000 (61.2)	0.615
Ethiopia	35,683,000	15,683,000	5,143,000 (48.8)	0.735
Ghana	15,900,000	7,600,000	2,800,000 (58.3)	0.732
Kenya	27,450,000	6,150,000	680,000 (12.4)	0.743
Liberia	2,630,000	630,000	130,000 (26.0)	0.507
Malawi	5,580,000	3,730,000	1,352,000 (56.9)	0.712
Mali	41,621,000	6,981,000	4,858,000 (228.8)	0.515
Mozambique	49,400,000	5,400,000	1,720,000 (46.7)	0.714
Niger	43,782,000	15,000,000	5,220,000 (53.3)	0.541
Nigeria	76,200,000	39,200,000	7,126,000 (22.2)	0.466
Rwanda	1,920,000	1,470,000	285,000 (24.1)	0.823
Sierra Leone	3,435,000	1,235,000	614,000 (98.9)	0.529
South Sudan*	28,533,000	2,760,000	N/A	N/A
Tanzania	37,300,000	13,300,000	3,300,000 (33.0)	0.777
Uganda	14,062,000	8,950,000	2,100,000 (30.7)	0.842
Zambia	23,435,000	3,435,000	524,000 (18.0)	0.641

Sources: FAOSTAT3 (http://faostat3.fao.org/home/index.html) for columns 1-3; Millennium Challenge Corporation. 2012. 2012 Country Scorebook, Washington DC.
* South Sudan was not a country in 1990 and thus not included in column 3 and was not included in the MCC land access index.

FIGURE 12. AVERAGE SIZE OF FARM HOLDING IN SELECTED COUNTRIES



Source: AGRA Baseline Studies (2009–2010).

Urban sprawl and large-scale land acquisitions are competing with smallholders for agricultural land. Data on trends in urban land area are only available for major cities and thus a national- or regional-level assessment is not possible. However, cities often are located in favorable environments, so land that is converted into urban area is often of relatively high production potential. Furthermore, because urban incomes are higher than those in rural areas, demand for food will increase as urban populations grow and lead to increased demand for agricultural land. In terms of large land acquisitions, recent studies have been undertaken by Cotula, Vermulen, Leonard, & Keeley (2009); Oxfam International (2011); and Anseeuw et al., (2012) to assemble, and where possible, validate foreign and other large acquisitions of land in developing countries. Information is poor on many deals, but about one-third of all reported land transactions were verified to have been signed, representing 26 million hectares of land globally. More than one-half of all deals are in Africa; confirmed land transactions total about 3.2 million hectares in Ethiopia, 2 million hectares in Tanzania, 1.6 million hectares in Sudan, 1 million hectares in Mozambique, and 0.6 million hectares in Ghana (Anseeuw et al., 2012). The impact of these transactions on current and future land availability for smallholders varies according to the particular circumstance. Effects already are being felt in Ethiopia, which has a high and growing rural population density and current farm sizes that already are small.

Land Tenure Systems in Africa and Agriculture

Land tenure in much of Africa often is categorized either as customary/traditional, or state/statutory.[4] In reality, however, the neat distinction between these two models of land tenure is blurred. It is not uncommon to find a range of customary, statutory, and hybrid institutions with de jure or de facto authority over land rights coexisting in the same location, a phenomenon referred to as legal pluralism. The existence of legal pluralism is a critical, defining feature of African land tenure. The lack of clear hierarchy or other form of coordination among the different regimes and arrangements creates confusion and has resulted in land tenure insecurity in many countries.

In Africa, the importance of customary land tenure systems varies from country to country. Customary land rights are dominant tenure systems in Mali, Zambia, Malawi, Ghana, Burkina Faso, and Niger and in large parts of Sierra Leone, Liberia, Nigeria, Tanzania, and Mozambique, among others. Customary systems are similar in some aspects. For example, there is normally a recognized authority with land allocating and adjudicating powers, and inheritance of land is the main mode of land acquisition. In other cases systems are different, such as in the recognition of market-like land transactions and the promotion of secondary or derived rights to resources.

It is not uncommon for national land policies and laws to have little relevance on how land is accessed and/or used because land under customary systems usually is accessed through complex social relations governed by local institutions (Knight, 2010). Under customary tenure, land tends to be held collectively by lineages or families and, in many cases, with complex systems of multiple and overlapping rights (Namubiru-Mwaura, Knox, & Hughes, 2012).

Customary land tenure systems tend to meet the needs of a community's livelihood systems, environmental circumstances, and values. They also facilitate access to land through group membership, and short-term land contracts, and sharing of risks between landowners and tenants. Customary land tenure systems can be important in areas where statutory tenure is absent or not well mainstreamed, which seems to be the case in most African countries.

Critics of customary land tenure systems, on the other hand, argue that these systems of land ownership are not inherently egalitarian, with certain clans favored over others; they are usually biased against women and favor the rich and powerful, as has been witnessed in Ghana, Uganda, Liberia, and South Africa. Moreover, these systems can be abused easily by governments because of the lack of legal backing. Subdivisions of land continue unabated under customary systems and resulting farm sizes are alarmingly small in some areas. The use of land as collateral under customary systems is inhibited by lack of recognized ownership documentation and impediments to free land sale markets.

Despite its importance, land tenure insecurity is still a major problem in many countries in Africa. To date, in many African countries the state continues to own large portions of valuable land even though evidence has shown that this facilitates mismanagement, underuse of resources, and corruption. In addition to state ownership of land, tenure insecurity also can be manifested in weak assurance of rights, such as faced by migrants in many areas of Africa and very often by women (e.g., widows). Tenure insecurity also exists in the short-term land

[4] Customary land tenure is characterized by its largely unwritten nature, is based on local practices and norms, and is flexible, negotiable, and location specific.

borrowing, sharecropping, or renting arrangements. It can be observed in the lack of clarity of rights and is expressed in numerous conflicts over inheritance, other land transactions, sharing of resources (e.g., crop stover), and boundaries. Lastly, the lack of formal certificate or title is one of the barriers preventing smallholders from having collateral to be used to access formal credit.

The Millennium Challenge Corporation publishes an annual scorebook that rates countries on a number of performance indicators across justice, economic freedom, and investing in people. Land rights and access is one measure assessed.[5] The results are presented in Table 2. Relatively speaking, Uganda, Rwanda, Tanzania, Kenya, Ethiopia, Ghana, and Mozambique are ranked high. At the bottom of the rankings are Nigeria, Liberia, and Mali. Long and cumbersome land access procedures in many lower- and middle-income countries emerged in several *World Bank Doing Business* reports as a significant constraint to business (World Bank, 2010). Deininger (2005) also reported that poor access to land was one of the main obstacles to business for 25% of enterprises in Kenya and Tanzania and 57% in Ethiopia.

Women's Access to Agricultural Land

A growing body of literature documents persistent gender gaps in African agriculture in particular and across the developing world in general (World Bank, 2012; Bezabih, Holden and Mannberg, 2012; Peterman, Quisumbing, Behrman, & Nkonya, 2010). In many parts of Africa, most women have limited land use rights and have no control over production and management decisions. Women's rights to land and property are very limited and dependent on their marital status. Studies have shown that although women contribute more than 70% of agricultural labor, they own only 1%–2% of land in Africa, with most of them only accessing land through male relatives (Bennet, 2010).

It is now well known that lack of tenure security is one of the main hindrances to increasing agricultural productivity and family income, and nutrition of rural women (UNECA, 2004). Experts also report that security of tenure can encourage women to invest in the land, adopt sustainable farming practices, and take better care of agricultural land. Currently, however, women in Africa, especially in rural areas, remain vulnerable to land tenure insecurity because of intra-community customary norms. Women's land rights tend to be fluid and subsidiary relative to men's, which leaves them vulnerable and tenure insecure. In most instances, women must depend on a male to access land and do not control or inherit land. Moreover, they also tend to lack financial resources to buy land.

Despite some positive steps toward reforming land laws and policies in Africa, women's rights to land have yet to become fully realized and the reality for women is still characterized strongly by entrenched patterns of exclusion. Typically, gender relations are governed by the prevailing socio-political structures and ideological value systems. Recent studies show that in Uganda, Malawi, Zambia, Rwanda, Tanzania, and Mozambique, even though the land laws and policies mandate equality of men and women under statutory law, in principle; the institutions for land administration still discriminate against women, either explicitly or implicitly (Duncan, 2010; Food and Agriculture Organization of the United Nations [FAO], 2010). For example, although Rwanda has undertaken land reforms, including land registration and formalization—all aimed at improving growth, reducing poverty, and addressing gender inequality—the issue of gender inequality in rural areas is yet to be addressed (FAO, 2010). A study carried out in Liberia also showed that in general, although women may be aware of land and policies that protect their rights they often do not know the details of such laws or how to address land access and ownership problems (Namubiru-Mwaura et al., 2012).

Increasing Agricultural Land Transaction

Land transactions are increasing rapidly in Africa. Increased land scarcity, rising land values, growing urbanization, and many other factors have resulted in increased formal and informal land markets across Africa. Land under both statutory and customary land tenure, is sold or bought through many different kinds of financial transactions—from rental agreements to sharecropping to outright sale and purchase. The land market is thriving where the population is denser and significant numbers of people migrate between agricultural seasons. For instance, in Ghana and Liberia, where migrants can receive land to establish crop farms for a proportion of their yield, there are more land transactions compared to Ethiopia, where there are restrictions on rental market operations and hence decreased land transactions.

In general, land purchases are more frequent among smallholders in East Africa compared to other places in

[5] This is an index that rates countries on the extent to which the institutional, legal, and market frameworks provide secure land tenure and equitable access to land in rural areas and the time and cost of property registration in periurban areas.

Africa. According to Place (2002), 80% of households have purchased land in southwest Uganda with the percentage of plots acquired through purchase being equal to that acquired from inheritance. High percentages were observed also in Kenya, Rwanda, and Tanzania. In some countries such as Ethiopia, however, there are hardly any sales because of enforced government policy banning sales. The fact that many national legal frameworks establish that all land is owned by the state on behalf of the people adds to the problem. For example, although people may own their houses or other improvements on the land, it is still common for them not to own or transfer the land.

Short-term land transactions, such as renting and tenancies, have been found to improve equality of land holdings; that is, they shift land from the land rich to the land poor (Holden, Otsuka, & Place, 2008). Also, numerous studies have found that short-term productivity is high on rented lands (Place, 2009). However, a problem with short-term use rights is the disincentive for either the landlord or the tenant to make long-term improvements, threatening the long-term productivity on those lands. The impact of land purchasing on equity of holdings is less clear. Studies from smallholder communities in Kenya and Uganda suggest that purchasing land is often done by individuals without other land and therefore does not increase inequality (Place & Migot-Adholla, 1998; Baland et al., 2007). However, large acquisitions by nationals and foreigners in other countries have greatly increased inequality. From the seller's point of view, there is concern about distress sales where poor households have no alternative for meeting emergencies than to sell their land at very low prices.

Land Reforms in Africa

What is clear now is that no single land policy or strategy can address land tenure problems in Africa. Policy reforms must be tailored to the physical, social, and economic contexts. The challenge is to find an appropriate reform that takes into consideration economic factors, issues of equity, and less-tangible concerns such as the social or religious beliefs that people attach to land. Furthermore, when crafting new reforms, policy makers need to consider costs carefully in terms of finances and time before reforms are commenced. Experience shows that successful implementation needs long-term budgetary commitment from governments and donors.

Effective land governance systems that provide improved access and rights to land resources are very important. In some situations particular individuals or groups may have difficulty accessing land and land markets, which limits their opportunity to acquire and exercise these rights. Providing secure access is an important precedent to providing clear, secure, and negotiable rights.

In the past few decades, land policy formulation and reforms in Africa have escalated mainly due to complex and persistent land problems; lack of access to land for agriculture and livelihoods; and political, economic, social, and environmental needs (Obeng-Odoom, 2012; Ngaido, 2005). See Box 2 for an example of policy reforms in Rwanda.

CASE STUDY: BOX 2

RWANDA:
Economic Policy Reforms

In the mid-2000s, the Government of Rwanda (GOR) recognized the importance of land issues and embarked upon a series of new policies and acts in response to continued subdivision and fragmentation. The land policies and rules were formulated to prevent further subdivision of land under 1 ha and to promote consolidation of land into larger production units. The latter goal was to be implemented at the household level and was to be obligatory; the GOR, instead, induced consolidation of land use through incentives and targeted adjacent parcels of multiple owners. According to the GOR, more than 500,000 ha had by 2011 become part of land consolidation. The rewards for land consolidation are high: participating households can benefit from the government's crop-intensification program. The GOR also attempted to increase tenure security of households through a regularization program, which was expected to lead to formal land titling. That program demarcated land parcels, provided written documentation to the owners, and provided stronger rights to women.

At the macro level, the results have been impressive: cereal production nearly doubled between 2004 and 2010. No studies, however, have shown the relative effects of the different policies and programs. Ali, Deninger, & Goldstein (2011), however, studied the pilot land regularization compared to farms and plots just outside the schemes and found that the program led to increased likelihood of households making soil conservation investment. Certainly, it will be important to continue to evaluate the impact of the different policies on investment, productivity, and food security.

Unfortunately, the process of reforming land policies has been difficult for most African states because of the competing interests of a range of stakeholders, including smallholder farmers, commercial investors, agribusiness, and the landless and vulnerable people (FAO, 2010).

In a recent report, FAO (2010) showed that despite the progress in development of land policy frameworks, many of the frameworks contain gaps in content and implementation outcomes. Some policies are weak in addressing ethnic and gender issues, land information systems, and monitoring mechanisms. Where policies are well crafted, the capacity to implement land policies has been constrained by a lack of human resources, technical expertise, and finances. For example, in Zimbabwe the current land policy was intended to promote smallholder production although its implementation has been derailed by an overreliance on legal and bureaucratic process of expropriation and resettlement, reliance on distorted land markets to correct farm size inequities, and the influence of powerful antiland-reform lobbies (Van den Brink, 2002). In Zambia, though improvements on a piece of land are recognized through law, most Zambians still conduct their activities through customary land tenure rules while in Tanzania, the main challenge is to undo the Ujamaa policy (United Republic of Tanzania [URT], 2005). Another example is Mozambique, which has had a long history of a dual system of state farms and collectives. While the 1997 Land Law emphasized the need to address land rights of peasant groups with the aim of reversing discrimination toward the rural poor, the implementation of the law was limited by a fast-track process of privatization that encouraged the development of individual land holdings.

Land Policy Options

Land Holdings

Expansion of agricultural land to meet growing smallholder demand is feasible in some countries (e.g., Mozambique and Zambia). More generally, supply is limited and a key policy issue is how to sustainably increase productivity and meet other objectives from agricultural land. If governments were only concerned with poverty and employment of the rural population, the best option likely would be to promote a smallholder farming structure where land was evenly distributed across households. However, the experiences from Kenya, Ethiopia, Malawi, Zambia, and Mozambique show that a relatively low percentage of farmers accounts for most of the maize marketed to cities (Jayne, Zulu, & Nijhoff, 2006); therefore, a policy of land equality under severe population pressure may not provide much food security to urban populations. Thus, governments must make land use and distribution decisions to fill a number of policy objectives. There may be need to support a farm structure where smallholder agriculture coexists with larger commercial farms, such as what is observed already in Kenya and Zambia.

In all instances, governments need to make sure the land is used productively. In general, it is important for governments to promote investment in agriculture and to develop input and output markets. In doing so, farmers will be encouraged to invest, land values will increase, and land holdings will be induced to adjust — thereby becoming more efficient. Whether that happens in practice depends on policies toward land markets, which are discussed below.

Land Tenure Security

In many areas, land is becoming increasingly scarce due to a variety of pressures, including demographic growth. These pressures have resulted in increased competition for land between different stakeholders and in increased land tenure insecurity. To try and enhance tenure security, several African states have adopted new policies and laws aimed at restructuring land relations. The models and approaches adopted vary greatly, especially in relation to the nature of local-level institutions. While some countries have made great progress in improving land tenure security, other countries' efforts have been hindered by historical, social, economic, and other institutional factors.

In an increasing number of countries, including Tanzania, Malawi, Ghana, Mali, Uganda, and Mozambique, land policies now support the idea of legally strengthening customary land tenure. Many recent laws protect customary land rights and provide for or allow their registration (e.g., Uganda's Land Act 1998 and subsequent amendments, Mozambique's Land Act 1997, Malawi's 2002 National Land Policy, and Namibia's Communal Land Reform Act 2002). In Ethiopia, Mozambique, and Namibia, use/lease rights over state-owned land can be registered. In addition, customary rights are protected regardless of whether they have been registered or not (e.g., Article 4.7.2 [a] in the Malawi National Land Policy).

However, the use of formal systems to strengthen customary land tenure is complex. In Eastern and Southern Africa, practical approaches to land tenure pluralism are increasingly being developed (Knight, 2010). Some countries such as Uganda and Ghana, which are implementing wide-ranging land administration reforms, are handling land tenure dualism in innovative

[6] Supported through the Ghana Land Administration Project (LAP) and Uganda Competitive and Enterprise Development Project.

and inclusive ways, adjusting to and embracing it rather than throwing out customary land tenure regimes. In Ghana, for example three distinct land tenure systems (i.e., public lands, stool lands, and private freehold lands) are recognized under the 1992 Constitution. Customary land governance is to be improved under the new Land Administration Program.

Land tenure reforms are proceeding on two levels. The first is to demarcate and formally recognize customary lands under different traditional authorities. This aims to protect the community at large against external threats (Obeng-Odoom, 2012). The second is to strengthen individual farmer security within the customary systems. Some have called for registration/titling of customary land rights because this is seen as an important bridge between unsecured customary land rights and secured titled land. Land titling or certification can increase land tenure security and facilitate access to inputs and financial markets for poor farmers, as has been the case for some farmers in Ethiopia, Kenya, Mali, and Niger (Ngaido. 2005; Deininger, Ali, & Alemu, 2011). But it may also expose communities to greater risks as elite farmers take advantage of titling effort and the emerging land markets. For example, in Botswana, Swaziland, and Zambia, smallholder farmers lost land to elite farmers and private agribusinesses because of distorted land policies.

Women

Addressing women's access to and ownership of land needs a proactive stance that favors awarding land rights to women by governments, followed by rigorous evaluation policies, programs, and projects to promote greater gender equality in control of conjugal land.

Key ingredients to improving access to land among women in Africa include legal recognition elevating women's secondary land rights to equal those of men; legal recognition of women's inheritance rights; and joint registration of spousal land rights. Supporting elements include conducting education, awareness, and information campaigns highlighting women's land rights; providing for adequate representation of women in program implementation teams; and having an open and accessible appeal system to address the concerns of any aggrieved parties. In Africa, these issues have been articulated in the reforms in land registration program design and implementation in Ethiopia and Rwanda. The results imply that reforms such as these, when properly scaled up, are likely to reduce the existing gender gaps, thereby helping to address the cultural biases and historical shortcomings of land policies in many parts of Sub-Saharan Africa.

New land policies, such as requiring both spouses to consent to the renting or sale of land, in Ethiopia and Rwanda are first steps toward giving women more decision-making power in land transactions. How these policies will work in practice will require follow-up monitoring.

Land Market Transactions

Increasingly, governments in Africa are keen to reform policies and regulations that will improve the functioning of rural land markets. Simultaneously, they are concerned about the risks for the poor or other vulnerable groups losing one of their main assets through sale. If improvements in land transaction/markets are to be achieved, whereby farmers benefit from them, then there is a need for complementary actions to safeguard land rights of unwilling sellers. The need for effective land administration, with acceptable mechanisms for purchase, compensation, and rights of appeal, cannot be overemphasized. Thus, recent reforms have attempted to account for these concerns through the requirement of witnesses or the signatures of spouses on land transactions. The question of whether foreign land acquisitions will contribute positively to policy objectives requires evaluation on a case-by-case basis because this will depend on enterprise choice, investments made, and production models used.

Conclusions

Land issues cannot be addressed in isolation. Governments need to work with other stakeholders to find appropriate solutions. Several key stakeholders (e.g., AGRA, the Land Policy Initiative (LPI) of the African Union [AU], the United Nations Economic Commission for Africa (UNECA), the Global Land Tenure Network) have and will continue to facilitate the reforms to make sure that farmers in Africa, particularly women, have access and improved security of tenure, which are important factors for sustained investment in the land for optimal productivity.

Given the inherent complexity of land tenure systems, the limited capacity of the state, and the costs of tenure reform, there is need to monitor and learn from progress made with land reforms in the region and, if needed, to redirect policy design and implementation. It is imperative to analyze the implementation and impact of the land policies and laws recently adopted by many African countries, so as to learn lessons for land policy design and implementation in the continent.

References

Alexandratos, N., & Bruinisma, J. (2012). *World agriculture towards 2030/2050: The 2012 revision*. ESA Working Paper No. 12-03. Rome, Italy: Food and Agriculture Organization of the United Nations. Available at http://www.fao.org/docrep/016/ap106e/ap106e.pdf.

Ali, D. A., & and Deininger, K. (2013). *Is there a farm-size productivity relationship in African agriculture? Evidence from rural Rwanda.* Working Paper v. 3. Washington, DC: World Bank.

Ali, D. A., Deininger, K., & Goldstein, M. (2011). Environmental and gender impacts of land tenure regularization in Africa: Pilot evidence from Rwanda. Policy Research Working Paper 5765. Washington DC: World Bank.

Anseeuw, W., Boche, M., Breu, T., Giger, M., Lay, J., Messerli, P., et al. (2013). *Transnational land deals for agriculture in the global south: Analytical report based on the LAND Matrix database.* Bern, Switzerland, Montpellier, France, & Hamburg, Germany: Centre for Development and Environment (CDE), Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), & German Institute of Global and Area Studies (GIGA).

Baland, J., Gaspart, F., Place, F., and J. Platteau. 2007. The Distributive Impact of Land Markets in Uganda. *Economic Development and Cultural Change* 55 (2): 283-312.

Bezabih, M., Holden, S. and A. Mannberg. 2012. The Role of Land Certification in Reducing Gender Gaps in Productivity in Rural Ethiopia. CLTS Working Paper No. 1/2012

Cotula, L., Vermeulen, S., Leonard, R., & Keeley, J. (2009). *Land grab or development opportunity? Agricultural investment and international land deals in Africa.* London, United Kingdom, & Rome, Italy: International Fund for Agricultural Development (IIED), Food and Agriculture Organization of the United Nations (FAO), and International Institute for Environment and Development (IFAD).

Deininger, K. (2005). *Land policies for growth and poverty reduction: Key issues and challenges ahead.* http://www.oecd.org/development/povertyreduction/36562720.pdf. *UN, FIG, PC IDEA Inter-regional Special Forum on the Building of Land Information Policies in the Americas, Aguascalientes, Mexico 26-27 October 2004*

Deininger, K. Ali, D. A., & Alemu, T. (2011). Impacts of land certification on tenure security, investment and land market participation: Evidence from Ethiopia. *Land Economics, 87*(2), 312–334.

Duncan, B. A. (2010). Cocoa, marriage, labour and land in Ghana: Some matrilineal and patrilineal perspectives. Africa, 80(2), 301–321. doi: 10.1353/afr.0.0176

Eastwood, R., Lipton, M., & Newell, A. (2010). Farm size. In P. Pingali and R. Evenson (Eds.), *Handbook of Agricultural Economics* (pp. 3323–3397). Burlington, Vermont, USA: Academic Press.

Gittinger, J. Price ; Chernick, Sidney ; Horenstein, Nadine R. ; Saito, Katrine (1990), *Household food security and the role of women*. World Bank Paper No. 96. Washington. DC.

FAO. See Food and Agriculture Organization of the United Nations.

FAOSTAT. (2013). Rome, Italy: Author. Available at http://faostat3.fao.org/home/index.html#VISUALIZE.

Food and Agriculture Organization of the United Nations. (2010). *Africa's changing landscape: Securing land access for the rural poor.* Rome, Italy: Available at http://www.fao.org/docrep/012/al209e/al209e00.pdf.

Holden, S., Otsuka, K., & Place, F. (Eds.). (2008). *The emergence of land markets in Africa: Impacts on poverty, equity, and efficiency.* London, United Kingdom: Routledge.

Jayne, T. S., Zulu, B., & Nijhoff, J. J. (2006). Stabilizing food markets in Eastern and Southern Africa. *Food Policy, 31*(4), 328–341.

Jayne, T., Yamano, T., Weber, M., Tschirley, D., Benfica, R., Chapoto, A., et al. (2003). Smallholder income and land distribution in Africa: Implications for poverty reduction strategies. *Food Policy, 28*(3), 253–275.

Knight, R. S. (2010). *Statutory recognition of customary land rights in Africa: An investigation into best practices for lawmaking and implementation.* FAO Legislative Study, 105. Rome, Italy: Food and Agriculture Organization of the United Nations.

Namubiru-Mwaura, E. L., Knox, A., & Hughes, A. (2012). *Customary land tenure in Liberia: Findings and implications drawn from 11 case studies.* Report prepared for the Liberia Land Policy & Institutional Support (LPIS) Project. Washington, DC: United States Agency for International Development.

Ngaido, T. 2005. Reforming land rights in Africa. IFPRI 2020 Brief, International Food Policy Research Institute, Washington, DC.

Obeng-Odoom, F. (2012). Land reforms in Africa: Theory, practice, and outcome. *Habitat International, 36*(1), 161–170.

Oxfam International. (2011). *Land and power: The growing scandal surrounding the new wave of investments in land.* Oxfam Briefing Paper 151. Oxford, United Kingdom: Author.

Place, F. (2002, April–May). *Land markets in Sub-Saharan Africa: Preconditions, potentials and limitations.* Paper presented at the Land Issues in Africa Conference, Kampala, Uganda.

Place, F. and S. Migot-Adholla. 1998. Land Registration and Smallholder Farms in Kenya. Land Economics 74 (3): 360-373.

Place, F. 2009. Land Tenure and Agricultural Productivity in Africa: A Comparative Analysis of the Economics Literature and Recent Policy Strategies and Reforms, World Development 37: pp. 1326-1336.

Peterman, A., Quisumbing, A., Berhman, J., & Nkonya, E. (2010). *Understanding gender differences in agricultural productivity in Uganda and Nigeria*. IFPRI Discussion Paper. Washington, DC: International Food Policy and Research Institute.

Salami, A., Kamara, A. B., & Brixiova, Z. (2010). *Smallholder agriculture in East Africa: Trends, constraints and opportunities.* Working Papers Series No. 105. Tunis, Tunisia: African Development Bank.

UNECA. See United Nations Economic Commission for Africa.

United Nations Economic Commission for Africa. (2004). *Land tenure systems and their impacts on food security and sustainable development in Africa.* Addis Ababa, Ethiopia: Author.

United Republic of Tanzania. (2005). *Investment plan for SPILL: Final report.* Dar es Salaam, Tanzania: Ministry of Lands, Housing and Human Settlement Development.

URT. See United Republic of Tanzania.

Van den Brink, R. 2002. 'Land Policy and Land Reform in Sub-Saharan Africa: Consensus and Controversy'. Paper presented at the conference on "Land Issues in Africa," 29 April – 2 May, 2002, Africana Hotel, Kampala.

New Agriculturist www.new-ag.info November 2010. *Women's rights and access to land in Africa.* Available online at http://www.new-ag.info/en/pov/views.php?a=1796.

World Bank. (2010). *Doing business 2010: Reforming through difficult times: Comparing regulations in 183 economies*., Washington, DC, & New York, New York: World Bank, IFC, & Palgrave MacMillan. Available at ttp://www.doingbusiness.org/~/media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB10-FullReport.pdf.http://www.doingbusiness.org/).

World Bank. (2013). *Rural population data.* Available at http://data.worldbank.org/indicator/SP.RUR.TOTL.

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CHAPTER 04

IMPROVING SOIL HEALTH IN AFRICA: CHALLENGES AND PROMISING SOLUTIONS

By Bashir Jama, Rebbie Harawa, Abednego Kiwia, Marie Rarieya, David Kimani, and Abdi Zeila ; AGRA
Jason Scarpone, AFAP

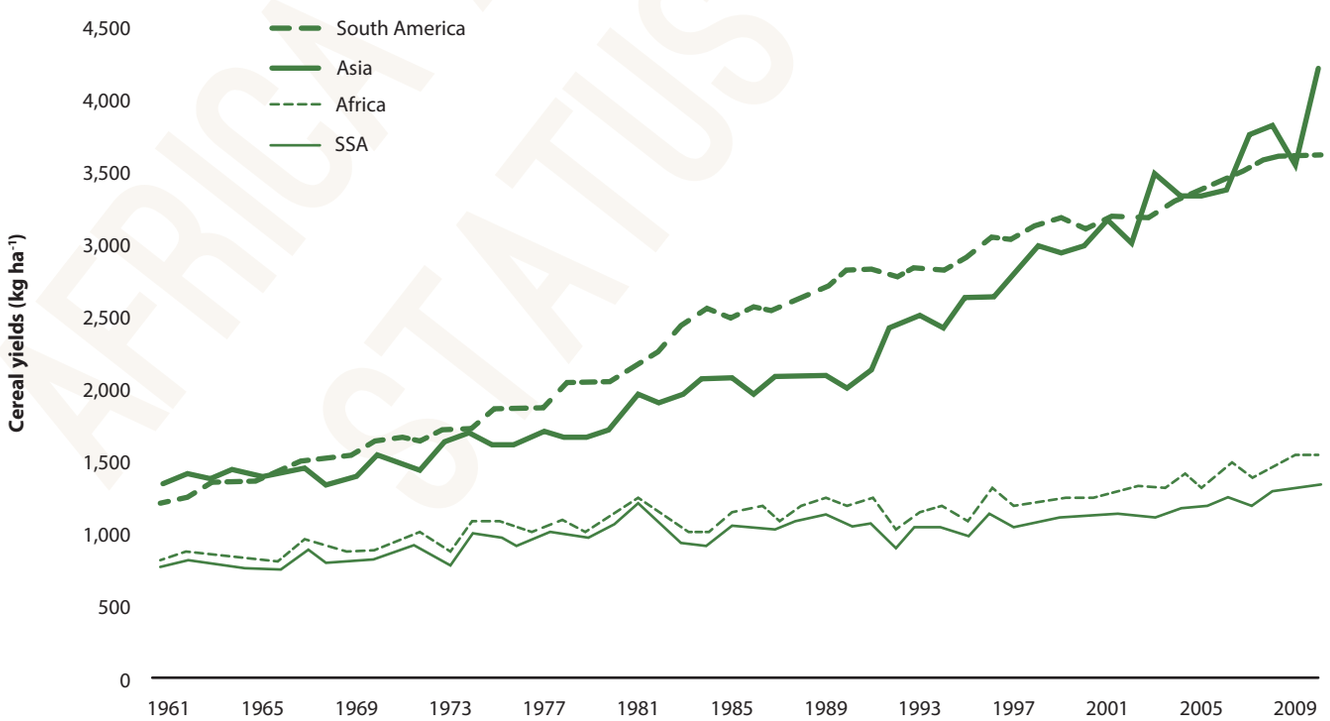
Introduction

Soil health is critical to sustainable agricultural productivity and environmental well-being. The term soil health refers to the capacity of soil to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation. Soil-health improvement that includes maintaining its three key properties (physical, chemical, and biological) is essential for food security at a time when many countries in Africa are faced with the global volatility of food prices. It is also essential for intensifying agricultural production because of high population pressure on land in many regions of Africa. Declining soil health is, indeed, a major cause of stagnant agricultural productivity growth in Africa. This is attributed to the depletion of nutrients by crops harvested and to soil erosion. Fallowing land that traditionally helped restore soil fertility is no longer feasible in many areas due to population pressure.

Soil nutrient losses are estimated to be about 8 million metric tons and are valued at more than US$4 billion (Toenniessen, Adesina, & Devries, 2008). These losses combined with soil erosion have led to soil degradation, with more than 80% of Africa's soils having chemical or physical limitations that impede crop production (Lal, 2010). This is, indeed, the case with many smallholder fields in Africa, where application of fertilizer and manure inputs have been too low for too long.

The impact has been a declining trend of per capita food production in Africa over the past 40 years, although there has been positive growth in the past 5–6 years (Figure 13). This in turn, has led to severe food and nutritional insecurity and reduced on-farm incomes (Hazell & Haggblade, 2009) and contributed to farmers expanding production to less suitable lands, thus further extending the frontiers of degradation. The cost of this can be enormous (Nkonya et al., 2011).

FIGURE 13. CEREAL YIELD TRENDS, 1961–2009



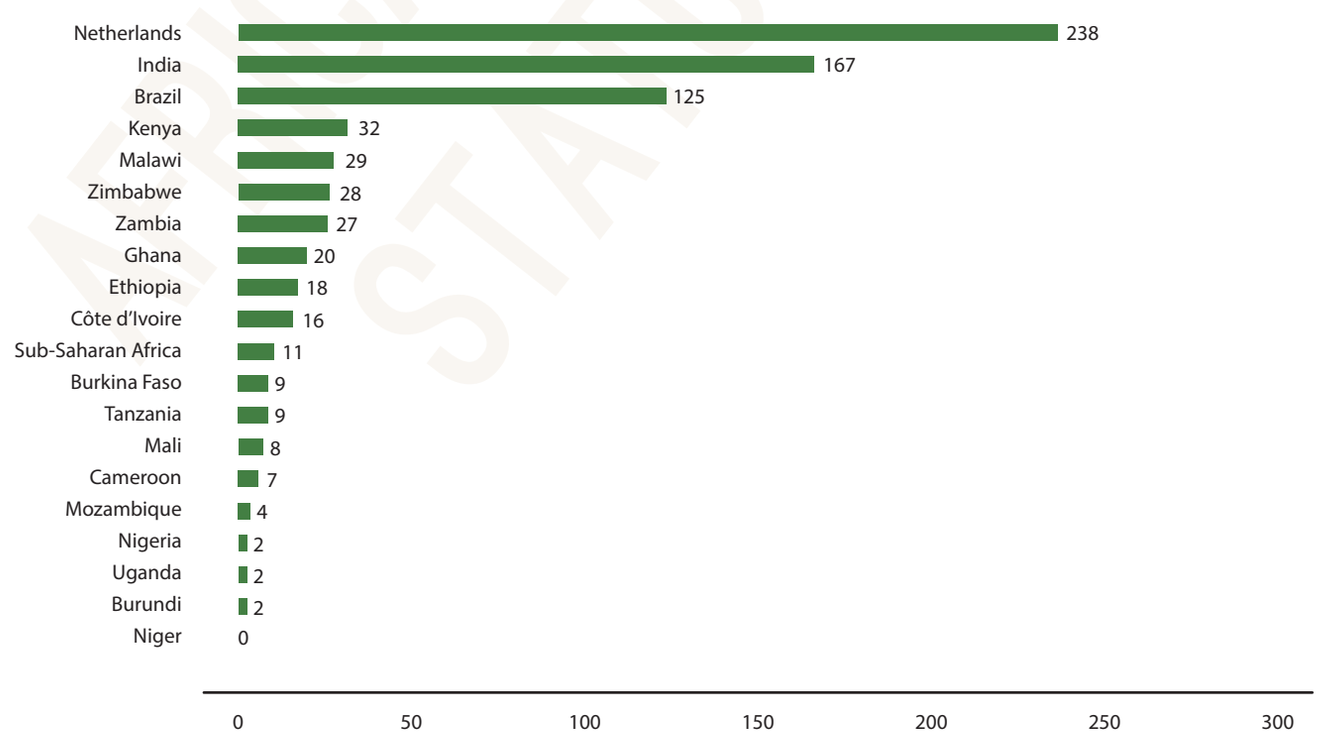
Increasing Fertilizer Use and Accessibility

There is consensus among the R&D community that increasing fertilizer use by smallholder farmers is essential to reverse the declining trend of food production in Africa (Hazell & Haggblade, 2009; Sanchez, Denning, & Nzighubea, 2009). Inorganic (mineral) fertilizer usage in Africa currently stands at 9–10 kg/ha^{-1} of nutrients compared to greater than 150 kg/ha in Asia (Figure 14). At the minimum, mineral fertilizer use should be increased to at least 50 kg of nutrients per hectare by 2015 as per recommendations of the Abuja Summit on fertilizer use in Africa (International Fertilizer Development Center [IFDC], 2006). Key to this is reducing the high costs of fertilizer, which are often in the range of US$800–US$1,000 per ton at farm gate and the most expensive in the world.

In general, the high prices are due to fertilizer markets that are weak, underdeveloped, and characterized by high transaction costs. Consequently, these markets sell at prices that are beyond the reach of the majority of small-scale and subsistence farmers. The high transaction costs are exacerbated by supply-side and demand-side constraints, which severely hinder the development of efficient and effective private sector-led fertilizer markets in Africa. These constraints manifest themselves in the form of irregular and costly supply of inputs and weak demand. A key constraint to both the supply and demand sides is lack of access to finance for the fertilizer value chain actors. Fertilizer is a capital-intensive business; therefore, manufacturers, importers, distributors, and agro-dealers require access to finance to manufacture, procure, and distribute fertilizer.

With regard to access to finance by importers and agro-dealers, banks tend to view the fertilizer business as risky and therefore charge high interest rates and impose strict collateral requirements on potential borrowers from the fertilizer business sector. For their part, the importers and distributors find the collateral and lending terms unattractive, given the seasonality of agriculture, the relatively low returns from the inputs business, and the high level of risk caused by climatic variations. As a result, banks in Africa typically have a low percentage of loans

FIGURE 14. FERTILIZER USAGE (IN KG/HA) ON ARABLE LAND



Source: FAO (2009)

to the fertilizer importing and distribution businesses. Although microfinance facilities are widely available in many countries, the size of the loans is typically too small to support the development of a fertilizer business. Consequently, importers, and even more so agro-dealers and stockists, have limited access to finance to invest in the fertilizer business. The majority resort to using their own savings or income from other business ventures to finance part or all of their businesses. This limits the size of their orders, increases transport and other transaction costs, and restricts the scale of business operations. It also reduces the funds available to invest in market development activities, such as extending credit to farmers and providing technical support and fertilizer delivery services.

Weak demand for fertilizers is due to a number of factors, including low purchasing power of farmers and the low input/output price ratio. Fertilizer is costly and often out of the reach of smallholder and subsistence farmers. In 2007–2008, fertilizer prices reached historically high levels, and although prices have since declined to pre-2007–2008 levels they still remain high, particularly in relation to output prices. Even when farmers can afford to purchase fertilizers, the poor performance of output markets (lack of storage, poor roads, and low output prices) results in low returns. In light of the low economic incentive to use fertilizers, governments, donor agencies, and NGOs have adopted strategies to reduce the economic burden on farmers by increasing their financial access to fertilizers. These strategies include direct subsidies on fertilizer prices, distribution of vouchers that can be redeemed for fertilizer, distribution of starter packs to get farmers to experiment with fertilizer, and fertilizer-for-work programs. While many of these approaches have achieved some short-term successes, they often have collapsed once the external funding ended, making them unsustainable over the longer term.

Notwithstanding this, there is definitely something positive to say about fertilizer subsidy programs that many countries have reintroduced since 2005 in Eastern Africa (Kenya, Malawi, Rwanda, Tanzania, Zambia) and West Africa (Burkina Faso, Senegal, Mali, Nigeria, Ghana). The subsidy programs take into consideration lessons learned and bring innovations to their design (e.g., targeting vouchers) to support both the most constrained farmers and encourage the development of input markets. Despite their high costs and management problems, the subsidy programs have resulted in growth in supply volumes and increasing impact on agricultural productivity in several countries, with Malawi being a good example (Denning et al. 2009). This is corroborated by a more recent study (Druilhe & Barreiro-Hurlé, 2012) that, albeit available evidence being limited, indicates the subsidy programs have been effective in raising fertilizer use, average yields, and agricultural production but that their success is highly dependent on implementation.

On the financing side, several instruments are being piloted, including credit guarantees with banks. Some of these instruments are now being deployed by the African Fertilizer Agribusiness Partnership (AFAP) that was established in 2011 with some starter funding from AGRA. Specifically, AFAP focuses on addressing the supply-side constraints through agribusiness partnership contracts that involve matching grants with fertilizer suppliers and distributors. Initial focal countries are Mozambique, Tanzania, and Ghana.

Among the various options deployed by AFAP and others, the most sustainable and scalable is probably the value chain financing approach through the private sector that provides inputs (seeds and fertilizers) and output markets for produce. Some promising examples of this approach are emerging in several countries (Malawi, Zambia, and Ghana) for both cereals and grain legumes. At the same time, availability has been improved significantly through the expansion of the agro-dealers. For instance, AGRA has trained more than 14,000 agro-dealers in 13 focal countries over the past 5–6 years. This has, in some regions, reduced the distance for farmers to access fertilizers to less than 2 km.

Closing the Yield Gap through the Combination of Organic and Inorganic Fertilizers

There is consensus among the agricultural scientific community that jumpstarting smallholder participation in agriculture in Africa requires the combination of organic and inorganic fertilizers, not either or none. This approach is that commonly referred to as integrated soil fertility management (ISFM). ISFM is a set of soil fertility management practices that includes the use of fertilizer, organic inputs, and improved germplasm, combined with the knowledge of how to adapt these practices to local conditions. The aim is to maximize agronomic use efficiency of the applied nutrients and improve crop productivity (Vanlauwe et al., 2011). In acidic soils, the application of agricultural lime would be essential for enhancing the efficiency and benefits of fertilizers applied. For example, two projects supported by AGRA in western Kenya and Rwanda in 2009 showed that the use of lime improved soil fertility and increased crop production (see Text Box A) (AGRA Reports 2012).

TEXT BOX A: IMPROVED SOIL FERTILITY INCREASES CROP PRODUCTION

Effect of Lime and Fertilizer on Maize Crop Yield in Western Kenya and Wheat in Rwanda

Recommended fertilizer rates in western Kenya (i.e., 60 kg N/ha^{-1} and 50 kg P/ha^{-1} applied either as DAP or Mavuno (10-26-10; 4% sulfur, 8% calcium, and 4% magnesium) increased maize yield more than threefold. Although maize crop responses to lime were small (200–300 kg/ha^{-1}), farmers were nevertheless excited by this effect, especially in plots that previously yielded almost nothing. Part of this excitement has been associated with observed reduction in striga in limed plots.

Effect of Lime and Fertilizers Application on Wheat Yields in Kibeho and Cyahinda Sites of Nyaruguru District, Rwanda, during February–June 2012 Rain Season

Results from the field indicated that high yields (1.7–3.4 metric tons/ha) were obtained from lime in combination with farmyard manure and DAP. Therefore, combining lime with fertilizer increased crop yields through enhanced soil health and reduced effects of noxious weeds.

The entry point for ISFM in many areas is likely to be fertilizers because of the limited availability and poor quality of organic fertilizers such as farmyard manure. Under such conditions, the applications of small amounts of fertilizers can jumpstart smallholder crop yields (Figure 15), resulting in three to four times more production of maize (a staple food crop in many countries) when improved seeds are also used compared with no fertilizer application. The yields of cassava, another staple food, can also be raised similarly, up from the typical less than 12 metric tons/ha under smallholder production with application of small amounts of fertilizer, especially those containing potassium (Vanlauwe, 2012). Crop yields can also be increased through the integration of fertilizers with the leafy biomass of *Tithonia diversifolia*, a shrub commonly found in many regions of Africa that is high in potassium and other nutrients (Jama et al., 2000).

The integration of legumes into the production system is another key feature of ISFM. Legumes require appropriate Rhizobium bacteria to fix nitrogen (N) from the air. Because of the importance of grain legumes in African farming systems and their potential benefits to soil health, there is renewed interest in the identification and supply of appropriate (infective, effective, and competitive) Rhizobium strains to optimize biological N fixation. Rhizobia inoculants cost only a fraction of the N equivalent of fertilizer supplied through regular chemical fertilizer. There is scope for increasing the benefits of N fixation through growth of fodder legumes, including agroforestry species, especially in areas where no grazing systems for livestock are practiced.

Currently, the yields of grain legumes are low (typically less than 1 ton/ ha^{-1}) in much of Africa, as is their likely contribution to soil fertility improvement. This can, however, be changed through the use of improved seeds along with the application of small amount of phosphorus (P) fertilizers and Rhizobium inoculum (Figure 16).

FIGURE 15. MAIZE YIELDS WITH AND WITHOUT FERTILIZER APPLICATION IN FIVE AFRICAN COUNTRIES UNDER ON-FARM CONDITIONS*

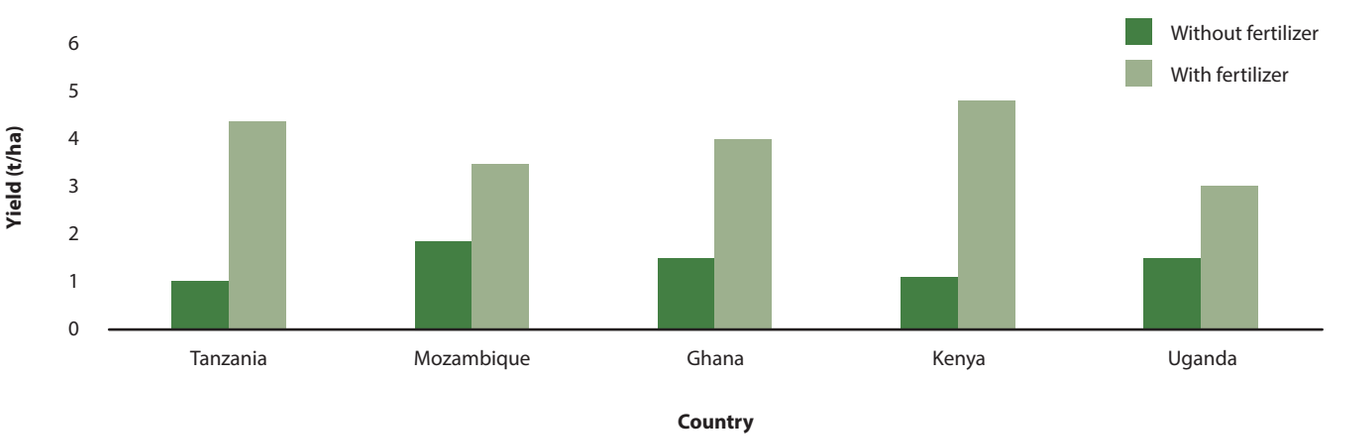
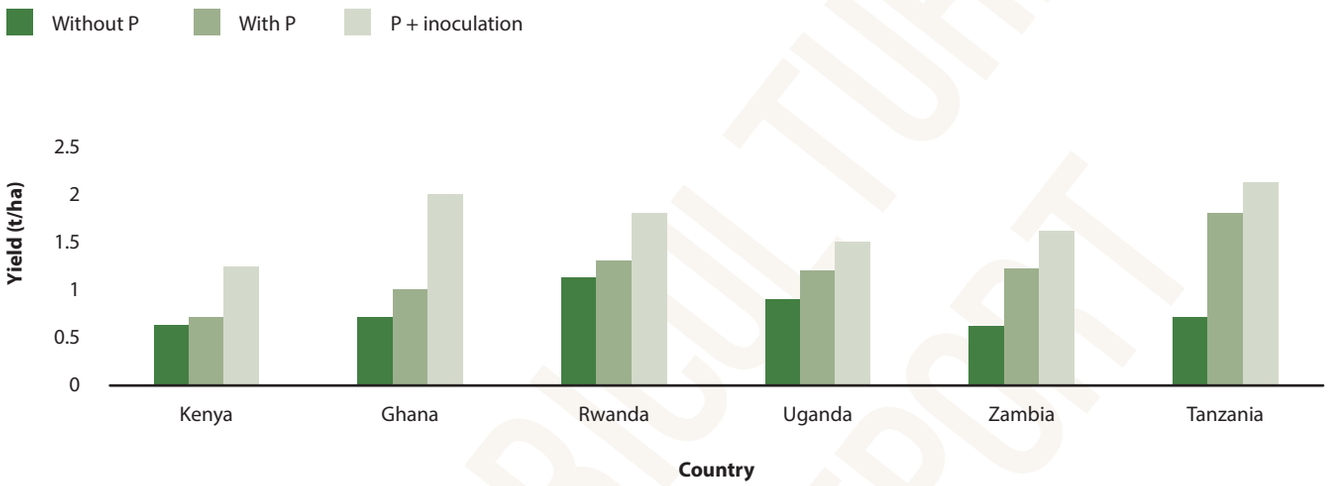


FIGURE 16. SOYBEAN YIELDS WITH PHOSPHORUS AND RHIZOBIUM INOCULUM APPLICATION IN SIX COUNTRIES



Such high yields generate additional crop residues that can be used to produce compost manure or used as livestock feed that in turn gives quality manure. Because of this recognition of the importance of grain legumes in the farming of Africa, many R&D organizations are scaling up the production and commercialization of grain legumes. They are also addressing challenges associated with supply of improved seeds and inoculum through public–private initiatives. The N2Africa and the Tropical Legumes projects are among the many stakeholders addressing these challenges, the former on the production and distribution of quality inoculum and the latter on the supply of improved legume seeds.

Entrance to Sustainable Agriculture through ISFM

Yield improvement normally is greater when organic inputs and inorganic fertilizers are applied together, and especially when farmers apply the right fertilizer source at the right rate, right time, in the right place, and using the right method. Such improvement in realized yields provides a good entry point for developing sustainable agriculture. High yields result in the production of more crop residues that can be used to supplement farmyard manure production through compositing. The biomass can also be fed to livestock to supplement much-needed feed and produce high-quality manure at the same time.

While it is possible to increase yields in similar ways with organics such as high-quality manure in the absence of fertilizers, the amounts of organics needed would often not be available on smallholder farms to cover large production areas. Over time, as the production of crops residues and other organic materials increases on the farms, fertilizer use could be reduced.

The practice of ISFM also lends itself to the gradual introduction of conservation agriculture principles, starting with the rotation of cereals with legumes. Depending on the species and site, the rotations could have minimum tillage benefits. This practice can result in significant soil fertility benefits and yield gains over conventional tillage systems, as demonstrated by 4-year-long multilocational studies in Zambia involving maize and cotton in rotation with a Crotalaria species, a non-grain-bearing, fast-growing leguminous shrub (Thierfelder & Wall, 2010).

Such interventions that integrate conservation agriculture, especially with trees, can be a good entry point for highly degraded soil. This is important because of the poor and variable response to fertilizers in such soils (Vanlauwe et al., 2011). Under such conditions, small fertilizer applications, such as the microdosing practice promoted in the Sahelian countries of Mali, Burkina Faso, and Niger, are recommended. When these applications are combined with livestock manure, the yields of sorghum increase by three to four times over the no-input system (AGRA, 2012). The amount of fertilizer applied is about one-third of what is typically recommended for broadcast application; about 60 and 25 kg of N and P per hectare, respectively. The yields can be further enhanced by practices that conserve water such as the zai pits (i.e., small planting pits) that are widely practiced in the Sahelian countries, especially Burkina Faso. This technology can also enhance crop yields in wetter regions that have degraded soils, such as the Ethiopian highlands (Amede, Menza, & Awlachew, 2011).

Sound, integrated use of fertilizers in ISFM requires developing and disseminating appropriate recommendations that are soil and crop specific and that take advantage of the nutrients supplied by organic fertilizers. Unfortunately, this is lacking in many countries, partly due to the absence of rapid methods of soil analysis. Fortunately, diagnostic methods that use infrared spectroscopy and remote sensing have emerged recently. This technology has been pioneered by the Africa Soil Information Service (AfSIS) in several countries. Ethiopia is now using the AfSIS approach to rapidly map its soils ahead of a national effort to refine and improve upon the existing fertilizer recommendations nationwide.

The benefits of improved fertilizer recommendations cannot, however, be realized by farmers unless the agricultural extension systems are improved and resourced well. This is particularly essential for ISFM technologies that are knowledge intensive. The public extension services in many countries are too few to deliver this knowledge well. This service could, however, be strengthened through public–private investments and in ways that take advantage of the opportunities offered by Africa's rapidly growing ICT.

Sustaining Gains Made Through Crop–Livestock–Agroforestry Interventions

The journey toward sustainable agriculture that is based on ISFM can be hastened by the integration of livestock and agroforestry interventions in the production system. Smallholder farmers in Africa mostly practice mixed farming, and its benefits are greater when livestock are incorporated, partly through sustained crop productivity with manure that complements inorganic fertilizer use. Indeed, farmers know the economic value of manure and are among the many reasons why they raise livestock (Steinfeld et al., 2006). Use of manure, although not often enough, plays a crucial role in sustaining smallholder crop–livestock production systems. This is achieved through the cycling of nutrients within the systems through interventions such as use of fodder trees.

There are many niches where trees can be grown on smallholder farms to provide services such as soil and water conservation. This includes terraces on sloping lands where hedges that are continuously cut back for fodder are planted (Mugwe et al., 2008). Such examples of livestock-mediated agroforestry interventions provide unique opportunities for the sustainable intensification of smallholder agriculture, with good examples practiced at scale on the densely populated eastern slopes of Mount Kenya and Mount Kilimanjaro. Many such agroforestry technologies are available and need to be scaled up as part of integrated soil fertility management (ISFM).

Implications for Policy

Improving African soil health and enhancing fertilizer use are interlinked with the need to adopt a long-term perspective instead of a narrow focus on short-term yield gains. Public policy interventions should be geared toward strengthening smallholder farmers' demand for fertilizers through investments in agricultural research and extension.

The yield improvement realized with the use of various options that improve soil fertility (e.g., the use of small amounts of fertilizers, good agronomic practices and technology packages [ISFM], and crop–livestock integration) represent low-hanging fruit for reversing the current stagnation of Africa's agriculture. Doing so will provide opportunity for sustainable intensification of their agriculture and longer-term prosperity, which hinges on generating surpluses that could be sold into competitive markets. This, however, has the following important implications for policy and investments:

- Skills in soil fertility diagnosis are essential for developing appropriate fertilizer recommendation that farmers can adapt to their circumstances
- The application of ICT for extension and advisory services for soil health must take into consideration the fact that ISFM dissemination is complex and knowledge intensive
- Innovations in financing that can improve access to affordable credit required to procure inputs, especially expensive fertilizers
- Agricultural water management can help reduce risks associated with frequent droughts, some within the cropping season after farmers have invested in fertilizers and improved seeds and that are likely to discourage farmers from their investment unless they could count on water for their crops
- Improved access to remunerative markets can drive farmers' investments in improving their soils and raising their productivity

References

AGRA 2012. See Alliance for the Green Revolution in Africa.

Alliance for a Green Revolution in Africa. (2012). *Annual report of 2011*. Nairobi, Kenya: Author.

Amede, T., Menza, M., & Awlachew, S. B. (2011). Zai improves nutrient and water productivity in the Ethiopian highlands. Experimental Agriculture, 47(Suppl. S1), 1–5.

Denning, G., Kabambe, P., Sanchez, P., Malik, A., Flor, R., Harawa, R., et al. (2009). Input subsidies to improve smallholder maize productivity in Malawi: Towards an African Green Revolution. *PLoS Biology, 7*(1), e1000023. doi:10.1371/journal.pbio.1000023

Druilhe, Z., & Barreiro-Hurlé, J. (2012). *Fertilizer subsidies in Sub-Saharan Africa*. ESA Working Paper No. 12-04. Rome, Italy: Food and Agriculture Organization of the United Nations.

Hazell, P., & Hazell, S. (2009) The Least Developed Countries Report 2009: The State and Development Governance (United Nations Conference on Trade and Development) FAO. See Food and Agriculture Organization of the United Nations.

Food and Agriculture Organization of the United Nations. (2009). *Food security and agricultural mitigation in developing countries: Options for capturing synergies.* Rome, Italy: Author. Available at http://www.fao.org/docrep/012/i1318e/i1318e00.pdf.

IFDC. See International Fertilizer Development Center.

International Fertilizer Development Center. (2006). *Abuja Declaration on fertilizer for an African Green Revolution.* Prepared for Africa Fertilizer Summit, African Union Special Summit of the Heads of State and Government, Abuja, Nigeria. Muscle Shoals, AL: Author.

Jama, B. A., Palm, C. A., Buresh, R. J., Niang, A. I., Gachengo, C., Nziguheba, G., et al. (2000). *Tithonia diversifolia* as a green manure for soil fertility improvement in western Kenya: a review. *Agroforestry Systems*, 49, 201-221

Lal, R. (2010). Managing soils for a warming earth in a food-insecure and energy-starved world. *Journal of Plant Nutrition and Soil Science, 173*, 4–15. doi: 10.1002/jpln.200900290.

Mugwe, J., Mugendi, D., Mucheru-Muna, M. W., Merckx, R., Chianu, J., & Vanlauwe, B. (2008). Determinants of the decision to adopt integrated soil fertility management practices by small holder farmers in the central highlands of Kenya. *Experimental Agriculture, 45*, 61–75.

Nkonya, E., N. Gerber, P. Baumgartner, J. von Braun, A. de Pinto, V. Graw, E. Kato, J. Kloos, T. Walter. 2011. The Economics of Land Degradation. Towards an Integrated Global

Sanchez, P. A., Denning, G. C., & Nzighubea, G. (2009). The Africa Green Revolution moves forward. *Food Security, 1*(1), 37–44. doi: 10.1007/s1571-009-0011-5.

Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M., & de Haan, C. (2006). *Livestock's long shadow: Environmental issues and options.* Rome, Italy. Food and Agriculture Organization of the United Nations.

Thierfelder, C., & Wall, C. (2010). Rotation in conservation agriculture systems of Zambia: Effects on soil quality and water relations. *Experimental Agriculture, 46*(3), 309–325.

Toenniessen, G., Adesina, A., & DeVries, J. (2008). Building an alliance for a Green Revolution in Africa. *Annals of the New York Academy of Sciences, 1136*(1), 233–242. doi: 10.1196/annals.1425.028.

Vanlauwe, B. A., Chianu, J., Giller, K. E., Merckx, R., Mokwunye, U., et al. (2011). Integrated soil fertility management: Operational definition and consequences for implementation and dissemination. *Outlook on Agriculture, 39*(1), 17–24.

Vanlauwe, B. 2012. Boosting the productivity of cassava-based systems in DR Congo through integrated soil fertility management. In *Regional highlights* (pp. 18–21). Ibadan, Nigeria: International Institute of Tropical Agriculture

"The nation that destroys its soil, destroys itself."

Franklin Delano Roosevelt

32nd President of the United States of America

CHAPTER 05

STATUS OF SEED SYSTEMS DEVELOPMENT IN SUB-SAHARAN AFRICA

By Edward Mabaya, Cornell University; Paul Omanga, FAO; and Joseph DeVries, AGRA

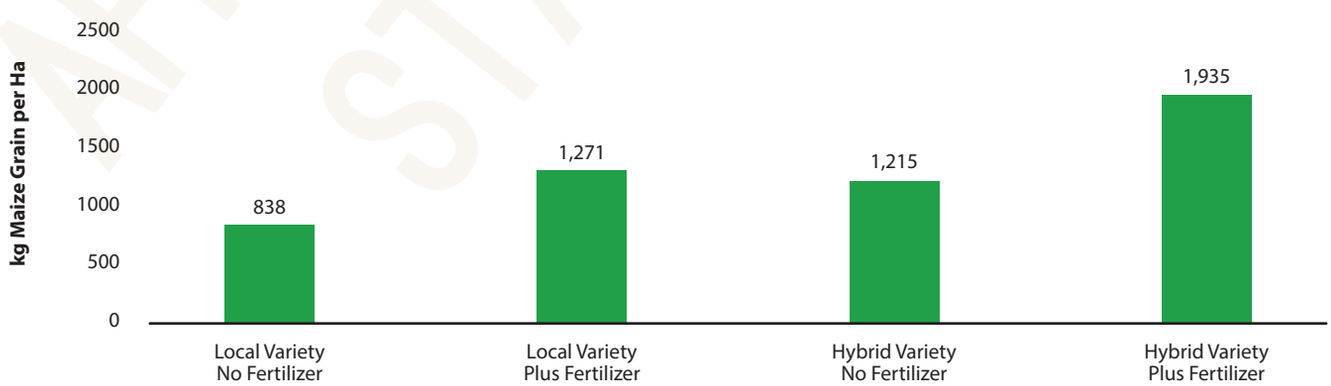
Introduction

Access to high quality, locally adapted, improved seed at affordable prices has long been recognized as an essential ingredient to boosting agricultural productivity. This is particularly important in Sub-Saharan Africa given its ever-growing population. The sustained use of high quality seed and planting materials of improved crop varieties is also key to achieving sustainable food security in Sub-Saharan Africa. Direct benefits to farmers adopting improved seed include enhanced productivity, higher harvest index, reduced risks from pests, diseases, and drought, as well as higher incomes. Faced with different choices of high quality seeds of adapted crop varieties, farmers will select varieties suitable for their local environments and socio-economic conditions. Production patterns will become more predictable and sustainable, as has been the case in countries where the seed sector is well established, such as South Africa, Nigeria, Kenya and Zimbabwe. Agricultural policies in Sub-Saharan Africa countries must therefore create enabling environments for seed systems that ensure access to improved seeds by smallholder farmers.

Yet seed systems in most Sub-Saharan Africa countries are still relatively underdeveloped with farmer-saved seed accounting for approximately 80% of planted seeds, compared to a worldwide average of 35% (Bay, 1998; Scowcroft & Scowcroft, 1999). Most farmers have not been able to take advantage of new crop varieties developed by the National Agricultural Research Systems (NARS) and the International Agricultural Research Centers (IARCs), mainly due to weak seed production and distribution linkages. The use of low quality seeds partly explains the low yields of grain crops as farmer-saved seeds often produce less vigorous plants. Empirical evidence shows that most smallholder farmers are willing to pay for high quality seeds of improved crop varieties, if given the choice (O'Connor Funk and Wamache, 2012). Figure 17 shows the increased productivity due to maize and fertilizer among smallholder farmers in western Kenya.

This section gives a broad overview of the current structure and key trends in Sub-Saharan Africa seed systems. To set the stage, the section starts by acknowledging the diversity and dynamic nature of seed systems in Africa. This is followed by a review of the major dynamics and key players at various stages of the formal seed systems, including research and development, seed production and processing, marketing and distribution, and farmer utilization. A performance review of the formal seed sector classifies Sub-Saharan Africa countries into five stages of development: (1) Nascent, (2) Emerging, (3) Early Growth, (4) Growth, and (5) Mature. The section explores the role of the informal seed sector and appraises its performance followed by an examination of adoption by smallholder farmers and evaluates the state of enabling environments for seed systems by looking at seed policy, regulation, and supporting institutions. A quick look at potential of genetically modified (GM) crops follows. The section closes with a summary of key challenges facing the seed sector in Sub-Saharan Africa.

FIGURE 17. EFFECT OF FERTILIZER AND IMPROVED SEED ADOPTION ON MAIZE YIELDS AMONG SMALLHOLDER FARMERS IN WESTERN KENYA



Source: Ayieko and Tschirley (2006)

Diverse and Dynamic Seed System

A seed system comprises organizations, individuals, and institutions involved in different seed system functions, (i.e., the development, multiplication, processing, storage, distribution, or marketing of seeds). In the case of Sub-Saharan Africa and most developing countries, a seed system includes both informal and formal sectors often operating in parallel (Maredia and Howard, 1998). The formal seed system is "a deliberately constructed system, which includes a chain of activities leading to clear products: certified seeds of verified varieties" (Sperling and Cooper, 2003). In contrast, informal seed systems largely involve farmers producing seeds of both traditional and self-pollinated non-hybrid crops and a distribution system limited to barter trade and sales in local markets.

Reflecting the wide range of staple foods and the diverse agro-ecological conditions, seed systems in Africa are diverse. The seed systems vary by type of targeted farmers (smallholder or commercial), crop reproduction systems (self-pollinating, cross-pollinating, and vegetatively reproducing crops), and geographic location. It is useful to classify the key Sub-Saharan Africa crops into four categories as follows:

- Cereal food crops: maize, sorghum, millets, wheat, and rice.
- Pulses and oils: beans, cowpeas, pigeon pea, green grams, chickpeas, soybeans, and groundnuts.
- Tuber and root crops: cassava, sweet potatoes, potatoes, and yams are among the important.
- Vegetables: tomato, pepper, onion, cabbage, and a range of African indigenous vegetables.

Despite the diversity of crops grown in Sub-Saharan Africa, the bulk of seed production in Eastern and Southern Africa is geared toward maize, as shown in Table 3. West African countries have a more diversified demand for seed that includes rice, millet, sorghum, and groundnut.

Seed systems in Sub-Saharan Africa are also highly dynamic, especially over the last two decades. Since the mid-1970s, Sub-Saharan Africa governments and the donor community have "recognized the critical role of seed in agricultural transformation and began to provide substantial support for seed system development" (Rusike, Howard and Maredia, 1997). Many of these investments were in experiment research stations, public certification boards, and parastatals with exclusive mandate to produce and market seeds. For most countries, the deregulation of agriculture sectors in the early 1990s under Structural Adjustment Programs ended state-owned monopolies in seed production, marketing, and distribution. Consequently, the past two decades have seen a rapid shift from government-driven to privatized formal seed systems. However, the transition from government monopolies to a competitive private sector has been slow and difficult. Countries that have successfully privatized their seed systems have seen a rapid uptake of hybrid seed by smallholder farmers resulting in increased yields.

TABLE 3. CROPS RANKING BY COUNTRY BASED ON SEED PRODUCTION VOLUMES

COUNTRY	CROP 1	CROP 2	CROP 3	CROP 4
Burkina Faso	Sorghum	Millet	Maize	
Ethiopia	Maize	Sorghum	Bean	Millet
Ghana	Groundnut	Maize	Rice	
Kenya	Maize	Beans	Sorghum	
Liberia	Rice			
Malawi	Maize	Groundnut	Bean	
Mali	Rice	Millet	Sorghum	Groundnut
Mozambique	Maize	Groundnuts	Rice	Sorghum
Niger	Millets	Sorghum	Groundnut	
Nigeria	Groundnut	Sorghum	Rice	Maize
Rwanda	Beans	Maize	Sorghum	Groundnut
Sierra Leonne	Rice	Groundnut		
Uganda	Bean	Maize	Groundnut	
Zambia	Maize	Groundnut		

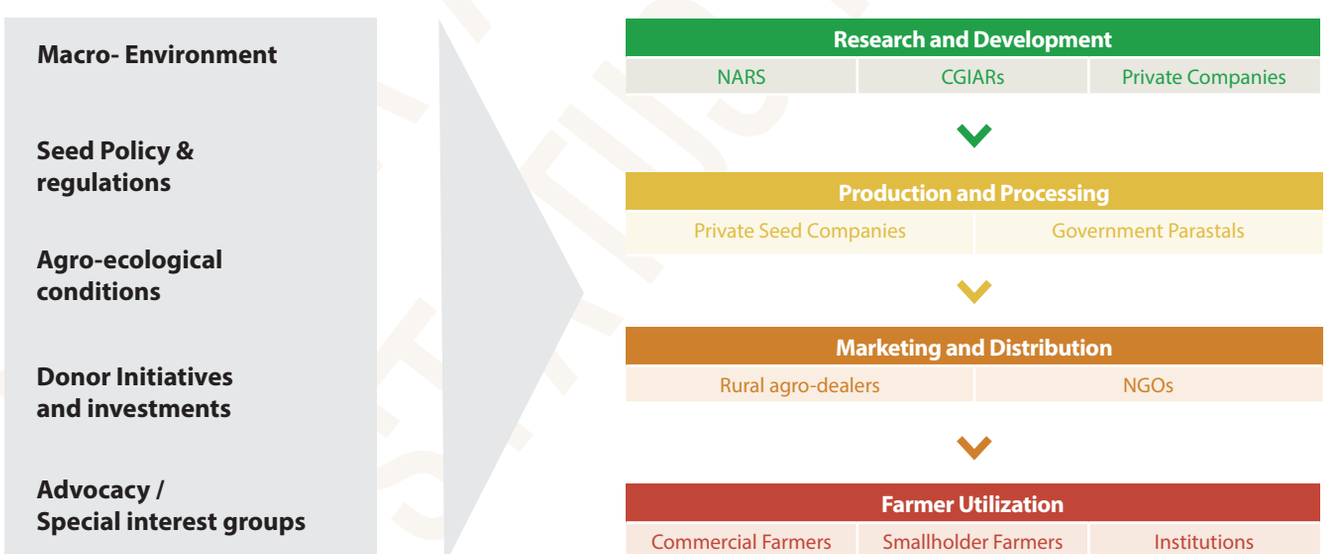
Formal Seed Systems

Formal seed systems (hereafter referred to as seed sector) comprise all seed program components, including plant breeding, seed production, processing, marketing, quality control, and certification, which are usually controlled by laws and regulations. Seed marketing and distribution within the formal system takes place through a limited number of officially recognized seed outlets, usually for financial sale. The formal sector promotes materials toward formal variety release and maintenance.

Structural Overview

As illustrated in Figure 18, formal seed systems in Sub-Saharan Africa are highly fragmented and complex. In developed countries where formal seed systems are well established, the entire seed value chain from research through distribution is often controlled by one or two private companies that have vertically integrated over the years through mergers and acquisitions. In contrast, Africa's seed sector involves numerous players, sometimes with conflicting interests, operating in a loosely integrated value chain. Within the formal seed sector, two models are common in Sub-Saharan Africa. First is the public / parastatal model in which a state agency multiplies and processes seed often protected from competition by statutory instruments. Second is the private sector model in which seed production, processing and marketing is mainly conducted by private enterprises. Under both models, seed is mostly marketed and distributed through networks of rural agro-dealers or non-governmental organizations (NGOs) that distribute seeds through aid programs. The structure of the formal seed sector is constantly changing to cope with the dynamic macro-environment which includes seed policy and regulations, agro-ecological conditions, donor initiatives and investments, advocacy/special interest groups, and socio-economic factors.

FIGURE 18: STYLIZED STRUCTURE OF FORMAL SEED SYSTEMS IN SUB-SAHARAN AFRICA



Source: Adapted from Mabaya (2010)

Stages of Seed Sector Development

Formal seed sectors in Sub-Saharan Africa countries are at different stages of development ranging from nascent through mature. With some bias toward maize, Table 4 delineates the different stages and classifies most Sub-Saharan Africa countries accordingly. For brevity, we eliminate the trivial case of countries without any formal seed sector activity often due to either conflict and/or adverse climatic conditions. Even within the same country, different crops and/or regions could be classified into different stages. Often maize leads the seed sector development followed closely by other grains while pulses and vegetatively propagated crops lag behind.

Stage 1. Nascent: Many African countries are still in the nascent or embryonic stages of seed sector development wherein key policy and institutional frameworks for a formal seed sector are absent. The little seed that is available is imported and used almost exclusively by commercial farmers or relief programs. Countries in this category include South Sudan, Liberia, Sierra Leone, Angola, and the Democratic Republic of Congo.

Stage 2. Emerging: Countries with emerging seed sectors often have some original breeding programs and a formalized variety release process supported by a basic policy and regulatory framework. Seed production and distribution is conducted by a handful of seed companies and/or government parastatals. Adoption of improved seed in these countries is limited to innovating farmers served by NGOs and a limited agro-dealer network. Countries with an emerging seed sector include Niger, Mozambique, Rwanda, Mali, Senegal, Botswana, Madagascar, and Côte d'Ivoire.

Stage 3. Early Growth: With breeding programs well-established and seed policies still evolving, countries transition to the early growth stage. Start-up seed companies begin to produce and sell a limited range of staple crops to early adopting farmers. Countries in the early growth stage include Burkina Faso, Ghana, Ethiopia, Tanzania, and Nigeria. Both government and NGOs are still significant players supported by a growing agro-dealer network.

Stage 4. Late Growth: Spurred by private companies, countries in the late growth stage have well established seed sectors supported by strong breeding programs and seed policies that support private sector participation. In this stage, the private sector participation is highly competitive often with multinational and domestic seed companies producing a wide array of high quality seeds distributed through a strong agro-dealer network plus specialized outlets. Only a handful of Eastern and Southern African countries are in this stage namely Uganda, Zambia, Kenya, Malawi, and Zimbabwe.

Stage 5. Mature: This final stage of seed sector development is characterized by a self-regulating and fully privatized seed sector that is at par with developed countries. Due to mergers and acquisitions, the number of seed companies is lower than those in the growth phases. Most participating companies are vertically integrated with in-house breeding programs and a tightly managed distribution system. The role of the government is minimal and mostly in line with private sector needs. In Sub-Saharan Africa, only South Africa has reached the mature stage.

TABLE 4. STAGES OF SEED SECTOR DEVELOPMENT IN SUB-SAHARAN AFRICA

STAGE OF GROWTH	STAGE 1 Nascent	STAGE 2 Emerging	STAGE 3 Early Growth	STAGE 4 Late Growth	STAGE 5 Mature
Improved seed adoption	Aid/relief programs, Few commercial farmers	<2.5% Innovators	2.5-16% Early adopters	16-84% Early to late majority	>84% All but laggards
Breeding and variety release	No original breeding No formal variety release process	Some original breeding Variety release formalized	Strong breeding systems Significant policy issues preventing further growth	Robust breeding pipeline Favorable seed policies	Mostly private sector driven
Policy and regulation	Non- existent in most cases	Basic and incomplete	Evolving seed policy and regulations	Established and enforced	Industry driven & self -regulating
Private sector participation	No private seed companies	Few small seed companies	Many small/med seed companies	Many stable seed companies	Mostly large seed companies
Distribution system	Imported seed only	Limited agro-dealer network	Growing agro-dealer network	Strong agro-dealer network plus specialized outlets	Vertical integration
Country Examples	South Sudan Liberia Sierra Leone Angola DR Congo	Niger Mozambique Rwanda Mali Senegal Botswana Madagascar Ivory Coast	Burkina Faso Ghana Ethiopia Tanzania Nigeria	Uganda Zambia Kenya Malawi Zimbabwe	South Africa

Source: This table is adapted from unpublished versions of country classification frameworks by Edward Mabaya, Joseph DeVries and Aline O'Connor.

TEXT BOX A: AGRA'S PROGRAM FOR AFRICA'S SEED SYSTEMS (PASS)

Established in 2007, Program For Africa's Seed Systems (PASS) operates through four integrated sub-programs across the seed value chain. It begins with educating a new generation of plant breeders and seed specialists and ends with improved seed on the shelves of village-level agro dealers. PASS is divided into four key components:

Education for African Crop Improvement (EACI): Increasing crop productivity requires the development of hundreds of new, locally adapted crop varieties. This work must be done by well-trained, knowledgeable crop scientists who understand not only plant breeding but also the ecologies, production constraints and local farmer practices in a wide range of countries. EACI provides PhD and MSc fellowships to aspiring African agricultural scientists. It also funds the strengthening of university curricula and facilities. PASS makes a concerted effort to increase female MSc students and has improved the participation rate of women in postgraduate programs from a historical 10% to 31%.

Fund for the Improvement and Adoption of African Crops (FIACC): The FIACC program is intended to increase the farmer's choice for improved variety of seeds. This is done by involving farmers in variety selection where local crop breeders work with farmers to include farmer preferences in variety selection. The breeders use local varieties in combination with modern, higher-yielding lines to achieve better adaptation to local environments. The approach is referred to as farmer participatory variety selection. New varieties are tested with government regulation processes involving on-farm trials and demonstrations on farmers' fields to have the seeds authorized for commercial authorization by seed enterprises.

Seed Production for Africa (SEPA): Once identified, new and improved varieties must be multiplied and distributed so farmers can adopt the new seeds. SEPA helps develop local seed companies that can produce locally adapted varieties of key African crops with traits such as high yielding, drought tolerant and disease resistant. Seed companies require investment capital but commercial banks are unwilling to shoulder the risk associated with young seed enterprises. To fill the financing gap, PASS created two stand-alone venture capital funds to make debt and equity investments in small- and medium-sized seed companies.

Agro-dealer Development Program (ADP): Farmers throughout Africa lack access to the improved technologies needed to increase yields on their farms. The goal of ADP is to increase access to farm inputs among smallholder farmers through the development of agro-dealer networks. Agro-dealers are a primary conduit of seeds, fertilizers, and knowledge to smallholder farmers throughout Africa. Agro-dealers are forming a new generation of frontline extension workers, as they play a critical role in increasing uptake of agricultural technologies by farmers. ADP establishes and supports the growth of agro-dealers in remote, rural areas where farmers currently lack access to seed, fertilizer, and other inputs.

Adapted from AGRA-PASS Website - http://www.agra.org/what-we-do/seed/pass-subprograms/

Research and Development

Lack of national capacity in plant breeding and farmer focused extension has been a limitation to crop improvement in many African countries. There are few well-trained scientists and only a handful of these continue with activities related to plant breeding and varietal development. In most Sub-Saharan Africa countries, varietal development has historically been the mandate of the public sector through the NARS. Although the NARS conduct research in varietal development, recently they have mainly been evaluating improved germplasm from the International Agricultural Research Centers (IARCs). It is only in the recent past that the private sector and universities have started involving themselves in varietal development and release. However, through collaboration between the IARCs, NARS, and donors, several varieties of major food crops, especially maize, sorghum and rice, have been released in the various Sub-Saharan Africa countries. For example, in 7 West African countries, over 131 crop varieties have been released in the past 10 years as shown in Table 5.

TABLE 5. NUMBER OF CROP VARIETIES RELEASED IN WEST AFRICA IN THE PAST 10 YEARS

COUNTRY/CROP	MAIZE	SORGHUM	MILLET	RICE	COWPEA	GROUND NUTS	CASSAVA	SOY BEAN	SWEET POTATO
Burkina Faso	11				4				
Ghana	11			3	3	4	4	4	
Mali	14	13	8	22	9				
Nigeria	4		1		2		4		2
Niger		5*							
Sierra Leone	1*			8*			9*		
Liberia				3*					

* Lines being evaluated and awaiting release

In East Africa, both the public and private sector have been involved to some extent in varietal development. The involvement of the private sector in the variety evaluation and release process has also greatly improved, compared to the situation before 2000. For instance, out of the total of 140 seed varieties released for commercialization in Kenya, 43 (30.7%) were released by the private sector, while 77 (55%) were released by NARS and the Kenya Seed Company (KSC). The number of varieties released in collaboration with IARCs was 20 (14.3%). However, in some countries, notably Ethiopia and Sudan, private sector involvement is still very limited.

TABLE 6. TRENDS IN VARIETY RELEASE OF THE 10 SELECTED CROPS IN THE EASTERN AND CENTRAL AFRICA REGION

COUNTRY	NUMBER OF VARIETIES RELEASED		% RELEASED BY PRIVATE SECTOR	NUMBER OF SEED COMPANIES
	1995-2000	2001-2008		
Burundi	18	40	0	3 (2 private)
Ethiopia	46	574	0.03	76 (70 private but only 24 active)
Kenya	38	140	30	74 (70 private)
Rwanda	NI	12	0	
Sudan	NI	172	0	23 (22 private)
Tanzania	27	121	30	31 (30 private)
Uganda	8	27	50	20 (all private)
Total		715		

NI = No information.
Source: ASARECA

Seed Production and Processing

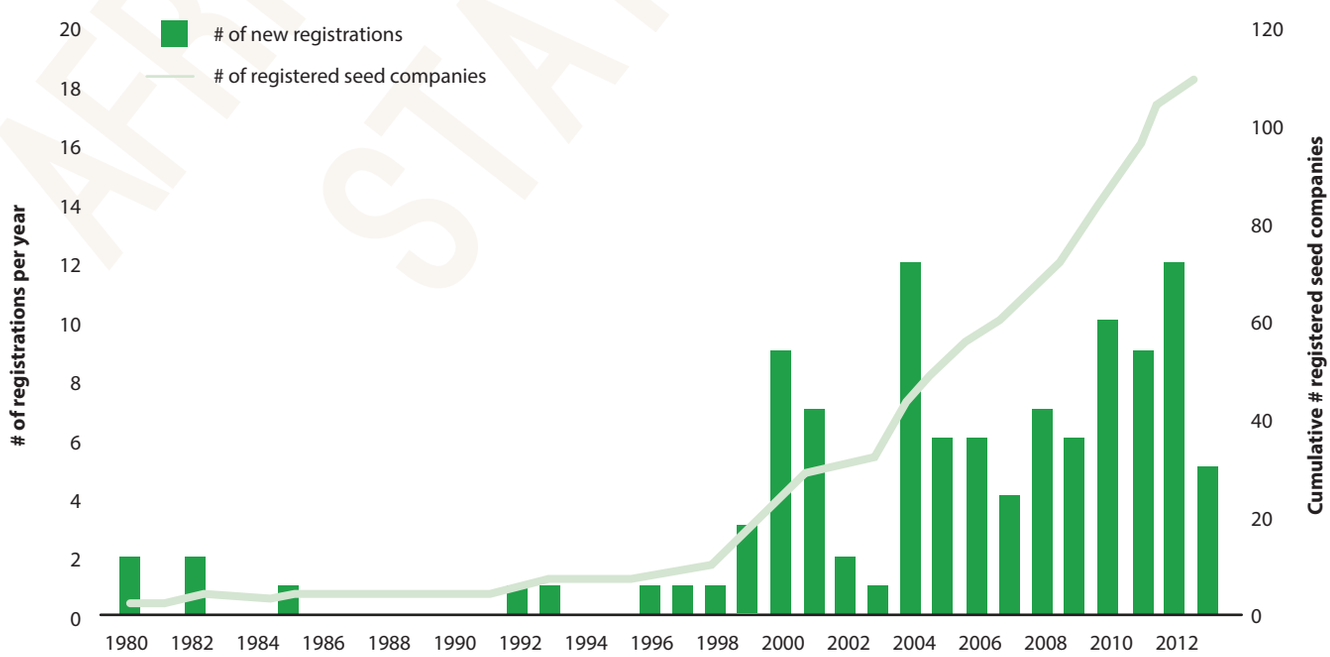
According to a recent report, Africa's seed market is estimated at US$1.5 billion—about 3% of the world total—and is expected to double to US$3 billion within the next 10 years (Bloomberg, 2012). The market opportunities are attracting investments from domestic, regional, and multinational seed companies. Perhaps the biggest change in Sub-Saharan Africa seed systems over the past decade has been the rise of private seed companies, especially in East and Southern Africa. Table 7 shows the rising number of registered seed companies in East African countries in 2002, 2007, and 2012. At country level, this exponential growth in private sector participation is most evident in Kenya as represented in Figure 19.

TABLE 7. NUMBER OF REGISTERED SEED COMPANIES BY COUNTRY

COUNTRY	2002	2007	2012
Kenya	31	60	104
Ethiopia	0	8	13
Rwanda	0	1	5
Tanzania			66
Uganda			23
Malawi	2	5	11

Source: Based on company registration information provided by national seed traders associations

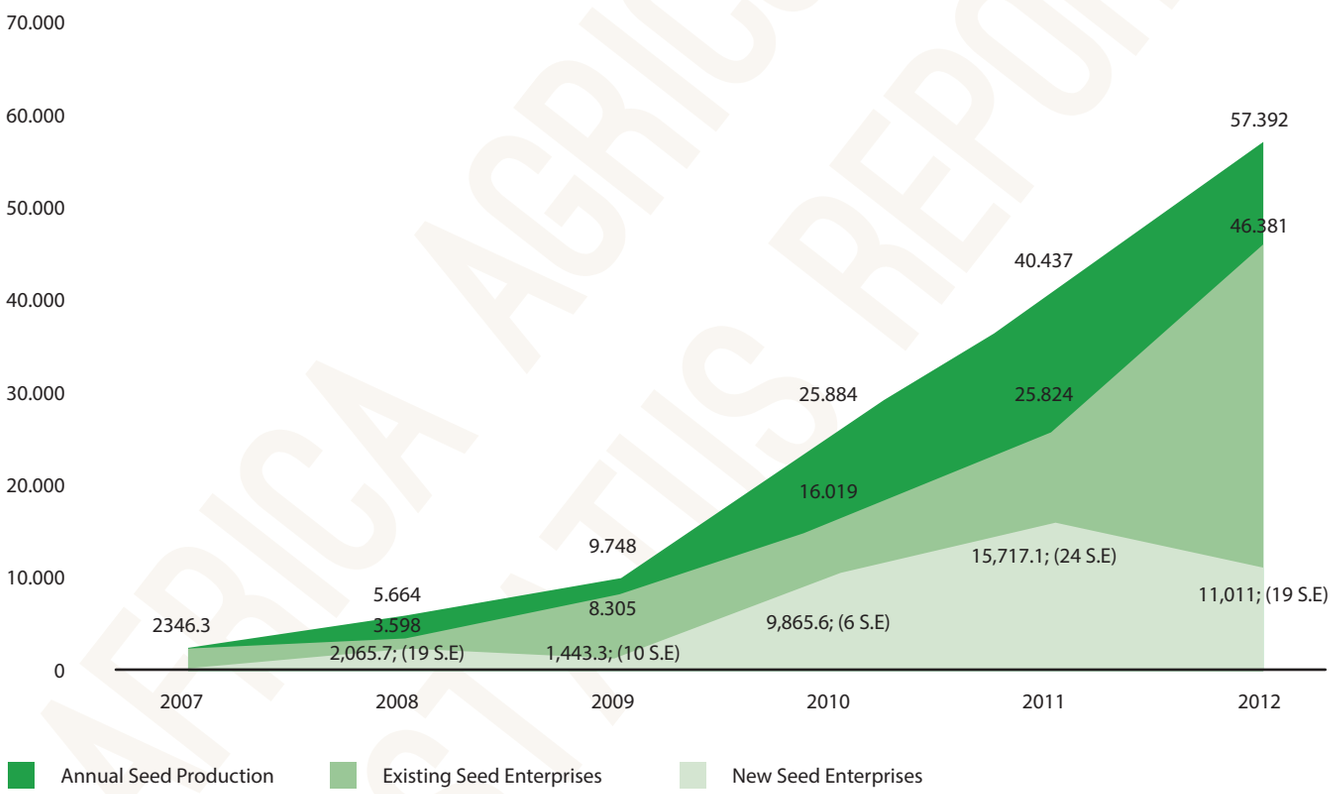
FIGURE 19: EXPONENTIAL INCREASE OF REGISTERED SEED COMPANIES IN KENYA



Source: Based on company registration data provided by Kenya Seed Traders Association

Seed supply from the formal sector is still limited—in particular in West Africa. Before the PASS program began, the private sector in West Africa was non-existent with the possible exception of Nigeria. By 2012, seed production volumes for PASS supported companies varied from 1,088 metric tons in Niger, 1,172 metric tons in Ghana, 1,409 metric tons in Mali, 2,389 metric tons in Burkina, to 10,933 metric tons in Nigeria. Nonetheless, many small companies operating in West Africa are still bedeviled by problems typical of infant industries, such as limited access to capital finance and poor management. Based on criteria such as farmer focus, introduction of clean seed of improved varieties, rapid expansion of the production capacity, and recognized presence in the national seed market, a short list of leading companies from West Africa could include: Nafaso (Burkina Faso), M&B Seeds (Ghana), Faso Kaba (Mali), Enterprise Alheri (Niger), Manoma Seeds and Maslaha Seeds (Nigeria). Figure 20 shows the volume of seed produced through PASS supported seed companies from 2007 through 2012.

FIGURE 20: VOLUME OF SEED PRODUCED BY AGRA-PASS SUPPORTED COMPANIES (METRIC TONS)



Seed Marketing and Distribution

Given the fragmented nature of rural seed markets in Sub-Saharan Africa and poor transport infrastructure, it is inefficient for private seed companies and government parastatals to distribute seed directly to smallholder farmers. Instead, they rely on rural agro-dealers or NGOs that serve smallholder farmers. In 2007, AGRA-PASS initiated the agro-dealership development program (ADP) to train a professional cadre of agricultural input distributors in 10 Sub-Saharan Africa countries.

Since 2007, the program has trained and developed over 17,000 agro-dealers. These rural entrepreneurs have enhanced the availability, uptake, and use of improved agricultural inputs by smallholder farmers. Over the period, a total of nearly 400,000 metric tons of seed and 1 million metric tons of fertilizers have been sold to farmers through agro-dealers in over 16 countries in Sub-Saharan Africa, some of which are shown in Table 8. Through the various promotional and market development activities, agro-dealers contribute to farmer mobilization and training to increase their awareness of the importance of using improved agricultural technologies. Over the period, agro-dealers have conducted over 7,000 technology demonstrations and held nearly 4,000 farmer field days. Together with agricultural researchers and seed enterprises, agro-dealers contribute to commercialization of new crop varieties.

TABLE 8. OUTCOMES OF THE AGRO-DEALER DEVELOPMENT PROGRAM

COUNTRY	NO. OF AGRO-DEALERS TRAINED	QUANTITY OF SEEDS DISTRIBUTED (MT)	QUANTITIES OF FERTILIZERS DISTRIBUTED (MT)	AMOUNT OF LOANS DISBURSED (USD)	NO. OF AGRO-DEALERS GETTING LOANS
Ghana	2,650	NA	NA	3.3	300
Nigeria	3,987	4,515	45,600	0.724	294
Mali	1,000	900	15,800	1.0	276
Burkina Faso	747	2,261	16,717	0.7	83
Kenya	1,976	83,000	86,000	4.4	NA
Tanzania	3,455	NA	NA	4.3	NA
Mozambique	425	3,900	5,600	1.5	NA
Malawi	1,507	NA	NA	4.3	NA
Zambia		9,000	NA	3.1	NA
Uganda	2,000	NA	NA	2.4	NA
Totals	17,747	103,576	169,717	25.724	953

Informal Seed Systems

For most smallholder farmers in Sub-Saharan Africa, the formal seed system does not fully meet their seed requirements. Based on a lack of education, inability to purchase seed, limited access to agro-dealer, or other reasons, most farmers still rely on informal seed systems. The informal seed sector broadly refers to the system where farmers produce, obtain, maintain, develop, and distribute seed resources, from one growing season to the next and in the long run (FAO, 1998). Thus, the informal seed system forms an integral part of a wider agricultural system and depends largely on the capacity of farmers to plant crops each season and successfully retain some of the harvest for planting the following season. In cases when the farmer is unable to retain part of the harvest, or when a farmer decides to plant a different variety, seed is generally acquired from within the local community, including markets, as well as farmers' social networks.

The main characteristic of the informal seed systems is its flexibility. The varieties may be landraces or mixed races and heterogeneous (modified through breeding and use), and seed is of variable quality (Almekinders and Louwaars, 1999). The same general process takes place in the local systems as in the formal sector (variety choice, variety testing, introduction, seed multiplication, selection, dissemination and storage), but as an integral part of the farmers production systems rather than as a discrete activity. The steps in the informal seed systems are not monitored or controlled by government policies and regulations; rather they are guided by local technical knowledge and standards and by social structures.

More than 80% of the seed planted by farmers in Sub-Saharan Africa originates from informal systems (African Union, 2008; Byerlee, et al., 2007). To a large degree, farmers rely on informal seed sources, independent of whether they cultivate local or modern varieties. Despite many investments in technology, dissemination, and marketing systems, the continued importance of informal seed systems in any region or production system is by a large degree defined by the fact that most small-scale, poor farmers operate in complex, risk-prone, and diverse environments. Local varieties from informal sources do remain to meet the needs of many farmers and communities (Jarvis et al., 2011). Farmers continue to use farmer-saved seed of both local and modern varieties for several reasons. Some of the reasons are:

- Inadequate access to markets
- Structure and functioning of market channels often unfavorable to those farmers living in remote areas
- Limited access to financial resources or credit to buy or produce seed
- Limited effectiveness of the formal system in providing timely and adequate access to quality seed of improved varieties

- Lack of interest or capacity of the research system for developing genotypes that are specifically adapted to their production environment, owing to economic and organizational considerations. While there is some literature examining both formal and informal seed systems, the interactive effect between these two systems has not been studied in-depth

Adoption of Improved Varieties

Adoption of improved varieties in Sub-Saharan Africa varies widely by location and crop. Adoption rates of improved seed by country are as follows (the number in parentheses indicating adoption rate): Burkina Faso (6.9%), Ghana (10%), Malawi (46%), Mali (16.9%), Mozambique (8.3%), Niger (13%), Rwanda (14%), Sierra Leone (13%), Tanzania (19%), and Uganda (15%). Over the past two decades, the area planted with modern varieties of maize (including both hybrids and open-pollinated varieties) has increased significantly. In 2006, modern maize varieties covered 33% of the area in Eastern Africa and 38% in Southern Africa, excluding South Africa (Mason et al., 2011), and maize coverage reached 15% in 2005 in Western Africa (Alene et al., 2009). In the early 2000s, adoption rates for modern varieties reached 60% for wheat and 40%–50% for rice (Evenson & Gollin, 2003). Variety replacement for the major (non-African) food crops is estimated at 40%, while variety replacement of food crops such as sorghum stays low at 10% (Byerlee, et al., 2007).

The situation for maize is different from that of other crops. Modern variety adoption and yearly purchase of formal quality seed of maize hybrids has increased through an emerging commercial maize seed sector (Kenya), public maize dissemination (Ethiopia), a strong association between NGOs and private companies in seed marketing (Ghana), and public subsidized input programs (Malawi, Zambia) (Scoones & Thompson, 2011). The increase is the result of major initiatives that foster market-led technology adoption (Toennissen, Adesina, & Devries, 2008). The "maize model" boosts technology use and is enforced by favorable institutional and policy frameworks. In several countries (e.g., Malawi, Zambia), the maize model is embedded in national subsidized input programs targeting national food security and enterprise development. However, in both countries these programs take a major share of the government budget available for agriculture (Chinsanga 2011; Nakaponda, 2011), which indicates limited sustainability. Smale, Byerlee, and Jayne (2011) and Scoones and Thompson (2011) question whether the maize model is economically viable and institutionally sustainable, and suggest that it is not applicable to other seed systems or food crops. Alternative approaches are required, for example, upgrading or strengthening "fragile" public breeding and seed systems (Scoones & Thompson, 2011), supporting local seed businesses (Thijssen et al., 2008; Neate & Guei, 2011), and strengthening national seed companies (MacRobert, 2009; O'Connor, Funk, 2009). The primary focus on maize is an illustration of the limited picture dominant in seed sector development, varietal replacement, and adoption of modern varieties in Sub-Saharan Africa; it only addresses part of a much more robust reality of food and seed markets (Lipper, Anderson, & Dalton, 2010; Sperling & McGuire, 2010).

Seed Policy, Regulation, and Institutions

Many Sub-Saharan Africa governments have recognized the fundamental importance of sustainable seed production systems in contributing to increased agricultural production. Governments in Sub-Saharan Africa currently employ different policies, laws, regulations, and procedures to promote and regulate the seed sector. However, through regional organizations such as the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), the Southern Africa Development Community (SADC), and the Economic Community of West African States (ECOWAS), efforts are underway to rationalize and harmonize seed policies, laws, regulations, and procedures. Since 2002, individual countries have been modifying their policy environments to conform to the common procedures for variety release, seed certification, and laboratory testing based on standards developed by the International Seed Testing Association (ISTA) and the Organisation for the Economic Cooperation and Development (OECD). Most of the countries in Sub-Saharan Africa are currently introducing Plant Variety Protection Laws based on the International Union for the Protection of New Varieties of Plants (UPOV) model.

Over the past five years, considerable progress has been made in the harmonization of seed policies within the East and Central African (ECA) region. This has allowed the length of the variety release period to be reduced from three or more years to only two seasons. This has greatly improved the availability of improved seed varieties and increased private sector participation in the variety release process. In countries where variety release data was available for the period before and after the harmonization project, the growth in the number of seed companies and the total number of seed varieties released was quite substantial. Many countries are now drafting new or revising existing legislation in the light of current developments and to meet the requirements of the international seed trade, (e.g., variety registration, variety protection, plant breeders' rights, and seed import/export regulations).

The seed certification procedures in countries with an established seed sector have been standardized to the OECD standards. Kenya and Uganda have acceded to the OECD standards while Tanzania has applied for membership. The standardized certification procedure has greatly improved the working relationship between regulators and seed companies in the ECA region. However, the failure to establish interagency certification for seeds in transit may be hampering seed trade. Within the harmonization period, quarantine pest lists have been revised for Kenya, Uganda, and Tanzania. The crops for which lists have been developed include maize, rice, wheat, sorghum, beans, soybeans, groundnuts, sunflower, Irish potatoes, and cassava. Unlike Kenya, Tanzania, and Uganda, the other ASARECA member countries have not revised their quarantine pest lists. However, the Eastern Africa Seed Committee (EASCOM) is in the process of reviewing and updating the quarantine pest lists for the countries that have not yet revised them.

The ECA countries are at different stages of developing Plant Variety Protection (PVP) systems. While Ethiopia, Kenya, and Tanzania have PVP laws based on the International Union for the Protection of New Varieties of Plants (UPOV) 1991 Convention—only Kenya has an operational PVP system compliant with UPOV 1978 Convention. Uganda has a draft PVP legislation that is awaiting parliamentary debate. Burundi, Rwanda, Sudan, and Madagascar do not have Sui Generis systems based on the UPOV (1991). All ECA countries have put in place elaborate import/export documentation procedures. As a result of harmonizing the phytosanitary procedures in the ECA region, the time taken to process seed import/export documentation has been reduced, lowering the cost of doing cross-border trade. However, while Burundi, Madagascar, Sudan, Tanzania, and Uganda have put in place measures to unify and simplify their cross-border trade documentation procedures, the plant import/export documentation procedures in Kenya and Ethiopia have remained largely rigid.

The relevance of the seed trade associations in a harmonized seed policy regime largely depends on how well they meet their set objectives in the face of a rapidly changing seed industry. When judged against the objective of promoting regional formal seed trade, the seed associations have achieved a great deal of success. Local seed production tripled from 43,000 tons to about 122,000 tons between 2002 and 2008. In addition, seed imports into the region almost doubled from 9,000 tons to about 15,000 tons over the period under analysis. Over the same period, intra-ECA seed imports have more than tripled as seed exports from Kenya and Uganda have gradually increased from less than 1000 tons to more than 3,000 tons. Moreover, the harmonization of seed policies in the ECA region has seen a general increase in seed price stability for maize seed in the entire region, which benefits commercial farmers. The results of the welfare analysis give compelling evidence in support of an improved seed policy environment.

Policy issues affecting the seed industry vary from country to country, but there are some commons threads such as the restriction of local seed companies from producing foundation seed of public varieties, which is the case in Tanzania, Ethiopia and Mozambique. However, some of these seed regulations have been revised but their implementation is what is remaining to be seen. In Ethiopia, local companies producing public varieties are prohibited from setting their own prices and selling to areas of choice. They are mandated to sell back the seed to the government, which then allocates the seed to cooperatives for distribution to farmers.

The Farce about Genetically Modified Crops

The introduction of genetically modified (GM or GMO) crops has attracted much debate among seed companies, policy makers, and the general public in Africa. First it is important to point out that GM crops have been subject to more testing worldwide than any other new crops, and have been declared as safe as conventionally bred crops by scientific and food safety authorities worldwide. A recent EU report concludes that more than 130 EU research projects, covering a period of more than 25 years of research and involving more than 500 independent research groups, concur that consuming foods containing ingredients derived from GM crops is no riskier than consuming the same foods containing ingredients from conventional crops (European Commission, 2010). Such well-known organizations as the World Health Organization (WHO, 2010), the U.S. National Academy of Sciences (National Academy of Sciences, 2005), and the European Food Safety Authority (EFSA) have come to the same conclusion. Secondly and equally important, given low adoption of improved crops by smallholder farmers in most countries, GMO crops are unlikely to impact Africa food security in the near future given low marginal yield gains over conventionally bred seeds.

As of 2012, GM crops were being grown in 20 developing countries and 8 industrial countries conferring beneficial traits such as herbicide tolerance, insect resistance, and nutritional enhancement (Clive, 2012). Despite the potential advantages, adoption of GM crops in Africa has been slow and marred by controversy. At present, only four African countries—Burkina Faso, Egypt, Sudan, and South Africa—have fully commercialized GM crops. Table 9 shows the area planted to GM crops in Africa during the 2012 cropping year.

TABLE 9. GM CROP ADOPTION IN AFRICA (HECTARES PLANTED IN 2012)

COUNTRY/CROP	COTTON	SOYBEAN	MAIZE	TOTAL
Burkina Faso	300,000	0	0	300,000
Egypt	0	0	1,000	1,000
South Africa	15,000	382,000	1,873,000	2,300,000
Sudan	200,000	0	0	200,000
Total	515,000	382,000	1,874,000	2,801,000

Source: Compiled from Clive (2012)

Table 9 does not tell the full story of GM adoption in Africa. Most African countries are at various stages of creating enabling environments for GM crop commercialization. Five countries (Cameroon, Kenya, Malawi, Nigeria and Uganda) are currently conducting field trials of biotech crops, the final step before full approval for commercialization. One level lower on the adoption ladder are countries that have put in place the requisite policy and regulatory frameworks. Most African countries have signed and ratified the Convention on Biological Diversity as well as the Cartagena Protocol on Biosafety (Nang'anyo, 2006). There is growing public opposition to GM crops in Africa that is best described as a fear of the unknown. Unless milled, the import of GMO foods is currently banned in Angola, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Swaziland, Tanzania, Zambia, and Zimbabwe. More important to seed sector development, these bans signal the arbitrariness and unpredictability of public policy.

Key Challenges

Despite the significant progress that has been made over the last decade, African seed systems still fall short of meeting the task at hand — supplying most African smallholder farmers with high quality, appropriate, improved seed at affordable prices. With the possible exception of South Africa, no country in Sub-Saharan Africa is currently able to meet its seed demand for maize (Langyintuo, et al., 2008). It will take time and coordinated efforts by donors, governments, and the private sector to achieve well-functioning African seed systems. This section closes with a brief discussion on some of the some key challenges facing African seed systems.

Thinking beyond maize seed: Hybrid maize seed dominates the discussion on African seed systems. Despite its importance to food security, it will take much more than hybrid maize to sustainably feed the continent. Private seed companies are reluctant to produce and distribute open-pollinated varieties since they are easy to recycle, in turn resulting in few repeat purchases. However, from a nutritional point of view, these crops provide much needed vitamins and micronutrients. Parallel efforts are needed to address seed challenges for the so-called 'orphan crops' such as food legumes and small grains.

Vegetatively propagated crops: Root and tuber crops such as cassava, sweet potatoes, yams and potatoes are of immense importance to many communities that rely on these starchy staple crops. Most people living within the tropics depend on these root crops as their main staple. The most common root crops in the Sub-Saharan Africa region are cassava, sweet potatoes, yams and taro. Three CGIAR centers, namely International Potato Center (CIP) (potatoes and sweet potatoes), International Center for Tropical Agriculture (CIAT) (cassava), and International Institute of Tropical Agriculture (IITA) (cassava and sweet potatoes) assist Sub-Saharan Africa countries in the development of these crops. However, in Sub-Saharan Africa countries, very little of the technologies has reached farmers. Moreover, there are no clear strategies to sustainably multiply and distribute these vegetatively propagated crops.

Role of NGOs: NGOs' involvement in the purchasing and distribution of seed is a double-edged sword to seed sector development. In the short term, they increase farmer awareness of improved seed varieties while providing a reliable and lucrative market to private companies. However, the unintended consequences of

NGO involvement include a low appreciation of the value of seed by farmers (as they often get it for free) and market distortions to private seed companies. Further, the buying habits of such NGOs are highly unpredictable resulting in spikes and slumps in national seed demand. Thus, over-reliance on the NGO seed market can be detrimental to building sustainable seed systems. Where aid and relief are necessary, initiatives such as the input voucher project in Malawi and Zambia, that allow NGO participation with minimal market distortion, should be encouraged.

Poor data quality: In writing this chapter it became clear that quantitative data on African seed systems (both formal and informal) are limited and of poor quality. There are huge gaps in information on breeding activities, private sector participation, adoption rates, etc. Besides a handful of specific studies often covering narrow geographies, no organization has systematically maintained a compressive database on African seed systems. Much of the data available are of questionable quality due to a lack of consensus on the definition of seed, unreliable estimation methods and inconsistent collection. Consequently, key policy and investment decisions are being made with limited information of questionable quality.

Fake seed: Fake seed has been identified as the single biggest threat to Africa's emerging seed sector. In 2012 the Kenya Agricultural Research Institute (KARI) reported that "roughly four out of ten seed packets in the country contain fake seed and three-quarters of farmers have planted fake seeds at some point of time" (African Farming and Food Processing, 2012). The movement of counterfeit seeds within the Common Market for Eastern and Southern Africa (COMESA) region is estimated to be growing at about 5% per year since 2008. Left unchecked, this problem can undo the progress made to date in providing smallholder farmers access to improved seeds. Farmers who fall victim to fake seed stand to lose not only a whole season of crops but also their trust in improved seed. Fake seed therefore hurts both farmers and seed companies. Yet there is no coordinated effort to 'nip this problem in the bud' before it spreads.

Coordination challenge: As highlighted in this chapter, seed systems in Africa are highly fragmented and ever changing. Further, there are numerous stakeholders including the public sector, development agencies, NGOs, research institutions, private companies, and farmer organizations. There are many initiatives, interventions, and investments seeking to improve adoption of yield increasing technologies by smallholder farmers at village, provincial, country, and regional levels. Some efficiency can be gained by better coordination between the myriad of players and initiatives by building synergies and reducing unnecessary duplications.

References

African Union. 2008. African seed and biotechnology programme. Addis Ababa, Ethiopia: African Union

African Farming and Food Processing. 2012. "African alliance sets up agency to eliminate fake seeds" Viewed 15 May 2013, < http://africanfarming.net/crops/agriculture/african-alliance-sets-up-agency-to-eliminate-fake-seeds

Ayieko, M. and Tschirley, D. (2006). "Enhancing access and utilization of improved seed for food security in Kenya." Working paper No. 27/2006. Tegemeo Institute of agricultural policy and development, Egerton University, Kenya.

Almekinders, C.J.M. and Louwaars, N.P. (1999) Farmers' Seed Production: New Approaches and Practices. Intermediate Technology Publications, London. 291 pp.

Alene, A. D., A. Menkir, S. O. Ajala, B. Badu-Apraku, A. S., Alanrewaju, V. M. Manyong and A. Ndiaye. 2009. The economic and poverty impacts of maize researcher in West and Central Africa. Agric. Econ. 40:535–550.

Bay, A.P.M., "The Seed Sector in Sub-Saharan Africa: Alternative Strategies", proceedings of the Regional Technical Meeting on Seed Policy and Programmes for Sub-Saharan Africa, Abidjan, Côte d'Ivoire, 23-27 November, 1998.

Bloomberg. 2012. "Syngenta Embarks on Africa Drive as Dupont Snaps Up Seed Target" Bloomberg (June 26, 2012)

Byerlee, D., A. de Janvry, E. Sadoulet, R. Townsend, and I. Klytchnikova. 2007. World development report, 2008. Agriculture for development. Washington, DC: World Bank.

Chinsanga, B. 2011. Seeds and subsidies: The political economy of input programmes in Malawi. IDS Bull. 42(4): 59–68.

Clive, J.. 2012. Global Status of Commercialized Biotech/GM Crops: 2012. ISAAA Brief No. 44. ISAAA: Ithaca, NY.

European Commission Directorate-General for Research and Innovation Biotechnologies, Agriculture, Food .2010. A Decade of EU-funded GMO Research, European Union, <http://ec.europa.eu/research/biosociety/pdf/a_decade_of_eu-funded_gmo_research.pdf>.

Evenson, R. E., and D. Gollin (Eds.). 2003. Crop variety improvement and its effect on productivity: The impact of international agricultural research. Wallingford, UK: CABI.

FAO. 1998, Seed and Plant Genetic Resource Services: Developing Seed Security Strategies and Programmes for Food Security in Developing Countries. In Proceedings of the International Workshop on Seed Security for Food Security, 30 November to 1 December 1997. Florence, Italy.

Jarvis, D. I., T. Hodgkin, B. R. Sthapit, C. Fadda, and I. Lopez Noriega. 2011. A heuristic framework for identifying multiple ways of supporting the conservation and use of traditional crop varieties within the agricultural production system. Crit. Rev. Plant Sci. 30(1 & 2): 125–176.

Langyintuo, A.S., Mwangi, W., Diallo, A.O., MacRobert, J., Dixon, J. and Bänziger, M. (2008) An Analysis of the Bottlenecks Affecting the Production and Deployment of Maize Seed in Eastern and Southern Africa. CIMMYT, Harare, Zimbabwe.

Lipper, L., C. L. Anderson, and T. J. Dalton (Eds.). 2010. Seed trade in rural markets. implications for crop diversity and agricultural development. London, UK: Earthscan.

Mabaya, E. 2010. "Sowing the 'Seeds of Development' in Africa" Seminar presented for Cornell International Institute for Food Agriculture and Development (CIIFAD), Cornell University, Ithaca, USA. Available http://ciifad.cornell.edu/downloads/Mabaya.pdf.

Nang'anyo, F. 2006. "The status of Regulations for Genetically modified crops in countries of Sub-Saharan Africa." African Agricultural Technology Foundation (AATF), Nairobi, Kenya.

MacRobert, J. F. 2009. Seed business management in Africa. Harare, Zimbabwe: CIMMYT.

Maredia, M. and Howard, J. 1998. "Facilitating Seed Sector Transformation in Africa: Key Findings From the Literature", Number 33 Food Security II Cooperative Agreement Policy Syntheses, Number 31, MSU Agricultural Economics, 1998.

Nakaponda, B. 2011. National seed sector assessment–Zambia. African seed and biotechnology programme/integrated seed sector development in Africa. Lusaka, Zambia: Self Help Africa Zambia.

National Academies. 2005. Technology to Feed the World, Washington DC, viewed 23 November 2012, < http://www.nationalacademies.org/webextra/crops/>

Neate, P. J. H., and R. G. Guei. 2011. Promoting the growth and development of smallholder seed enterprises for food security crops. Rome, Italy: FAO.

O'Connor Funk, A. 2009. The African seed company toolbox: 52 tools every seed company manager should know how to use. Nairobi, Kenya.

O'Connor Funk, A. and Wamache, A.K. 2012. "Kenya Seed Industry Study (KSIS)", Agri Experience, Nairobi, Kenya.

Rusike, J. , Howard, J., & Maredia, M., 1997 "Seed Sector Evolution in Zambia and Zimbabwe: Has Farmer Access Improved Following Economic Reforms?," MSU Policy Synthesis No. 31, 1997.

Scoones, I., and J. Thompson. 2011. The politics of seed in Africa's Green Revolution: Alternative narratives and competing pathways. IDS Bulletin 42(4): 1–23.

Scowcroft, W. R. and Polak Scowcroft, C.E.,. 1999. "Developing a strategy for seed security in Sub-Saharan Africa: Policies, stakeholders and coordination," Proceedings of Seed Policies and Programmes in Sub-Saharan Africa workshop, FAO, Rome, Italy, 1999.

Smale, M., D. Byerlee, and T. Jayne. 2011. Maize revolutions in Sub-Saharan Africa. Policy Research Working Paper 5659. Washington, DC: World Bank.

Sperling, L., and S. McGuire. 2010. Understanding and strengthening informal seed markets. Exper. Agric. 46(2): 119–136.

Sperling, L. and Cooper, H. D. 2003. "Understanding seed systems and seed security. In Improving the effectiveness and sustainability of seed relief." Proceedings of a stakeholders workshop, Rome, 26-28 May 2003. Rome: Food and Agriculture Organization.

Thijssen, M. H., Z. Bishaw, A. Beshir, and W.S. de Boef (Eds.). 2008. Farmers' seeds and varieties: supporting informal seed supply in Ethiopia. Wageningen, The Netherlands: Wageningen International

Toennissen, G., A. Adesina, and J. Devries (2008). Building an alliance for a Green Revolution in Africa. Ann. N.Y. Acad. Sci. 1,136:233–42.

"Africa desperately needs simple and efficient high-yielding farming systems: improved seeds bred for local conditions, combined with necessary chemical fertilizers and effective integrated pest management practices."

Dr. Norman Borlaug
1970 Nobel Peace Prize Laureate & former president, Sasakawa Africa Association

CHAPTER 06

FINANCING AFRICAN AGRICULTURE: AN IMPERATIVE FOR INCLUSIVE INNOVATIVE FINANCING

By Bernadette Mukonyora, IFAD and Nixon Bugo, AGRA

Background

Recent global developments have triggered a surge in investments in African agriculture. Efforts are being made to raise investment levels in African agriculture to help address global and regional concerns for food, industry and fuel. Drivers of investments in agriculture include: i) the rising global population expected to reach 9 billion by 2050 characterized by rapid growth in populous countries such as Brazil, China, India and the Republic of Korea which resulted in rising incomes, higher expenditures on foodstuffs and demand for higher value agricultural commodities, ii) biofuel initiatives around the world, which have resulted in a spate of investments in developing countries to grow sugarcane, grains (such as maize) and oilseeds (such as soya beans), as well as non-food crops such as jatropha, and iii) the rapid rise in food prices, with subsequent shortages in commodities such as rice and restrictions on exports of these products by some developing-country governments, has spawned new investors in agriculture.

Despite this positive financing trend for African agriculture, there remains the challenge of capital flight (unrecorded capital flows between a country and the rest of the world) which threatens to continue depleting the resources available for development in the region. Estimates by Boyce and Ndikumana (2012), based on an analysis of 33 Sub-Saharan African (SSA) countries suggest that Africa lost a total of US$814 billion dollars (constant 2010 US$) from 1970 to 2010, which exceeds the amount of official development aid (US$659 billion) and foreign direct investment (US$306 billion) received by these countries. At these alarming proportions, capital flight poses a significant challenge for development investments in the region.

An overview of the general nature of agricultural finance is necessary to understand how the sector has evolved over time in Africa. The discussion on agricultural finance can be divided into three time periods: 1950s–1970s, the 1980s, and the 1990s. These periods are marked by the following policy shifts:

- A supply-driven approach during 1950s–1970s emphasized the provision of financing to farmers through interventions such as input credit delivered through cooperatives and obtained from donors, government allocations, and central banks. However, this financing did not contribute to addressing the challenges of financing the agriculture sector in rural areas. Agricultural banks were also established during this time, however, most of these were ineffective, as they were unprofitable. A number of these banks closed down, and those remaining faced significant challenges of understanding the agriculture sector and attracting financing.

- The 1980s took a new turn toward more liberalized financial sectors. For instance, bank lending to agriculture in Africa was almost halved with the abolition of sectorial lending quotas, while most commercial banks in Nigeria, for example, preferred paying penalties to complying with agricultural lending quota regulations (Shepherd & Onumah, 1997).

- Microfinance emerged during the 1990s as a potential panacea to the failure of the agricultural banks and financial liberalization. In this era, several NGOs converted into full-service microfinance institutions targeting rural and micro-entrepreneurs replicating the Grameen model (Shepherd & Onumah, 1997). Microfinance proved to be more effective at targeting of the poor (in both rural and urban areas) with market-determined interest rates and better loan recovery through scheduling loan repayment in a manner that imposed minimum financial strain on poor households (basically requiring weekly repayment of very small amounts). However, the farm sector did not benefit much from the supply of microfinance (Murdoch, 2000).

The Landscape: Key Highlights

Financing requirements for African agriculture remain substantial. Foresight estimates by FAO (2009) suggested that global food production needs to grow by 70% to feed 9.1 billion people in 2050. This expansion of agricultural output will require average annual net investments of US$83 billion (in 2009 US$) by developing countries. Of the total, US$11 billion would be needed in Sub-Saharan Africa, where predominant numbers of farmers are smallholders—estimated at close to 50 million farms, representing 80% of all farms in the region. The projected investment needs US$20 billion going to crops production and US$13 billion going to livestock production. A further US$50 billion would be needed for downstream services to help achieve a global of 70% expansion in agricultural production by 2050. Carroll, et al., (2012) estimated that about US$450 billion is required to finance productive market-oriented smallholder farming. Given these huge financing requirements for smallholder agriculture, it is unlikely that African countries will be able to raise the needed funds through traditional sources, which often tend to be limited and volatile during times of global crisis.

Notwithstanding the huge financial needs required by the sector to thrive, the actors in the African agriculture sector are diverse. As illustrated in the FAO (2012) report (see Figure 21), *State of Food and Agriculture* (SOFA), which focused on agriculture investment; farmers themselves are central to the sector as the main financiers, followed by public investments which are vital for overcoming challenges. Foreign private and foreign public investments also have a significant stake in African agriculture.

FIGURE 21: SOURCES OF INVESTMENT IN AGRICULTURE

Source: FAO SOFA (2012)

Smallholder Farmers: Key Providers of Capital That is Not Necessarily Tangible

Smallholder farmers are the principal investors in African agriculture. FAO (2012) suggested that many investments made by farmers are not primarily or exclusively through financial outlays but through labor allocation (e.g., clearing or improving land or constructing farm buildings or irrigation channels). Capital by farmers often comprises both tangible and intangible assets and is often considered in terms of the following categories, all of which are important for agricultural productivity: physical capital; human capital; intellectual capital; natural capital; social capital, such as the institutions and networks that build trust and reduce risk; and financial capital, such as private savings, although income levels and savings are generally low in Africa. On the basis of an analysis by Lowder, Carisma, & Skoet (2012), the data reveal that of 23 countries in Sub-Saharan Africa, on-farm agricultural capital stock represents 84% of the total average annual investments in agriculture (see Table 10).

TABLE 10. AVERAGE ANNUAL INVESTMENT IN AGRICULTURE IN LOW- AND MIDDLE-INCOME COUNTRIES, BY SOURCE AND COUNTRY, 2005–2007 OR MOST RECENT YEAR[7] (US$ MILLIONS)

COUNTRY/CROP	ON-FARM INVESTMENT IN AGRICULTURAL CAPITAL	GOVERNMENT SPENDING	PUBLIC SPENDING TO AGRICULTURAL R&D	OFFICIAL DEVELOPMENT ASSISTANCE (ODA)	FOREIGN DIRECT INVESTMENT (FDI)
Sub-Saharan Africa	19,038	1,993	539	1,027	20
South Asia	36,726	4,715	703	912	10
Middle East and North Africa	12,864	3,594	427	194	67
Latin American Countries	26,483	2,910	1,356	213	1,225
Europe and Central Asia	21,791	4,138	-	78	383
East Asia and Pacific	51,675	20,607	1,693	682	1,677

[7] Data sourced from Lowder, Carisma, & Skoet (2012), p. 19. All flows are reported in constant 2005 US$ with the exception of FDI inflows, which are reported in current US$. Data are the average for the years 2005–2007 or for the most recent year available before that period. There may be some overlap between data on ODA and government investment in agriculture and/or expenditure on agricultural R&D.

Domestic Financing of Agriculture

Domestic public investors, primarily national governments, are the next largest sources of investment in agriculture (FAO, 2012); however, the current record is not so impressive. The CAADP (2009) policy brief stated that the number of countries spending more than 10% of their national budgets increased from 11% in 2003 to 22% in 2006. Results from the 2007 AU/NEPAD survey showed that 50% of the countries spent less than 5% of their national expenditure on agricultural development, reflecting a decrease from 57% in 2003. Among the selected countries (see Table 11), no country has consistently allocated 10% of its national budget to agriculture. Since the 2003 Maputo Declaration, Ethiopia has performed better than the sample of countries. Meeting the Maputo Declaration is one step in showing the commitment of African governments to the agriculture sector; understanding the per capita value of these public expenditures to agriculture, particularly in relation to the rural population that relies heavily on agricultural-based livelihoods, is another. An analysis (Table 12) of agricultural expenditures per capita of rural population reveals that high public expenditure does not necessarily translate to higher allocations per capita. In 2005, Zambia's allocation was far below allocations in Ethiopia and Nigeria but was the highest per capita allocation. At US$45 per capita to the rural population, Zambia allocates far more than all the other countries under analysis. The Agricultural Orientation Index (AOI)[8] of government spending for Sub-Saharan Africa also decreased dramatically over the period 1980–2007, indicating that decreasing amounts of funds have been channelled to the sector and thus substantiating financial neglect.

TABLE 11. SHARE OF AGRICULTURE EXPENDITURE (% OF TOTAL EXPENDITURE) IN SELECTED COUNTRIES

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Burkina Faso	25.0	18.0	23.0	33.0	20.0	12.0	20.0	16.0	14.0	9.0	11.0	-	-
Ethiopia	10.4	4.0	5.6	8.4	13.6	16.5	17.5	14.6	11.7	17.5	21.2	-	-
Ghana	3.2	4.7	6.9	5.8	8.8	9.8	10.3	9.9	10.2	9.0	9.1	-	-
Kenya*	6.8	6.6	5.4	4.1	5.1	6.6	5.9	4.4	4.8	3.9	4.6	8.7	6.8
Liberia	-	-	-	-	-	-	4.0	5.5	8.6	2.3	2.9	-	-
Malawi	8.8	4.9	8.7	6.6	7.0	11.1	11	13.2	31.6	24.7	28.9	-	-
Mali**	8.9	12.8	8.9	9.6	11.4	15.5	10.6	11.0	12.7	16.9	13.9	23.9	-
Mozambique	-	-	-	-	6.2	4.4	3.4	3.9	5.4	5.8	5.5	-	-
Niger	-	15.8	16.6	16.4	19.5	14.5	15.1	15.4	12.2	13.9	12.7	-	-
Nigeria	1.6	6.0	3.5	1.9	3.1	3.4	4.1	4.4	4.6	5.3	5.7	-	-
Rwanda	-	6.2	8.6	3.9	4.0	3.4	3.3	5.5	5.6	6.4	6.6	-	-
Sierra Leone	-	2.4	2.3	3.1	3.0	2.3	2.9	2.5	2.2	2.0	1.7	0.2	-
South Sudan	-	-	-	-	-	-	-	-	1.4	1.9	1.4	1.9	-
Tanzania**	-	-	4.5	6.8	5.7	4.7	5.8	5.8	2.5	6.7	6.8	6.8	-
Uganda**	2.6	1.6	2.6	2.3	2.1	2.0	3.0	3.0	3.2	4.5	3.8	3.1	4.5
Zambia	8.6	6.2	5.2	6.1	6.1	7.2	9.3	13.2	12.5	9.3	10.2	-	-

Source: ReSAkSS (http://www.resakss.org/)
*Kenya 2011, 2012 data are from the Central Bureau of Statistics.
*Mali, Tanzania, and Uganda 2009, 2010, 2011, 2012 data are from the countries' Bureaus of Statistics.

[8] The AO) for government spending is calculated as the agricultural share of government spending divided by the agricultural share of GDP. An AOI less than one indicates that government spending on agriculture represents a smaller share of total government spending than agriculture represents in the total economy.

TABLE 12. PUBLIC AGRICULTURAL EXPENDITURES PER CAPITA OF RURAL POPULATION (2005)

	PUBLIC EXPENDITURES TO AGRICULTURE (US$) *	RURAL POPULATION**	PER CAPITA ALLOCATION (US$) ***
Ethiopia	1,546,230,000	62,605,000	25
Ghana	43,561,000	11,319,000	4
Kenya	367,514,000	27,895,000	13
Malawi	80,861,000	10,892,000	7
Nigeria	1,507,470,000	75,854,000	20
Uganda	158,970,000	24,665,000	6
Zambia	325,444,000	7,266,000	45

Sources:
*International Food Policy Research Institute (IFPRI) Statistics of Public Expenditure for Economic Development (SPEED) Database.
** United Nations Department of Economic and Social Affairs (2012).
*** Authors' own calculations.

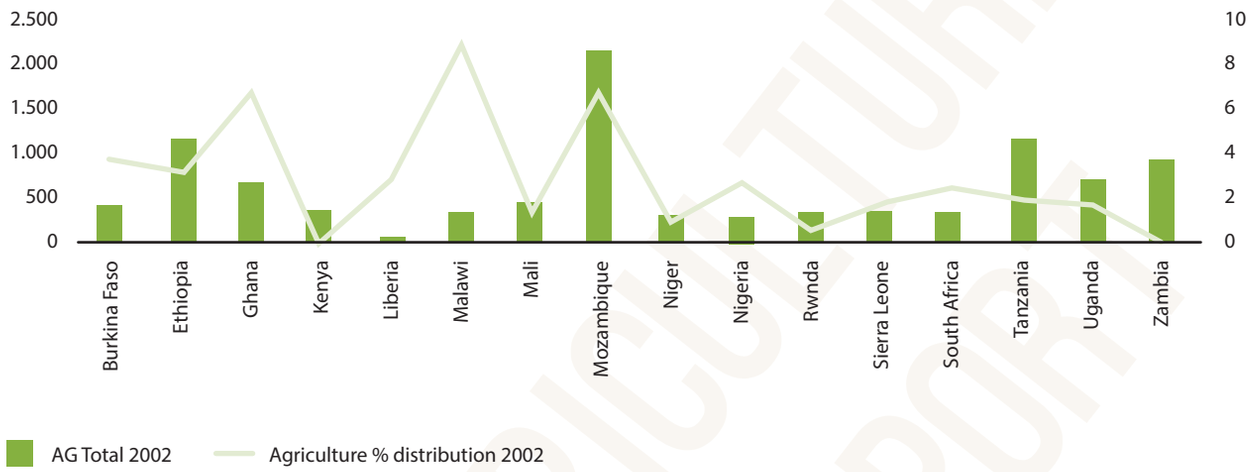
Official Development Assistance

The pattern and flow of Official Development Assistance (ODA) to agriculture in Africa remains relatively unimpressive and unpredictable and neared stagnation between 2008 and 2010. The exception was 2006, when ODA spiked to more than US$2 billion compared to about US$700 million in 2005 (Figure 22). The distribution of ODA is another challenge because it varies unevenly across countries. To illustrate, disbursements to selected countries have far surpassed disbursements to the Africa region. Allocations easily outstripped the rest of Africa, including the crisis year of 2009 in which the share of agriculture allocations to total disbursements in selected countries was 10%; in Africa it was 7%. Within the region, ODA disbursements are uneven, with some countries receiving relatively higher allocations than others. Even within the selected countries, allocations in 2002 varied significantly among countries (see Figure 23). Mozambique far surpassed the other countries by receiving more than US$2 billion, while the bulk of the countries received US$500,000 or less. This often is a consequence of inefficient budget execution, which erodes the financial credibility of the government. Bottlenecks at the country level include weak financial management systems and capacities, inflexible procurement procedures resulting in delays, lack of transparency, and overall delays in program implementation.

FIGURE 22: ODA DISBURSEMENTS TO AFRICAN AND AGRA COUNTRIES

Source: Organization for Economic Co-operation and Development (OECD) (2012)

FIGURE 23: ODA DISBURSEMENTS TO SELECTED COUNTRIES



Source: Organization for Economic Co-operation and Development (OECD) (2012)

Foreign Direct Investment: New Attractiveness of African Agriculture

The African continent generally has been unable to attract significant external resources to match the financing needs in the region. The total foreign direct investment (FDI) inflows shot up from US$17 billion in 2004 to an unprecedented US$31 billion in 2005, but the region's share in global FDI continues to be low, at just about 3% (Odhiambo, 2007). Total FDI inflows to the African agriculture sector amounted to about US$9.6 billion in 2000 and increased to US$46 billion in 2009 compared to the world average of US$1.610 billion and US$1.160 billion, respectively. Available United Nations Conference on Trade and Development (UNCTAD) (2012) statistics also show that agriculture FDI inflows in Latin America were US$79.7 billion in 2000 and declined to US$78.4 billion while general inflows to the developing regions were estimated at US$229 billion and US$390 billion for 2000 and 2009, respectively. Deeper analysis of FDI inflows to agriculture in the different countries is hampered by the lack of data because many transactions are shrouded in secrecy. Available data in the World Investment Directory (Table 13) show high levels of variation among countries, with South Africa drawing the most resources and exhibiting a degree of consistency.

An emerging trend is the upward movement in large-scale land-based investments in Africa. Investors in Africa are pulled largely by the abundant tracts of unused land and high productivity potential. Africa has about 12% of the world's arable land—80% of it is uncultivated, only 7% is irrigated (compared to 40% in Asia), and production yields are low. With a surface area of 24 million square kilometers, Sub-Saharan Africa is larger than all other developing regions. FDI is widely seen as an important resource for Africa to fill the financing gap for agriculture. These private investments have the potential to contribute significantly to the overall picture of FDI inflows to the continent, however, much of the information regarding these investments is still anecdotal and data on the acquisitions are unavailable. These land deals have not all been positive; concern has been raised with regard to social, economic, and environmental issues, in particular the risk for marginalizing rural producers and increasing land tenure insecurity.

TABLE 13. FDI INFLOWS INTO THE AGRICULTURE, HUNTING, FORESTRY AND FISHING SECTOR IN SELECTED AFRICAN COUNTRIES (US$ MILLIONS)

COUNTRY	2000	2001	2002	2003	2004	2005	2006
Morocco**	26	70	46	149	42	11	24
Mozambique*	-	6	29.2	24.8	8.6	26.7	9.3
South Africa**	457	653	655	500	719	734	888
Swaziland*	70	75	94	120	129	158	140
Uganda*	0.1	0.1	0.1	-	-	-	-
Tanzania*	50.4	47.7	-	-	-	-	-
Tunisia**	4	9	11	4	10	7	14
Namibia*	313	281	510	635	752	503	629
Ethiopia*	14.5	-	-	-	-	-	-

Source: UNCTAD (2008)
*US$ were used in calculating FDI inflows.
**Data were estimated using local currency.

The Special Challenge of Financing Smallholder Farmers

Access to finance is one of the major constraints facing millions of resource-constrained African smallholder farmers. Lack of access to finance prevents the farmers from investing in agricultural technologies that can help them achieve higher agricultural productivity and limits their participation in markets. Farmers also face significant levels of risks from uncertainties in weather conditions, which further reduce incentives to invest in agricultural production and commercialization. Investors in the sector have a high risk perception of the agriculture sector that does not match actual risks; this is because agriculture is not viewed as a strategic sector in which to engage. Investments, therefore, are based on opportunistic tendencies and hence financing is disparate, volatile, and short term. Also, producers are less willing to invest long-term to improve their land because they do not have security of tenure and they usually are unable to pledge their land as collateral for borrowing. It is worth bearing in mind that the heavy investment in the capitalization of agriculture in developed markets over the last few centuries has been underpinned by security that lenders can obtain in establishing a charge over agricultural land (Coates, et al., 2011).

Another challenge is how to finance different segments of smallholder farmers, who are not a homogenous unit. Research by Christen & Anderson, (2013) segmented smallholder farmers into three categories: (1) non-commercial smallholders, (2) commercial smallholders in loose value chains, and (3) commercial smallholders in tight value chains. Smallholder farmers are differentiated by what they grow, how they engage with markets as buyers and/or sellers, and how those markets are organized (see Table 14). There is a need to understand the financial mechanisms that might best fit the given financial goals and cash flows of each segment.

TABLE 14. SEGMENTATION OF SMALLHOLDER FARMERS

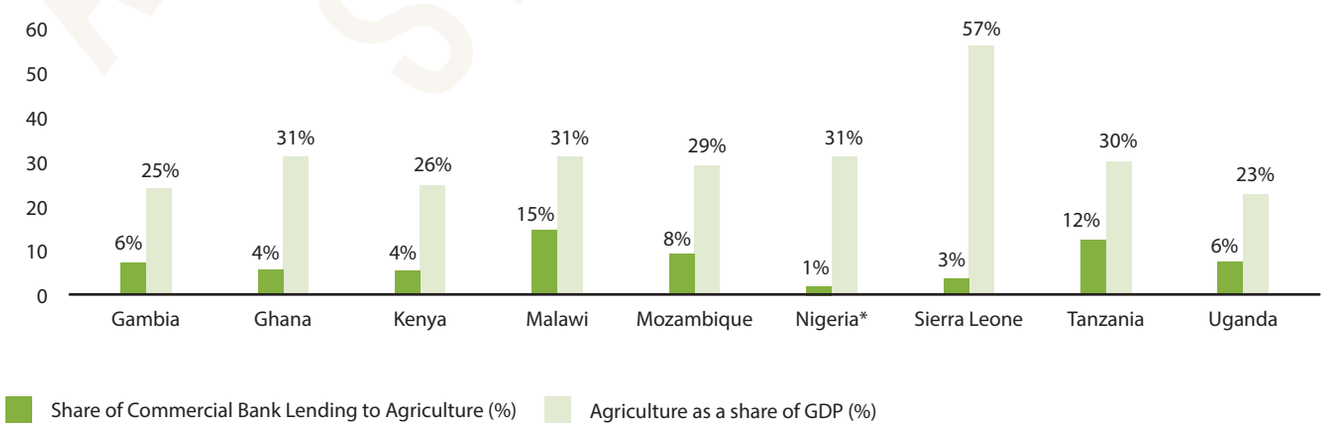
SMALLHOLDER HOUSEHOLD	CHARACTERISTICS
Non-commercial smallholder households	Smallholder farmers in this category are not connected to a structured value chain of any kind. They are limited largely to informal financial mechanisms and simple tools, such as local savings and loan groups, to meet their relatively basic financial service needs.
Commercial smallholders in loose value chains	Smallholder farmers in this category generate some level of surplus to sell, usually in informal local or regional markets. These households have access to a wider range of financial services than non-commercial smallholders and may be looking for opportunities to further diversify their assets and sources of income.
Commercial smallholders in tight value chains	Smallholder farmers in this category have the capacity to generate reliable, high-quality outputs that are sold on a contract basis through relatively highly organized value chains. Staple crops may be sold more informally through local and regional markets. As relatively larger producers, they may hire people to support some of their agricultural activities, including members of the two other segments. They are likely to demand and use a wider range of financial services from both formal and informal financial service providers than the other two segments.

Source: Organization for Economic Co-operation and Development (OECD) (2012)

Banks and Other Financial Institutions

Although agriculture accounts for 70% of the labor force and more than 25% of GDP in the region, it continues to be given low priority for investment, receiving only about 2%–3% of total financing (Figure 24). Financial institutions have not been inclined to lend to the sector for a variety of reasons: (1) high transaction costs for service providers due to the remoteness of the clients and heterogeneity among communities and farms, dispersed demand for financial services, small size of farms and individual transactions; (2) the lag between investment needs and expected revenues; (3) lack of usable collateral; (4) pests and diseases and lack of irrigation, contributing to high covariant risks due to variable rainfall; (5) underdeveloped communication, and transportation infrastructure; and (5) weather and price risks.

FIGURE 24: AGRICULTURAL LENDING AS SHARE OF AGRICULTURAL GDP IN SELECTED AFRICAN COUNTRIES



* Agriculture as a share of GDP (%)
Source: FAO, World Bank (2008)

Rural Banks and Cooperative Financial Institutions

Rural banks and cooperative financial institutions are the closest to the rural communities and best positioned to finance smallholder agriculture. According to Coates, et al. (2011), they are very keen to cooperate in the sharing of risk, particularly with commercial banks and agribusiness (which they consider a much greater investment in success than International Financial Institutions [IFIs] and development agencies). Institutionally, however, individual institutions tend to be very weak, with inexperienced management and staff and low levels of capitalization and investment. These institutions range from savings and credit cooperatives (SACCOs), such as the Kindi SACCO of Tanzania to rural banks, such as Nwabiagwa Rural Bank in Ghana (see Case Studies Box 3).

CASE STUDIES: BOX 3

TANZANIA:
Kindi SACCO

Kindi SACCO was formalized in 2002 through a partnership between International fund for Agriculture Development (IFAD) and the Government of Tanzania under the Rural Financial Services Programme (RFSP). In 2009, the SACCO had 1,218 individual members, 133 groups and 13 institutions, and served an estimated ward population of 21, 896, consisting mostly of small-scale farmers deriving their livelihood from coffee, maize, beans, rice, vegetable production and dairy farming. The SACCO is financed through internally generated resources – members' shares, savings, deposits and accumulated reserves. The SACCO had capital of TZS 271 million shillings (US$167,000) in 2009, an increase of over 200% since 2002. Loans were utilised for small businesses (66%) and agricultural activities (28%), indicating challenges to financing small-scale farming due to the high levels of risk and unavailability of land for agriculture expansion. The positive performance of the SACCO was attributed to employment of full-time technical staff, knowledge sharing and improved operational systems.

Source: Mlowe & Kaleshu (2009)

GHANA:
Nwabiagwa Rural Bank

Nwabiagwa Rural Bank is one of the largest rural banks in Ghana; it has six branches, a separate head office, and 131 staff members. The bank has about 50,000 customers, of whom approximately 10% are farmers, 25% are traders/processors, and 65% are salaried workers. Salaried workers get the best loan deals with interest rates around 25%. Farmers' loans are priced at 30% and higher because of their higher risks (some years the bank claims to have had a 100% default rate from farmers). The bank, however, is much more comfortable with cocoa, which is seen as a stable industry. Farmers are expected to save for at least 3 months or retain at least one-third of the earnings from last year's crop. The term is around 8 months, with a full and final bullet payment encompassing both principal and interest at the end. The bank prefers to finance customers with good relationships with licensed buying companies (LBCs, private traders authorized by the state cocoa marketing monopoly). Depositing a check for the proceeds of a cocoa sale to an LBC is seen as a very positive step toward getting a loan. The loan is used to support production inputs and is not suitable for plantation rehabilitation. The bank finances farmer-based organizations, as well as individual farmers.

Source: Coates et.al. (2011)

Innovative Finance: Emerging Advancements in Africa

Against this history of low investment in the African agriculture sector, and structural challenges that affect the accessibility of finance to smallholder farmers and/or disincentivize the commercial sector from lending to primary agriculture, efforts are being made to close this gap. Different innovative financing approaches for agriculture have emerged over the past few years, linking large capital investments to agriculture development in high-potential areas in Sub-Saharan Africa. These approaches have focused on facilitating access to financial capital for investment in the agriculture sector and reducing risk associated with the sector to attract private investors. A number of pilot projects, including innovative financing mechanisms, are already underway; these include pull mechanisms, agricultural insurance schemes, credit guarantee schemes, and public–private partnerships; but these projects are still few. The Report of the High-Level Expert Committee to the Leading Group on Innovative Financing for Agriculture, Food Security and Nutrition (Food and Security Task Force, 2012) recognized that "to be effective, such mechanisms should have a global scope, complement traditional ODA, and generate long-term and predictable financing." It has also been observed that such models and approaches should be systemic, transformational, and revolutionary for meaningful change and impact (See Case Studies Box 4 on innovative finance).

CASE STUDIES: BOX 4

Maximizing Social Impact through Patient Capital

Patient capital is one such example of an innovative model that helps to reduce the upfront barriers and disincentives for commercial agriculture in Africa. Patient capital is made available by the international community on concessional terms and is used to partly fund the capital costs of irrigation and related agriculture-supporting infrastructure. Motivated by new thinking that markets and aid alone cannot solve the problems of hunger and poverty in developing countries, patient capital is presented as a third way that maximizes the social impact of development. Patient capital is another type of funding that seeks to bridge the gap between the efficiency and scale of market-based approaches and the social impact of pure philanthropy. Other characteristics of patient capital include risk tolerance over other traditional investment capital and management support to enterprises.

Source: Palmer (2010).

Africa Enterprise Challenge Fund (AECF)

AECF was established in 2008 to promote pro-poor growth in Africa, by promoting agribusiness, finance, renewable energy, and information market systems that work better for the resource-constrained population in rural areas in Africa. The Fund offers grants and no-interest loans to private sector type entities through a competitive bidding process. AECF is a special partnership initiative of AGRA funded by a multidonor consortium.

As an innovative finance model, the challenge fund stimulates private-sector innovation and leverages investments by the private sector to find profitable ways to improve market access and functioning of the rural poor in Africa. AECF works with the private sector to achieve large development impact by funding companies that promote new ideas leading to growth in rural economies of Africa, generate employment, and create new opportunities for systemic change in the markets. AECF runs competitions referred to as 'funding windows' that are targeted at those sectors that matter most to the rural poor, which include agribusiness throughout the entire value chain, rural financial services and renewable energy/adaptation to climate change. The fund has Africa-wide programs but also focuses on specific countries such as Zimbabwe, Tanzania and South Sudan.

The competitions involve a bidding process that is open, transparent, and international. The selection criteria emphasize high socio-economic impact on the rural poor, innovation and commercial viability. The grants and/or interest-free loans range between US$250,000 and US$1.5 million and the company is required to match the funds requested as a means of leveraging private-sector investment in African development. As of December 2012, the matching funds from the private sector amounted to US$242.26 million. AECF is a US$207 million fund that has approved 178 projects in 23 African countries and benefitted 3 million rural poor Africans as of June 2012.

CASE STUDY: BOX 5

The Impact Investing Fund for African Agriculture

AGRA has been developing innovative financing approaches aimed at leveraging financing from private financial markets to the agriculture sector, especially to smallholder farmers. So far, AGRA and its partners have used US$17 million in loan guarantee funds to leverage US$160 million from commercial banks in Kenya, Tanzania, Uganda, Mozambique, and Ghana that have benefited about 2 million farmers.

To scale up these models, AGRA and its partners have been working on establishing a pooled risk-based initiative, the Impact Investing Fund for African Agriculture, aimed at enabling financial value chain actors to leverage more financing to the agriculture sector, especially to smallholder farmers. The initiative takes a more comprehensive development approach by having a de-risked incentivized financial value chain to support structured agricultural value chains.

The impact investing model is an integrated package of de-risking solutions comprising risk-sharing instruments, insurance facility, technical assistance, and a bank incentive mechanism. The approach aims at transforming public capital into productive capital—capital that is used to realign incentives for private-sector investments to the agriculture sector, meet and increase the market absorptive capacity, reduce the risks of lending, reduce learning curves for the financial players for understanding the sector and build their capacity to develop more appropriate and affordable loan products for smallholder farmers and businesses, and develop efficient financial delivery systems that serve the needs of all farmers.

The approach integrates a set of factors that are essential for success in expanding agricultural lending so that the risks and capacity bottlenecks along the agricultural and financial value chains are simultaneously addressed. It is demand driven and uses customized risk-sharing instruments to allow banks and other financial actors to select the parts of the value chains they are most interested in for lending. The value chain financing offers several advantages, including assured markets, guaranteed prices, reduction in marketing risks, sharing of risks in lending and input supply by all participants in the interlocked arrangements, positive spillover effects on other crops, and increased and stable cash flows for farmers (Swinnen, Vandeplas & Maertens, 2010).

Building from this initiative, Kenya is already applying the impact investing approach to leverage private-sector investments to the agriculture sector. In this regard the Government of Kenya, through the budget statement for the Financial Year 2011–2012, established a Ksh 0.5 billion (about US$50 million) Impact Investing Fund for the Development of Kenyan Agriculture, also known as the Kenya Incentive-Based Risk Sharing System for Agricultural Lending (KIRSAL), which targets leveraging at least Kshs0.5 billion (about US$50 million) of financing into agriculture over the next 5 years. The initiative is expected to benefit more than 1.5 million small-scale farmers and producers and more than 10,000 agribusinesses.

Similar initiatives are being scaled up under the Program of Marketing Infrastructure, Value Addition and Rural Finance (MIVARF) in Tanzania, with a total funding of US$92 million. The design mission recommended that as part of the rural finance component of MIVARF, a risk-sharing initiative should be set up as a subwindow of the Impact Investing Fund for Tanzania; as a result, a total of US$20 million is expected to leverage a further US$200 million in funds.

The Challenge Ahead

Ensuring predictable financing for agriculture entails a critical role for the various stakeholders, in particular the commercial private sector in providing financial resources, technology and innovation; governments in creating a business environment conducive to commercial activity; development organizations as brokers and facilitators of partnerships that are inclusive to smallholder farmers and the rural poor; and producer organizations in strengthening the position of smallholder farmers in markets; and civil society in ensuring accountability and transparency. Different innovative financing approaches for agriculture have emerged over the past few years, linking large capital investments to agricultural development in high-potential areas in Sub-Saharan Africa. A key objective is how to leverage private- and public-sector investments into the agriculture sector through use of relevant incentives. In achieving agricultural transformation, focus should be on how to use the public investments to play a catalytic role to incentivize and leverage private-sector investments into the agriculture sector.

Recommendations

- Develop relevant policies and establish enabling environments conducive for productive investments by both the private and public sectors to boost the productivity and performance of the agriculture sector players, especially small-scale farmers.
- Provide technical support and business development services and promote agricultural diversification and integration of agriculture as part of a wider business activity.
- Develop pro-poor, smallholder-centered investment models for agriculture financing that provide incentives for all players along the value chain, including financiers, smallholder farmers, traders, and agroprocessors.
- Develop financing mechanisms that are more responsive to the needs of segmented groups of smallholder farmers and diversified rural households.
- Develop agricultural insurance schemes, such as crop or weather insurance, to mitigate risks in the agriculture sector, especially in the smallholder segments.
- Encourage full disclosure of FDI to African agriculture.
- Conduct further analysis and data strengthening activities:
    - FDI to African agriculture: Answer the questions: Where do we stand? Where is the FDI finance going?
    - Measure impact of the current innovative financing (pilot) mechanisms on African agriculture
    - Disaggregate data on the flow of finance to the smallholder agriculture sector (e.g., by demographics, household activity)
    - Conduct deeper analyses on the (investment) contribution of smallholder farmers

References

Coates, M., Kitchen, R., Kebbell, G., Vignon, C., Guillemain, C., & Hofmeister, R. (2011) *Financing agricultural value chains in Africa—A synthesis of four country case studies*. Bonn, Germany: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

Christen, R., & Anderson, J. (2013). Segmentation of smallholder households: Meeting the range of financial needs in agricultural families. Washington, DC: Consultative Group to Assist the Poor (CGAP).

Carroll, T., Stern, W., Zook, D., Funes, R., Rastegan, A., & Lien, Y. (2012). *Catalyzing smallholder agricultural finance*. New York, NY: Dalberg Global Development Advisors.

FAO. See Food and Agriculture Organization of the United Nations.

Food and Agriculture Organization of the United Nations. (2012). *The State of Food and Agriculture*. Rome, Italy: Author.

Food and Agriculture Organization of the United States. (2009). *How to feed the world in 2050* (Investment issues brief). Rome, Italy: Author.

Food Security Task Force. (2012). *Innovative financing for agriculture, food security, and nutrition: Report of the High-Level Expert Committee to the Leading Group on Innovative Financing for agriculture, food security, and nutrition*. Rome, Italy: Food and Agriculture Organization of the United Nations.

Lesaffre, D. (2000). *About supply and demand of rural financing in West Africa*. New York, NY: CGAP Microfinance Gateway.

Ladislaus K. Mlowe and Jones T. Kaleshu (2009) Developing a Successful and Sustainable SACCOS: The Case Of Rural Financial Services Supported Kindi SACCOS, IFAD.

James K. Boyce and Léonce Ndikumana, 2012, Capital Flight from Sub-Saharan African Countries: Updated Estimates, 1970 – 2010, University of Massachusetts, Amherst.

Lowder, S. K and Carisma B (2011): *Financial resource flows to agriculture. A review of data on government spending, official development assistance and foreign direct investment.* ESA Working paper No. 11-19

Lowder, S., Carisma, B., & Skoet, J. (2012). *Who invests in agriculture and how much? An empirical review of the relative size of various investments in agriculture in low- and middle-income countries.* FAO-ESA Working Paper 12-09. Rome, Italy: Food and Agriculture Organization of the United Nations.

Mhlanga, N. (2010), *Private sector agribusiness investment in Sub-Saharan Africa*, FAO Agricultural Management, Marketing and Finance, Working Document no. 7, http://www.fao.org/docrep/016/k7443e/k7443e.pdf

Murdoch, J. (2000). The microfinance schism. World Development, .28(4), 617–629.

New Partnership for Afrida's Development. (2009). *How are countries measuring up to the Maputo Declaration?* CAADP Policy Brief. Available at http://www.nepadcaadp.net/pdf/How%20are%20countries%20measuring%20up%20to%20the%20Maputo%20declaration.pdf.

Odhiambo, W. (2007). *Financing African agriculture: Issues and challenges.* Paper presented at the Second African Economic Conference, Addis Ababa, Ethiopia.

OECD. See Organisation for Economic Co-operation and Development.

Organisation for Economic Co-operation and Development. (2012a). *Creditor Reporting System: Aid activities in support of agriculture, 2006–2010.* Paris, France: Author.

Organisation for Economic Co-operation and Development. (2012b). *Creditor Reporting System: Aid Activity database*. Available at http://stats.oecd.org/.

Palmer, K. (2010). *Agricultural growth and poverty reduction in Africa: The case for patient capital*. London, United Kingdom: AgDevCo.

Shepherd, A., & Onumah, G. E. (1997). Liberalised agricultural markets in Ghana: The role and capacity of government. The Role of Government in Adjusting Economies Studies Paper 12. Birmingham, United Kingdom: University of Birmingham.

Swinnen, J., Vandeplas, A., Maertens, M. (2010). Liberalization, endogenous institutions, and growth: a comparative analysis of agricultural reforms in Africa, Asia, and Europe. The World Bank Economic Review, 24 (3), 412-445.

UNCTAD. See United Nations Conference on Trade and Development.

United Nations Conference on Trade and Development. (2008). *World investment directory: Volume X, Africa*. New York, NY, and Geneva, Switzerland: Author.

United Nations Conference on Trade and Development. (2012). *World investment report 2012*. New York, NY, and Geneva, Switzerland: Author.

United Nations Department of Economic and Social Affairs. (2012). *World urbanization Prospects: The 2011 revision* (CD-ROM Ed.). New York, NY: Author.

CHAPTER 07

TRANSFORMING AFRICAN AGRICULTURE BY IMPROVING OUTPUT MARKETS

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Efficient Output Markets Essential for Sustained Growth in Grain Production in Africa

Discussions in the preceding chapters clearly illustrate the importance of improved agriculture sector growth to achieve Africa's economic growth, poverty reduction, and food security objectives. Hunger remains one of the most pervasive development challenges facing Africa and the agriculture sector is seen as the most likely source of economic growth that favors the poor (de Janvry & Saudoulet, 2010). There also is growing recognition that without efficient output markets, which offer a means to absorb surpluses resulting from improved farm technology, it will be difficult to sustain producer incentives and, therefore, output and productivity growth. This recognition is amply illustrated in the CAADP priorities—Pillar II focuses on promoting increased investments in rural infrastructure and markets. Furthermore, African Union Heads of State and Governments, at their June 2006 meeting in Abuja, Nigeria, declared the need "to accelerate investment in infrastructure … and other measures to improve output market incentives" as part of strategies adopted to increase agricultural productivity and output. Earlier, at a meeting in Arusha, Tanzania, in November 2005, AU Ministers of Trade resolved that African governments should promote the development of new market institutions and maintain policies that foster efficient marketing of agricultural commodities.

This chapter presents a review of developments in agricultural output markets in Africa, with particular attention paid to marketing systems for staple grains, especially maize, that account for 50% or more of total cropped area in Africa and are cultivated by the majority of the rural population. Though policy focus tends to be on traditional export commodities, estimates suggest that the value of domestic and regional food grain trade far exceeds that of the former. For instance, Diao, Dorosh, & Rahman (2003) estimated the aggregated value of domestic agricultural markets at more than US$50 billion per annum, compared to only US$16.6 billion for the traditional agricultural exports. In the following sections, post liberalization challenges to grain output markets in Africa are identified including, in particular, lack of market-supporting institutions. Efforts have been made to promote such market institutions as warehouse receipt systems (WRS) as part of the solution, but the outcome has been variable and in many cases frustrating. Priority actions that are needed to address some of the challenges in developing these systems are summarized in the concluding section of the chapter.

Challenges Remain Despite Reforms in Output Markets

Most African countries undertook major reforms in agricultural markets in the early 1980s, partly because of the need to overhaul pervasive state interventions that evidently had become an unsustainable fiscal burden and failed to produce significant increase in per capita output in food and cash crops (Jayne, Chapoto, & Shiferaw, 2011). Reforms in the grain subsectors included removing restrictions on the involvement of private traders, thereby abolishing pan-territorial and pan-seasonal pricing policies that reduced the profitability of trading in remote locations because they did not reflect the cost of assembling produce from different regions. In many countries, the overall impact of these reforms on producers has been rather mixed. Output markets generally have become more competitive, usually as a result of large numbers of small-scale traders, including women. However, inefficiencies remain in these markets, squeezing producer margins and therefore hampering efforts to promote sustained growth in agricultural output and productivity. This is partly because significant barriers to efficient trade in grains exist in most African countries (Barrett, 2010).

Factors constraining efficient grain trade in Africa include lack of efficient storage facilities, which combines with unavailability of inventory finance to limit the capacity of rural assemblers to absorb surpluses at harvest. As a consequence, postharvest losses are very high—estimated to range between 11% for rice and 19% for maize (World Bank, 2011). Intra-seasonal grain prices vary sharply while distribution margins are very high, partly because of high transport cost. In most African countries, temporal marketing margins in grain markets are high, ranging between 32% in Malawi and 100% or more in Ghana (Coulter & Poulton, 2001). Evidence from empirical studies suggest that a 10% drop in transport cost as a result of improved road infrastructure is likely to generate a 25% increase in trade and drive down distribution margins to the benefit of producers and consumers (Teravaninthorn & Raballand, 2009).

Transactors in grain output markets in Africa tend to be poorly informed—farmers lack information about buyers and prices from local or regional markets while buyers have limited information about the quantity and quality of available stocks, a situation that is largely due to the absence of effective systems of standard grades and measures. For instance, in Ghana, the average weight of a maxibag of maize differs from location to location. Zambia has a more formalized maize marketing system but grain sampling is usually by sight and is highly subjective, which increases

the risk for cheating on weights and quality and makes physical sampling imperative, though it increases the cost of transacting. Weak contract enforcement systems make it difficult to develop contract-based structured trading arrangements to the mutual benefit of sellers and buyers. Court enforcement of contracts tends to be very expensive and entails long delays. As a result, neither sellers nor buyers are able to use this option to manage price and supply uncertainties. Other market-based price hedging instruments, offered by successful commodity exchanges, are not available anywhere in Africa except in South Africa.

Agro-processing capacity remains severely underdeveloped in many African countries (FAO, 2010). This situation further compounds the challenges to postharvest handling of grains and other agricultural commodities, contributing to postharvest losses and seasonal glut that dampens producer incentives. Private investment in the agro-processing industry in Africa is low, partly because of uncertainty in raw material supply. This is due, in part, to the high cost of assembling agricultural produce from a large number of producers and the acute liquidity constraints facing assemblers (most of them being undercapitalized small-scale traders). Most rural borrowers—smallholder farmers and small-scale traders—cannot borrow from the formal sector because they lack assets that are acceptable as suitable collateral. The undercapitalized traders, therefore, are unable to absorb huge surpluses during the harvest season—a period when most smallholder households are compelled to sell the bulk of their produce as a result of lack of access to finance for consumption smoothing. The consequent glut during harvest depresses farm gate prices, erodes the purchasing power of poor households, and exposes them to food insecurity during the lean season. Another effect of this situation is that value addition occurs principally at small-scale (cottage) level with very basic technology. Product quality is often variable and packaging unattractive. Better-structured trading systems will reduce the uncertainty in supply of raw materials and potentially attract more investment in grain processing capacity.

Slow Progress in Developing Market-Supporting Institutions

A major difference between typical African grain marketing systems and the better-structured markets elsewhere is the non-existence of market institutions that can reduce transaction costs. Examples include reliable market information systems (MIS), trade-friendly commodity standards, credible WRS, and viable agricultural commodity exchanges (Onumah, 2011). African governments initially focused on setting up national agricultural MIS with support from donors such as FAO, IFAD, and the World Bank. Decades later, doubts remain about sustainability of most MIS as well as the relevance, reliability, and timeliness of information disseminated (Text Box C). However, more recent developments in MIS offer some hope.

TEXT BOX C: MARKET INFORMATION SYSTEMS (MIS) IN AFRICA

Many Sub-Saharan African countries launched MIS programs soon after the market reforms, with the aim of strengthening the bargaining position of farmers. In some countries, multiple MIS run by different agencies were set up—for instance, a joint survey undertaken by CIRAD–MSU in 2009 identified 49 MIS initiatives in 19 Sub-Saharan African countries. Initially, most of the MIS were run by public agencies and dissemination was principally via national radio broadcasts and print media dissemination. However, since the mid-2000s, different providers have emerged, including farmers' organizations and private providers (e.g., Esoko Ghana, Infotrade in Uganda, and Kenya Agricultural Commodity Exchange [KACE] in Kenya). Information dissemination now relies more on the use of mobile telephony and websites than radio broadcasts and print media. Furthermore, in response to the needs of farmers and other players in the grain value chains, providers also are going beyond disseminating price information. For instance, mFarms—which was developed in Ghana, is partly supported by AGRA and is being replicated in Eastern and Southern Africa—offers a platform consisting of an electronic database of farmers, agro-input dealers, and traders. The platform links agro-input dealers to farmers, thereby facilitating supply of inputs and making it possible to better manage the logistics of inputs distribution. It also enables buyers to obtain more reliable supply information that is used to facilitate contract negotiations for supply of grains. Despite the advances, there continue to be challenges regarding the sustainability of the systems. Furthermore, lack of enforceable commodity standards have frustrated efforts to develop structured trading systems linked to the MIS—the potential to resolve this problem by linking MIS to WRS is being explored by the Eastern Africa Grain Council (EAGC).

Source: Based in part on Staatz, Kizito, Weber, & Dembélé, N. N. (2011).

Governments, private sector players in Africa, and donors (e.g., the United States Agency for International Development [USAID], the Common Fund for Commodities [CFC], Department for International Development [DFID], the European Union, and AGRA) have been actively involved in promoting WRS and agricultural commodity exchanges. For example, a significant proportion of the more than US$39 million that AGRA has invested to support the development of agricultural output markets in Africa has been targeted at promoting WRS (Text Box D). The attraction of WRS and exchanges include fostering structured trading in agricultural commodities and making price-hedging instruments available, thereby improving the risk profile of agricultural credit. The interesting feature of the exchanges is that their essential building blocks include all the market-supporting institutions mentioned above.

Where such systems are in place, there is evidence that they contribute to enhanced uptake of yield-increasing inputs by improving producers' incentives to use them. This implies that the development of such institutions should be undertaken in tandem with initiatives targeting increased use of fertilizer and other inputs. Evidence from the maize subsectors in Ghana and Zambia demonstrates that the profitability of using fertilizer improves significantly if the grain produced is marketed using WRS. In the case of Ghana, the value-cost ratio rises from 1.4 when the grain is marketed without WRS to 2.05 when farmers use the system to market their output. This is largely because farmers can better time the sale of their crop to benefit from seasonal price increase and/or sell to market players further down the marketing chain (e.g., larger-scale traders and processors) for better prices. Furthermore, there is evidence that the use of market institutions makes it possible for traders to build up inventories, which are more efficiently stored, and therefore enhance their capacity to assure uninterrupted supply throughout the year. It is apparent that trade margins tend to be lower, improving profitability for processors. However, as a result of substantially increased throughput, traders end up much better off (Onumah, 2009).

Despite these benefits, progress in promoting these institutions in Africa has been frustratingly slow, as shown in Text Boxes C and D. In response, some African governments have tried to revert to the pre-reform interventions—with outcomes that have proved costly and with doubtful benefits (Nkonde, Mason, Sitko, & Jayne, 2011). This slow progress can be attributed to several factors described, including:

Missing or underdeveloped complementary institutions: The development of market-supporting institutions tends to be undertaken as bespoke initiatives. There are several cases where commodity exchanges are established independent of WRS, which can provide credible delivery platforms that assure contract performance by buyers. It is therefore no surprise that such exchanges struggle to achieve financial viability. WRS initiatives are also launched without parallel efforts to set up reliable trading platforms. Consequently, there can be difficulties when it comes to liquidating the receipted commodities, one of the reasons cited by banks for their reluctance to provide receipt financing; that is, they are uncertain about what to do with collateralized stocks in the event of default by borrowers. As noted in Text Box D, MIS have been promoted with the aim of enhancing farmers' bargaining position without necessarily aligning it with initiatives to strengthen the capacity of primary-level farmers' groups to use structured trading platforms.

Legal issues affecting transfer of rights: Bankers often cite uncertainty about the rights of parties to whom warehouse receipts are transferred as the major factor that discourages inventory financing. Often this problem can be resolved by appropriate legislation, as has happened in Tanzania, Uganda, and recently in Zambia. However, experience shows that the process of enacting enabling legislation can be very slow. Where the legislation is in place, effective enforcement of the law is another issue. To engender confidence, the regulatory agency set up to enforce the law should be seen by all parties as totally impartial and shielded from political and bureaucratic influence. Where this confidence is missing, it detracts from the development of WRS and related trading platforms, as has been the experience in Africa, South America (Brazil), and more recently in Eastern Europe (Ukraine).

Trade-off between welfare goals and sustainability of the systems: The dominance of smallholder farmers all over the continent means that priority often is given to assuring their exclusive access to innovative marketing systems such as WRS and exchanges. Experience suggests that there are significant diseconomies of scale issues with this approach. Evidence from Tanzania and Zambia, however, demonstrates that if commercially viable WRS and exchanges are developed, smallholder groups can still access them along with commercial users, if there is investment in building the capacity of primary-level farmers' organizations to undertake aggregation of grains and in collective marketing.

Limited access to suitable physical infrastructure: In most African countries, the state owns a dominant share of suitable storage infrastructure. These were constructed during the era of the parastatal marketing boards and even after their role was scaled back, the infrastructure remained under public ownership. Private-sector investment in such facilities often is limited to the export/import trade sectors and has been slow in extending significantly into the grain subsectors, especially in the surplus-producing

areas. This is partly because the persisting uncertainty in the grain markets does not assure a good business case for investing in these sectors. Leasing facilities to licensed operators can drive this business, but there has not been much enthusiasm in pursuing this option; it is sometimes argued that the state has to store grain in its own facilities whereas properly regulated private-service delivery can be more cost-effective.

Disabling policies: These tend to be the most debilitating of the constraints affecting the development of the market-supporting institutions. Examples include ad hoc interventions in grain markets, such as unpredictable export bans, waiver of import duties, and minimum price setting. In most cases, these interventions are driven by government food security objectives, especially when there is the threat of a domestic grain supply deficit. The evidence, documented especially in studies in Eastern and Southern Africa, suggests that the anticipated capping of consumer prices as a result of these interventions often is not achieved. However, the uncertainty created substantially reduces uptake of structured trading opportunities and therefore stymies the development of market institutions such as WRS and exchanges. Using strategic grain reserves to moderate grain price variability offers a means to manage this situation; however, the experience has been that management of such reserves often is totally delinked from the emerging market institutions and leads to considerable financial losses to the state and further accentuation of challenges in promoting efficient markets (Sitko & Jayne, 2011). Improving the quality of information on which to base whether such actions are taken is another important step because data quality is a problem in the whole of Africa.

TEXT BOX D: PROMOTING WRS IN AFRICA: AN OVERVIEW

From the 1990s, efforts were made to promote accessible WRS to farmers with the primary aim of improving access to finance. During this period, large commercial enterprises could access inventory finance through a system under which international inspection companies were willing to secure the interests of lenders by providing collateral management services. The high cost of these services virtually excluded access by smallholder farmers and small-scale traders and the financing available was predominantly for the import/export trade. There was little or no benefit to the domestic trade in agricultural commodities. Furthermore, the typical bespoke agreements underpinning these transactions also made transferability of the receipts issued impossible and therefore they could not be used to facilitate trade contracts. To ensure wider access, NGOs, such as TechnoServe, promoted inventory credit systems that exclusively targeted smallholder farmers. The promoters often were required to provide intensive supervision as well as loan guarantees (which could be as high as 100% of the credit advanced to farmers). The diseconomies of scale and high oversight costs associated with these systems limited efforts to scale them up and they often were not sustainable.

A more widely accessible WRS that is open to all parties, including smallholder farmers and larger-scale players in agricultural value chains, was subsequently promoted in Western, Eastern, and Southern Africa. The identified prerequisites for such a system included: (1) a network of licensed/certified warehouse operators who can satisfy specified capital and other requirements; (2) adoption and effective enforcement of trade-friendly grading and weight standards; (3) a robust regulatory system consisting of warehouse legislation (where needed) and a trusted regulatory agency that transparently enforces all regulations and standards; (4) issuing of transferable warehouse receipts with features that minimize the risk for fraud; (5) reliable market information systems to enable market players to make informed decisions regarding depositing and sale of collateralized stocks; (6) capacity building for key players; and (7) enabling policy and regulatory framework.

A recent review revealed that Tanzania has the most advanced WRS in Africa, outside of South Africa. Warehousing services are largely provided by private operators licensed by the Tanzania Warehouse Licensing Board. Inventory financing is provided by commercial banks and smallholder farmers are able to access these facilities as groups mobilized by the primary-level cooperatives and farmers associations. However, it is in export commodity subsectors (cashews, coffee, and to some extent cotton) that the system has been most successful. Efforts to extend the WRS to grains in Tanzania have not yet gained sufficient traction. The story is very much the same across the continent, where most of the WRS have primarily targeted the grains. In Tanzania, as in many countries, the grain WRS centers on surplus-producing communities that lack appropriate storage infrastructure, implying provision of storage services in low-capacity warehouses (100–200 tons of storage capacity). The viability of such an operation is quite a challenge. In addition, the review clearly demonstrated that success depends not so much on enacting enabling legislation

but on strengthening the capacity of regulatory agencies to robustly enforce adopted rules and standards. Even more crucially, it is important to remove or at least reduce policy-related uncertainties such as ad hoc imposition of export bans or waiver of import duties that undermine private storage incentives. This, for instance, appears to be a defining factor in explaining the differences in outcome in Tanzania (between the WRS for the grains subsectors and for export commodities). The same conclusion appears to apply in most African countries.

Source: Review of WRS and exchanges by Natural Resources Institute (NRI) with funding by Common Fund for Commodities (CFC).

TEXT BOX E: PROGRESS IN PROMOTING COMMODITY EXCHANGES IN AFRICA

Many African countries have attempted to establish agricultural commodity exchanges, mostly based on the expectation that exchanges can simultaneously address many of the marketing and financing constraints that hamper productivity and output growth in the agriculture sector. However, most of the exchanges have been unable to sustain spot trade, much less trade in futures and other derivatives, as noted by UNCTAD (2007). The major exceptions are JSE/SAFEX (formerly South Africa Futures Exchange or SAFEX) in South Africa and the Ethiopia Commodity Exchange (ECX). Another example, the Zimbabwe Agricultural Commodities Exchange (ZIMACE), successfully traded in grains from 1994 until 2001 when it was abolished as the Government of Zimbabwe intervened in the market to control the marketing of staple grains. The JSE/SAFEX is the only futures market in Africa, offering price risk–hedging instruments. The ECX has recorded appreciable trading volumes in coffee and other commodities that are mandated by Government to be traded though the exchange. However, it is yet to make major inroads in trading in the major food staples. Most of the other exchanges, including the well-known Kenya Agricultural Commodity Exchange (KACE), have been unable to trade significant volumes and have ended up mainly disseminating market information.

This rather disappointing outcome of initiatives to promote commodity exchanges is due in part to the fact that some of the prerequisites for success are either missing or under-developed. Prominent among the prerequisites is a reliable delivery system that can be developed on the basis of a trusted WRS under which transferable warehouse receipts are issued (the key features of such a system are discussed in Text Box D). Also, equity investment by governments and donors in establishing national agricultural commodity exchanges in Ethiopia, Nigeria, and Uganda tends to significantly dwarf private contributions. The focus of public and donor investment can be on the development of the institutional infrastructure, which is crucial to the success of an exchange. As has been emphasized, for instance by Rashid et al. (2008), such infrastructure also is fundamental to the development of efficient marketing systems. Hence, whether or not a country intends to establish a commodity exchange, investing in their development can generate significant social benefits. The lessons from various cases in Africa point to the need for governments to credibly commit to creating and maintaining a policy and regulatory environment that is supportive of the operations of an exchange and efficient free markets in general. It is essential, in particular, to avoid policy uncertainty that inhibits private investment in commodity markets. One means of assuring this may be to create public–private policy forums such as the National Agricultural Marketing Council (NAMC) in South Africa to provide platforms for effective policy dialogue. A final important issue is the challenge posed by the dominance of smallholder farmers in Africa's agricultural production system. The low marketable surplus produced by smallholder householders makes it uneconomical for them to directly access modern market institutions and remunerative markets. This is one of the main reasons why smallholder producers in South Africa have been unable to use marketing facilities offered by JSE/SAFEX to any significant extent. However, as has occurred in Tanzania and Zambia, strong farmers' organizations can facilitate the use of these systems by smallholders for purposes of collective marketing and related financing opportunities.

Source: Onumah G.E. (2011) and Njukia S. (2012).

Taking Agricultural Output Market Development Forward: Some Priority Issues

The foregoing discussions underscore the need for African governments to make the development of efficient output markets an integral part of strategies to promote agricultural output and productivity growth. This is crucial to ensuring that any gains through adoption of improved farm technology can be sustained. Investment in physical infrastructure, including rural road networks, can contribute to lower food distribution costs to the benefit of producers and consumers. One area that should particularly engage the attention of African governments is the need to invest in market-supporting institutional infrastructure that can help to reduce uncertainty and related costs of transacting in grain markets. Among the important market-supporting institutions are reliable MIS, credible WRS, and viable commodity exchanges. Progress in developing these has been slow in most African countries but this can be turned around if the following recommendations are prioritized.

1. A holistic approach should be adopted in developing these market-supporting institutions, ensuring optimum synergy between them rather than as bespoke initiatives. Where these systems have already been promoted as independent structures, efforts should be made to develop the complementary systems to optimize benefits to players in agricultural value chains. Specific to MIS, it is important to recognize recent advances, which go beyond collection and dissemination of price information to ensuring that reliable data on crop output and stock levels are collected and shared with all key market participants. Sustaining the new developments will certainly require active collaboration with farmers' organizations, NGOs, donors, and private-sector players in the grain value chains.

2. Efforts to foster an enabling regulatory framework for WRS and exchange should not be limited to enacting legislation. Attention needs to be paid to ensuring robust and transparent enforcement of laws and regulations that protect the interest of various parties. This will require that regulatory agencies are seen as insulated from political influence, including becoming financially independent of donors and governments within a reasonable timeframe. Harmonizing regulations across regions also will ease trade within the regions and therefore broaden marketing opportunities for users of these systems. Similarly, it will be important to foster adoption of trade-friendly commodity standards that are harmonized with those of key regional trading partners to ensure that producers can fully exploit domestic formal trade channels and regional opportunities. Challenges to accessing available suitable storage infrastructure for WRS and exchanges can be eased if the state leases such facilities to private operators.

3. Rather than exclusively targeting smallholder farmers, donors and governments need to support commercially viable systems and mobilize and build the capacity of smallholder farmers' organizations, thereby empowering them to effectively engage in aggregation and collective marketing using the innovative systems that are being promoted.

4. Equally important in this context is investment in physical storage infrastructure to reduce postharvest losses.

5. Creating and maintaining an enabling policy and regulatory framework that fosters the development of these market-supporting institutions will be important. Even if a country is not developing these market institutions, stable, predictable agricultural trade policies that improve prospects for their development also reduce uncertainty in markets and therefore augur well for efficient trading systems. In particular, ad hoc interventions that create uncertainty in markets need to be avoided. There could be potential short-term policy trade-offs between food security objectives and the goal of developing efficient markets that offer incentives to producers to invest in increased grain output and productivity. Priority has often been given to short-term food security considerations when this occurs, often having a negative impact on market development and impairing long-term producer incentives. Priority should be given to the development of efficient markets, including exploring the potential to use market institutions such as WRS and commodity exchanges to manage government interventions in a manner that minimizes adverse impact on market players.

References

Barrett, C. B. (2010). Smallholder market participation: Concepts and evidence from Eastern and Southern Africa. In A. Sarris & J. Morrison (Eds.). *Food security in Africa* (Chap. 3). Rome, Italy: Food and Agriculture Organization of the United Nations.

Coulter, J. P., Poulton, C. (2001). Cereal market liberalization in Africa. In T. Akiyama, J. Baffes, D. Larson, & P. Varangis (Eds.), *Commodity market reform: Lessons of two decades* (Chap. 6). Washington, DC: World Bank.

Diao X., Dorosh, P., & Rahman, S. (2003). *Market opportunities for African agriculture: Examination of demand-side constraints on agricultural growth*. Washington DC: International Food Policy Research Institute.

de Janvry, A., & Saudoulet, E. (2010). Agriculture for development in Africa: Business as usual or new departures?" *Journal of African Economies, 19*(12), 117–119.

FAO. See Food and Agriculture Organization of the United Nations.

Food and Agriculture Organization of the United Nations. (2010). *Value addition in agriculture: Malawi*. Rome, Italy: Author.

Jayne, T. S, Chapoto, A., & Shiferaw, B. (2011). Improving the performance of staple food markets to exploit the productive potential of smallholder agriculture. In *Proceedings of International Conference on Priority Actions Toward Market Development for African Farmers*. Nairobi, Kenya: International Livestock Research Institute.

Njukia, S. K. (2012). Commodity Exchanges Brief: Investing in the building blocks. Market Access Working Paper, Alliance for a Green Revolution in Africa. Nairobi.

Nkonde, C., Mason, N. M., Stiko, N. J., & Jayne, T. S. (2011). *Who gained and who lost from Zambia's maize marketing policies?*" FSRP Working Paper No. 49. Lusaka, Zambia: Food Security Research Project.

Onumah G. E. (2009) "Roadmap for establishment of commodity exchange and warehouse receipts system in Ghana", Presentation at Stakeholder Workshop on Enhancing Financial Deepening to the Benefit of Ghana's Agricultural and Other Commodity Sectors, Accra, 19th March 2009.

Onumah, G. E. (2011). Improving the efficiency of African agricultural marketing systems through promoting exchange infrastructure: potential benefits, challenges and prospects. In *Proceedings of International Conference on Priority Actions for Development of Markets for African Farmers*. Nairobi, Kenya: International Livestock Research Institute.

Rashid S., Winter-Nelson A and Garcia P. (2008) "Purpose and potential of commodity exchanges in African economies", IFPRI, Washington DC.Sitko, N. J., & Jayne, T. S. (2011). *Constraints to the development of commodity exchanges in Africa: A case study of ZAMACE*. FSRP Working Paper No. 53. Lusaka, Zambia: Food Security Research Project.

Staatz, J. M., Kizito, A. M., Weber, M. T., & Dembélé, N. N. (2011). *Evaluating the impact on market performance of investments in market information systems: Methodological challenges*. Staff Paper 2011-08, East Lansing, MI: Michigan State University Department of Agricultural, Food and Resource Economics.

Teravaninthorn, S., & Raballand, G. (2009). *Transport prices and costs in Africa: A review of the international corridors*. Washington, DC: World Bank.

UNCTAD. See United Nations Conference on Trade and Development.

United Nations Conference on Trade and Development. (2007). *Overview of the world's commodity exchanges 2006*. New York, NY, and Geneva, Switzerland: UNCTAD Secretariat.

World Bank. (2011). *World development indicators*. Washington DC.

"Efficient agricultural value chains and markets will help unlock the full potential of small holder farmers. Human capacity and physical infrastructure must be ramped up, and we pledge to work with key partners to ensure that markets are not a limiting factor in the Green Revolution."

Namanga Ngongi
Former President
Alliance for a Green Revolution in Africa (AGRA)

CHAPTER 08

ENABLING POLICY ENVIRONMENT

By Augustine Langyintuo, International Finance Corporation (IFC)-World Bank Group

Introduction

Agriculture is the mainstay of most economies in Africa, accounting for more than 30% of Gross Domestic Product (GDP). Apparent weak political will to support agriculture, combined with price risk and generally non-conducive policies, have had a negative impact on productivity growth. As measured by cereal productivity, growth remains low, averaging 1 metric ton per hectare, about one-fourth of the global average. Per capita food production has been declining even though aggregate production has been increasing through expansion of cultivated area. This has resulted in increased cereal imports from less than 5 million metric tons a year in the early 1960s to more than 50 million metric tons per year by the mid-2000s (FAO, 2010). This is in sharp contrast to the experience of Asia where production increases came from rapid uptake of high-yielding wheat and rice varieties and the use of fertilizers and irrigation combined with subsidies, which drove down the unit cost of production inputs and raised land and labor productivities (Hazell & Ramasamy, 1991). As a consequence, per capita food production in Asia almost doubled between the early 1960s and the mid-2000s.

Some historical factors, such as the infamous structural adjustment programs (SAP)[10] and declines in global support to agriculture, are also to blame for the dismal performance of Africa's agriculture sector (World Bank, 2010). Initiated in the 1980s by the World Bank and the International Monetary Fund, the key elements of the SAP reform included macroeconomic reforms, privatization of government agencies, liberalizations of markets, removal of the government from the agricultural markets, and elimination of subsidies. Because the policy reforms devalued currencies, reduced taxation on agriculture and raised producer prices, it is widely believed that significant positive benefits were generated for farmers selling traditional export crops like coffee and cocoa (Kherallah, Delgado, Gabre-Madhin, Minot, & Johnson, 2002). But for smallholder farmers producing staple foods for domestic markets, the net effect of SAP has been largely negative, as exemplified by the collapse of the hybrid maize Green Revolution[11] in Eastern and Southern Africa. Public-sector input and marketing subsidies that accompanied maize promotion programs proved to be fiscally unsustainable (Haggblade & Hazell, 2010).

Related constraints to productivity growth include competition for agricultural markets from low-cost and often subsidized food imports, reduced access to credit at affordable rates (discussed in Chapter 3), and the removal of input subsidies. These factors have led to a dramatic reduction in the adoption of modern technologies, especially fertilizers. Land insecurity (also discussed in Chapter 3) negatively affects adoption of fertilizer and other soil improvement technologies that have cumulative beneficial effects after a single cropping season.

The above discussion underpins the need for governments to reform and implement policies that enhance input use, support output markets, and ensure that farmers have secure access to land to invest in ISFM technologies. An emerging resource that African governments could use to enhance agricultural competitiveness is the benchmarking of Agribusiness Indicators (ABI) by the Agriculture and Rural Development Division of the World Bank. First piloted in Ethiopia, Ghana and Mozambique, the ABI: (a) present a matrix to benchmark country performance in the use of, e.g. fertilizer usage, tractors per 100 km^2, access to roads, (b) highlight new indicators of agricultural commercialization, e.g. numbers of farmers per private input dealer, rural access to financial institutions, percentage of crop areas planted with improved seed, and (c) track the impact of emerging policies, using both ordinal measures, such as the effectiveness of public-private sector round tables, emergence of new forms of collateral and credit reference bureaus, the implementation of new seed laws. In addition, specific quantitative measures, such as tariff rates on tractor spare parts, and time constraints on new seed variety introduction (World Bank, 2012a, 2012b, 2012c). These ABI could be used by development practitioners and stakeholders to inform public–private dialogue, shape policy reform, and guide both public and private investments in agriculture.

This chapter presents an outline of the policy challenges facing inputs and outputs markets for staple food crops and suggests a set of policies that can drive productivity growth on the continent.

Policy, Law, and Regulatory Challenges of Agriculture Growth in Africa

Many African leaders and technical specialists are convinced that enhanced agricultural performance will constitute a necessary centerpiece for broad-based poverty reduction efforts (Haggblade & Hazell, 2010). As noted in Chapter 2, in 2003 in Maputo, Mozambique, African Union Heads of States and Governments launched the Comprehensive Africa Agricultural Development Programme (CAADP) to spearhead agricultural development efforts at continental

[10] Structural adjustment programs (SAPs) were designed to reduce the role of government, cut back on public-sector expenditures, improve balance of payments, reduce government deficits, enhance macroeconomic performance, and help African countries to achieve higher economic growth rates.
[11] In the early 1960s the first double-cross hybrids in the world were developed and adopted widely by farmers in Eastern and Southern Africa, leading to widespread productivity increases for millions of small and large farms. This was termed the hybrid maize green revolution.

level. Governments committed to spending at least 10% of their national budgets on agriculture to raise agricultural productivity to at least 6%. They also resolved to increase the level of use of fertilizer from the current average of 8 kilograms per hectare to an average of at least 50 kilograms per hectare by 2015. These are clear testimonies of improved political will to support agriculture (Dorward & Chirwa, 2009), although there have not been many subsequent success stories. With the Maputo Declaration, for example, pledges were made by many countries but few are yet to be realized (see Figure 25).

Other forms of support to agriculture can be seen in the resurgence of fertilizer subsidy programs since 2005 in Burkina Faso, Ghana, Malawi, Nigeria, Rwanda, Senegal, Tanzania, and Zambia (Wanzala-Mlobela, Fuentes, & Mkumbeva, 2011). The Malawian input support program in particular has been the most widely cited example of a success story of government's support to agriculture, but it is nonetheless controversial (Morris, Ronchi, & Rohrbach, 2011; Doward et al., 2008). The following sections discuss the existing seed, fertilizer, and output markets policy landscapes.

The Seed Policies Landscape

Whereas significant progress has been made in the development of improved crop varieties, especially for maize, rice, cassava, and pigeon peas, data from Langyintuo et al. (2010) suggest that the adoption rates for maize, one of the most important food crops in Africa in 2006, was very low, averaging 28% of the estimated 17 million ha of cultivated maize (Table 15).

Recent data from Alene et al. (2011), however, show that maize, cassava, and beans have made substantial gains in adoption rates (Table 16). In the case of maize, Nigeria is thought to be driving the adoption rate in West and Central Africa. Whereas adoption level is moderately high in countries such as Senegal, in Nigeria it is approaching 100% (Alene et al., 2009).

FIGURE 25. PERCENTAGE OF AGRICULTURE SHARE OF TOTAL EXPENDITURE IN SELECTED COUNTRIES

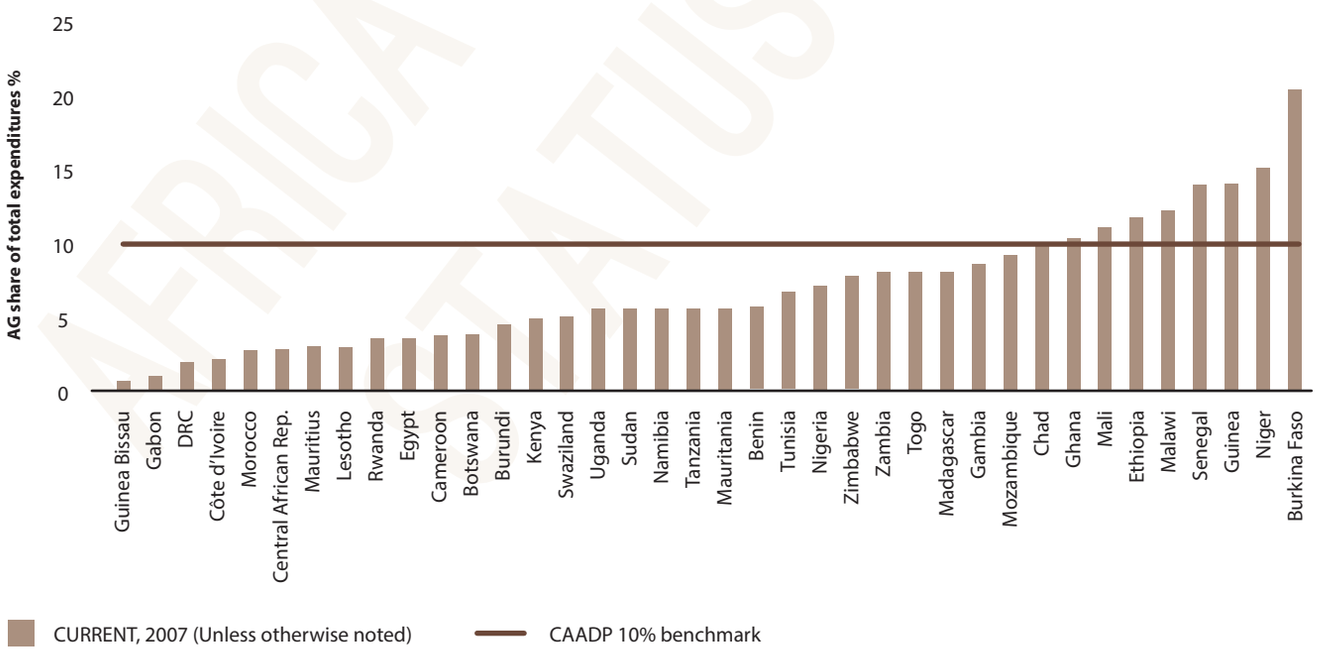


TABLE 15. ADOPTION RATE OF IMPROVED MAIZE VARIETIES IN SELECTED COUNTRIES IN AFRICA

COUNTRY	Area (ha)	Seed Demand (metric tons)	Adoption rate (% of Area)
Ethiopia	1,700,000	42,000	19
Kenya	1,6,00,000	39,000	72
Tanzania	2,600,000	64,000	18
Uganda	700,000	17,000	35
Angola	800,000	19,000	5
Malawi	1,400,000	35,000	22
Mozambique	1,200,000	30,000	11
Zambia	600,000	14,000	73
Zimbabwe	1,400,000	34,000	80
Benin	700,000	16,000	N/A
Ghana	700,000	19,000	1
Mali	300,000	8,000	<1
Nigeria	3,600,000	89,000	5
Total	**17,300,000**	**427,000**	**28**

Source: Langyintuo et al. (2010)

TABLE 16. PRELIMINARY RESULTS ON ADOPTION OF MODERN VARIETIES BY CROP FROM THE 2010 DATA SET

Crop	Number of Observations	Estimate of Modern Variety Adoption (% area)
Barley	2	22
Beans	7	32
Cassava	17	39
Chickpeas	3	20
Fava beans	3	14
Groundnuts	9	22
Lentils	2	10
Maize (from West and Central Africa)	11	67
Pearl millet	5	17
Pigeon peas	2	34
Potatoes	5	59
Sorghum	7	14

Source: Alene et al. (2011)

The relative rates of adoption of the different improved crop varieties in the target countries are all influenced by the existing policies and government support systems. A discussion follows on the current status of the African seed policy, laws, and regulatory environment.

Internal Functioning of the Seed Legal Framework

Recent empirical data from Langyintuo et al. (2010) suggest that seed company establishment is expensive, primarily because of high investment cost and lack of affordable credit for seed entrepreneurs. Technical personnel (especially plant breeders) are hard to come by and for that reason are relatively very expensive for the average emerging seed company. Combined with limited access to affordable production credit and appropriate germplasm, seed companies find it difficult to produce and deliver seed at prices most smallholder farmers can afford.

Except in a few countries in Africa (e.g., South Africa), the functioning of the seed sector leaves much to be desired. In the past two decades, the seed sectors were strictly regulated, allowing only public-sector research, foundation seed production, and certification of seeds while inhibiting the participation of the private sector (Rusike & Smale, 1998; Tripp, 1998; Tripp & Rohrbach, 2001; Lemonius, 2005). In the 1980s and 1990s, many countries made significant progress in liberalizing and restructuring their seed sectors (Hassan, Mekuria, & Mwangi, 2001). As a result, the seed industry is now less monopolized by the public sector because various national, regional, and multinational seed companies are producing and marketing seed. Nonetheless, the African seed policy environment still faces numerous developmental challenges. Key among these as noted by Langyintuo et al. (2010) include weak internal policies to regulate the seed sector and regional seed trade restrictions.

One of the weaknesses of the African seed system is the lack of updated seed policy[12] strategies to guide government's business in regulating the sector. In countries where the seed sector is underdeveloped, such as in West Africa, seed policies are rare. Partly because of the weak or lack of effective policies, the incidence of fake seeds is common in such countries (Langyintuo, 2004). Even in countries such as Kenya, Ghana, and Uganda that have updated seed laws, there are no policies. Yet, in many countries governments promulgate laws and regulations without policies, which are necessary to provide strategic direction for execution of such laws and regulations as well as investments in the seed sector. Where policies exist, they almost exclusively concentrate on the formal seed sector and fail to support the diversity of initiatives that farmers employ for their seed security (Louwaars & Engels, 2010). In the majority of cases, the emphasis is always on hybrids to the neglect of open-pollinated varieties, as observed in India by Spielman, Kodaly, Cavalieri, Chandrasekhara, & Rao (2011).

There are some success stories in terms of internal regulatory systems, which are predicated by the level of seed sector development. For instance, in Kenya, South Africa, Zambia, and Zimbabwe, the comprehensive and functioning legislation (laws and regulations) may have partly contributed to the better development of the seed sectors. In contrast, seed sectors in Angola, Malawi, Ethiopia, Tanzania, Uganda, and almost all West African countries have weak regulatory systems either because the seed laws are outdated or the laws are not effectively implemented and enforced. This makes it difficult for the seed regulatory authorities to guarantee efficient functioning of the seed sectors (Goncalves, 2001; Langyintuo, 2004; Lemonius, 2005).

In Ethiopia, the seed quality standards specified in the law are said to be too high for some crops, making it virtually impossible for compliance, especially because the executing agency is very inefficient (Bishaw, Sahlu, & Simane, 2008). In 2010, the Government of Ghana approved a new Seed Act, which replaced the 1972 Seed Decree. In addition to liberalizing basic seed production, the new act complies with the International Seed Testing Association (ISTA)[13] and the International Plant Protection Convention to promote easy free seed trade. Seed companies in Ghana can freely produce their own foundation seed and have access to an ISTA-accredited laboratory. The Tanzanian government also has agreed to liberalize basic seed production and is working to revise its seed law and associated regulations to support the policy change. These policy reforms have substantially improved seed sector development in both countries.

The implementation of seed regulations can be a source of restriction to seed sector development. For instance, variety registration that safeguards the genetic identity of a variety and thereby enhances public welfare by discouraging the release of germplasm that is inappropriate, unproductive, or unsafe is often problematic (Tripp, 1998). As part of the release process, a new variety undergoes an official National Performance Trial (NPT) in several locations in the country for 2–3 years. In addition, the new variety also undergoes a Distinctness, Uniformity and Stability (DUS) test conducted in parallel or subsequent to the NPT to certify that it is not a duplicate of an existing one. Although in theory the two processes are expected to take a maximum of 3 years, in practice they may take longer (Table 17). Reasons

[12] Broadly speaking, a seed policy is simply a statement of principles that guide government action in the seed sector. While articulating the government's vision reflected in the day-to-day operations within the seed sector, the policy explains the roles of relevant stakeholders in the coordination, structure, function, and development of the entire seed value chain. A seed policy in itself is not a legal document but serves as the overall framework for regulatory instruments, such as the seed law and associated regulations.

[13] ISTA gives accreditation to seed testing laboratories after verifying that a laboratory is technically competent to carry out seed testing procedures in accordance with the ISTA regulations.

for the delay include a failed NPT because of bad weather in a season or two, lack of sufficient breeder seed for the NPT to be conducted, or insufficient funds to pay for the NPT. Depending on the country, a breeder may pay US$1,000–US$2,500 per entry per year for both NPT and DUS tests (Langyintuo et al., 2010; Mwala & Gisselquist, 2012). This process poses a serious regulatory obstacle to the introduction of new varieties and lengthens the time it takes farmers to access a newly developed variety. Even after the release of the variety, it might still take 2–4 years for bulking of the basic seed to produce certified seed.

TABLE 17. LENGTH OF SEED RELEASE PROCESS IN SELECTED COUNTRIES

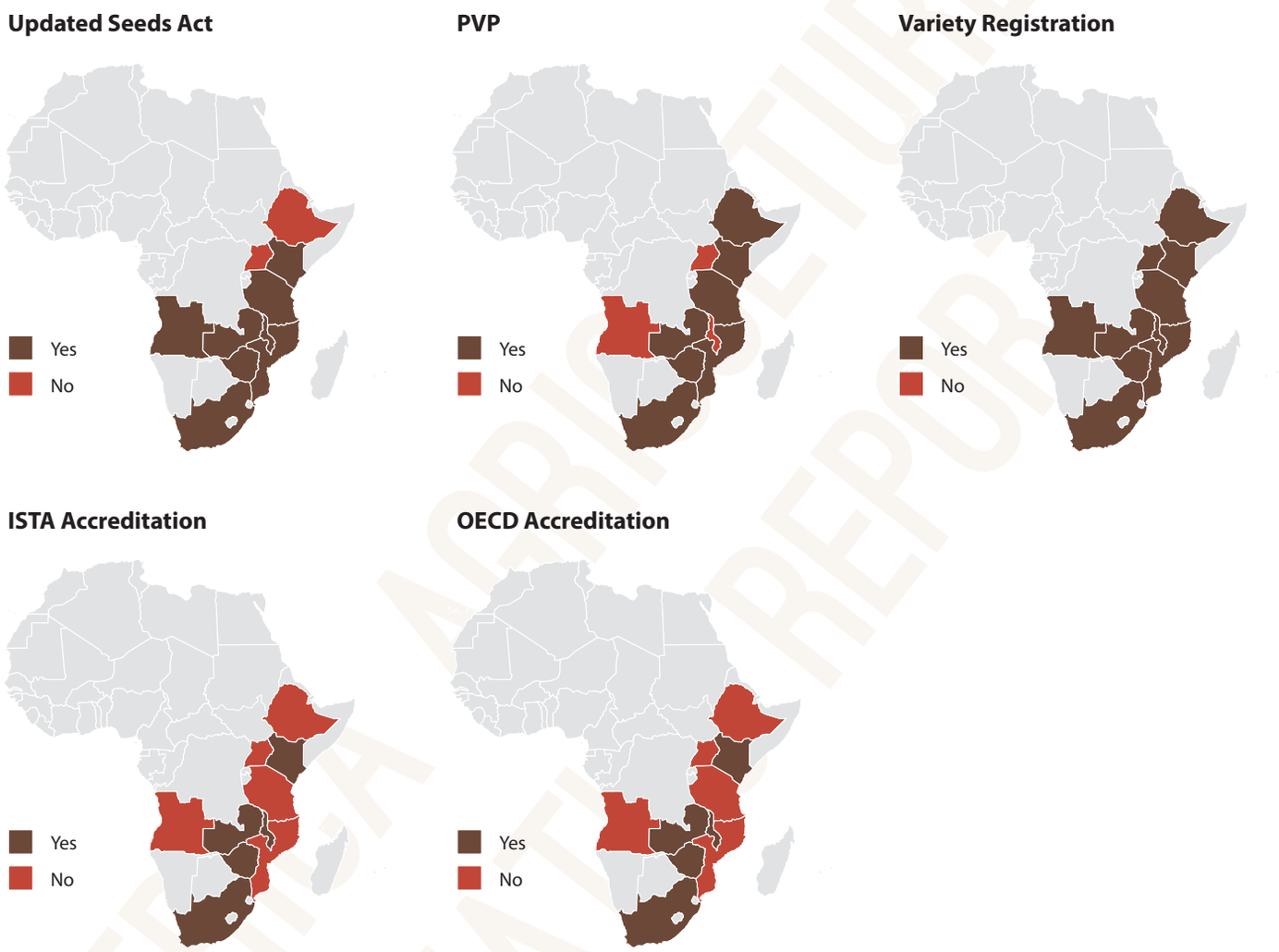
	ACTUAL TIME TO SEED RELEASE (YEARS)			TIME FROM RELEASE TO TIME SIGNIFICANT QUANTITY OF SEED IS AVAILABLE (YEARS)		
Country	**Mean**	**Minimum**	**Maximum**	**Mean**	**Minimum**	**Maximum**
Kenya	3.1	1.5	6.0	2.4	0.0	9.0
Malawi	3.0	2.0	7.0	1.9	0.5	3.0
Tanzania	2.2	1.0	3.0	2.0	1.0	3.5
Uganda	2.2	1.0	4.0	2.1	1.0	4.0
Zambia	2.1	1.0	3.5	2.5	2.0	3.0
Zimbabwe	2.2	1.0	3.0	2.4	1.5	4.0
South Africa	2.0	2.0	2.0	2.5	2.0	3.0

Source: Langyintuo et al. (2008)

Limitations to Seed Marketing and Regional Seed Trade

Domestication of harmonized regional seed laws and regulations can lead to a drastic reduction in the time lag between the release of a variety in one country and its access by farmers in similar agroecologies in other countries, more rapid availability of new seed varieties, and lower seed costs due to more competitive markets (Southern African Development Community (SADC) Seed Security Network [SSSN], 2006). Unfortunately, the legislative frameworks of countries within the regional economic communities are less than uniform to facilitate harmonization (see Table 18). Plant variety protection (PVP) is not enforced in Angola, Malawi, Uganda, and all countries in West Africa excluding Ghana (Ghana recently developed a PVP, which has been deposited with the International Union for the Protection of New Varieties of Plants in Geneva, Switzerland). Ethiopia and Uganda are yet to update their seed acts, while ISTA and the Organisation for Economic Co-operation and Development (OECD) accreditations required for official seed shipments across borders are available in Ghana, Kenya, Malawi South Africa, Zambia, and Zimbabwe. In other words, a country without an ISTA-accredited laboratory (e.g., Angola, Ethiopia, Mozambique, Tanzania, and Uganda) cannot sell seed across borders because any cross-border-traded seed lots must bear the ISTA Seed Lot and Sample Certificates that certify that the seed has met the requirements of ISTA. Differences in certification systems, standards, and procedures have led to diminished trust among seed-certification authorities in the different countries to the extent that there seems to be an overemphasis on Orange International Seed Analysis Certificates without recognition of National Seed Analysis Certificates or Private Seed Analysis Certificates issued by government-accredited private seed testing laboratories for trade.

TABLE 18. CURRENT STATUS OF SEED-CONTROL LEGISLATION IN EASTERN AND SOUTHERN AFRICA



Source: Langyintuo et al. (2008)

It is important to note that regional seed trade may also be restricted on political grounds. A government may ban or restrict volumes of imports and/or exports of seed to support domestic seed and grain production. This might only be a short-term solution to the perceived problem but is unsustainable in the long run.

The Policy of Free Seed Distribution Distorts Seed Markets

To ease the burden of disasters and calamities on vulnerable households, governments and development agents sometimes distribute free (or subsidized) seed to such households. However, there is overwhelming evidence suggesting that direct seed distributions tend to be repetitive to near continuous with somewhat limited effectiveness (Sperling, Cooper, & Remington, 2008). Langyintuo & Setimela (2009) showed that the effectiveness of such a program is compromised by inappropriate choice of seed type to distribute, the use of unreliable method of targeting beneficiaries, and limited flow of complementary information from participating development agents to beneficiaries. In addition, farmers' own seed procurement strategies are also distorted (Sperling, 2002; Phiri, Chirwa, & Haugen, 2004) and local seed market development undermined (Rohrbach, Charters, & Nyagwera, 2004). That notwithstanding, seed subsidies are not all gloom; well-designed programs can promote use of improved seed and private-sector development (Wanzala-Mlobela et al., 2011).

Fertilizer Policies

At the present level of the African fertilizer markets, it is cost-effective to import until markets expand to support large-scale production locally (World Bank, 2006). Presently, more than 90% of the fertilizer used in Africa is imported at very high sourcing costs, which ultimately reduce the profitability of distributing fertilizer and discourage increased supply. The scope for negotiating bulk purchases and arranging bulk shipments is limited by the lack of port facilities capable of handling large volumes. Most fertilizer imported into Africa is shipped via 10,000-ton vessels because of limited capacities at the ports, especially those outside of South Africa. This limits the size of bulk orders and entails a shipping cost premium of 10%–15% over medium-size vessels. All these factors negatively affect farmgate prices, thereby limiting farmers' use of fertilizers.

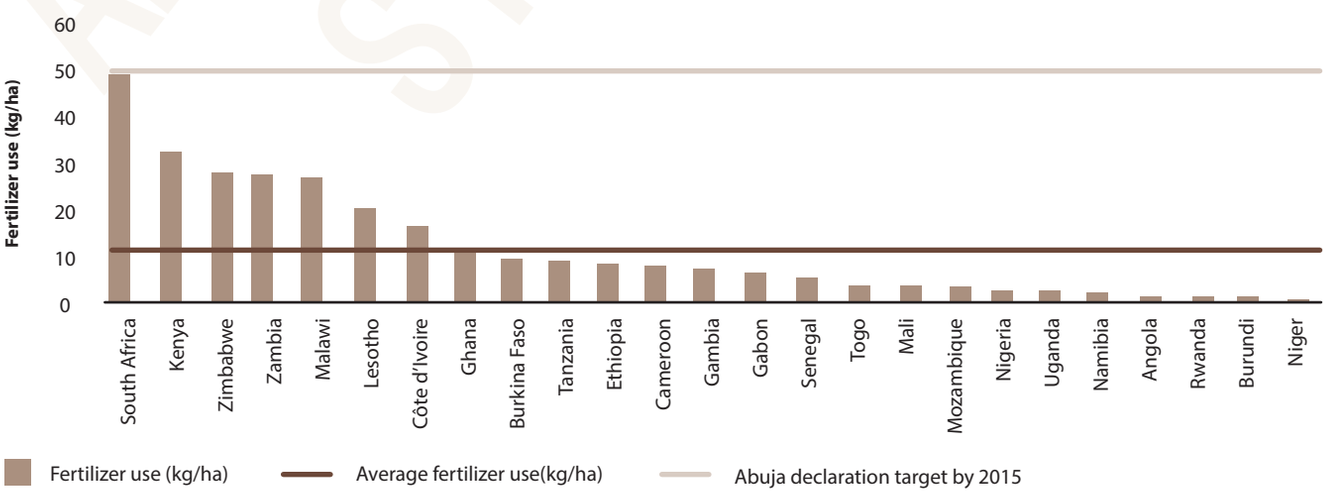
According to the World Bank (2012), African farmers use only about 11 kg/ha of nutrients on average, with a range of less than 1 kg/ha in Uganda and Democratic Republic of Congo to about 48 kg/ha in South Africa (Figure 26) compared with 96 kg/ha and 101 kg/ha in Southeast Asia and South Asia, respectively (Morris, Kopiki, & Byerlee, 2007) and more than 145 kg/ha in the developed world (World Bank, 2006). On aggregate, fertilizer use in Africa grew by 8.8% per year between 1964 and 1983 but slowed to 2.6 % between 1984 and 1993 and then became negative from 1994 to 2003 (Pratt and Yu, 2008). Total consumption did not change significantly between 1980 and 2005, averaging 1 million tons per year, with Egypt, South Africa, and Morocco accounting for 69% of total consumption on the continent (Wanzala-Mlobela et al., 2011).

Whereas high levels fertilizer use creates environmental problems in developed countries and in few countries in Africa (e.g., Egypt, Morocco, and South Africa), in most parts of Africa it is the limited use of the input that creates environmental degradation leading to an estimated loss of 4%–12% of GDP through soil mining and clearing of forest land to expand farms in an attempt to increase production (Olsen & Barry, 2003).

The reasons why African farmers appear reluctant to use fertilizers can be attributed to: (1) the risk of fertilizer use, (2) insufficient incentive to motivate farmers to invest in fertilizers, and (3) high relative fertilizer prices (Gregory & Bumb, 2006). Farmers generally operate under risky farming conditions: rain-fed farming under a high frequency of drought occurrence and limited access to competitive markets. As a result, they are often cautious about investing in high-risk technologies such as fertilizers.

The incentives for African farmers to use fertilizer have been eroded because of a poor nitrogen-to-maize price ratio. Between 1997 and 2003, the ratio has trended downward by 0.9% (Heisey & Norton, 2007). Even when the world prices crash, prices of fertilizers in Africa continue to rise because of a combination of the removal of price subsidies (Kherallah et al., 2002; Heisey & Norton, 2007), the small fertilizer market size,[14] high transport and handling costs from the port to consumption centers in the rural areas, and cost of finance. The slow emergence of the private sector, and consequently a lack of a vibrant market, is an artifact of unfavorable private sector policies: poorly defined rules of the game; weak regulatory enforcement; a proliferation of taxes and fees; cumbersome bureaucratic procedures; a general lack of security; and the widespread incidence of corruption (World Bank, 2006).

FIGURE 26. INTENSITY OF FERTILIZER USE IN SELECTED COUNTRIES IN AFRICA



Source: World Bank (2012).

[14] At a consumption rate of less than 25,000 tons, Africa consumes a little more than 1.3 million tons per year, accounting for less than 1% of the global fertilizer market.

Staple Food Crop Market Policies

Access to market is as important to agricultural productivity growth as technology and macroeconomic policies (Barrett, 2011; Jayne, Chapoto, & Schiferaw, 2011). Over the past decades, several highly committed and well-funded efforts in support of an African Green Revolution were thwarted because of insufficient preparedness to deal with marketing and governance issues (Jayne et al., 2011). In general, smallholder farmers need access to efficient marketing chains that they can rely on to dispose of their products at competitive and stable prices. Various governments, before SAPs, set up state marketing agencies intended to provide incentives for production and stabilize prices for food-insecure households and small-scale farmers. However, they quickly became corrupt and very inefficient. The market liberalization programs following SAP removed many highly inefficient and corrupt state agencies that used to control the markets for food staples. However, the private sector has not come in and filled the void as fully as anticipated.

Apart from market price volatility that poses a major risk to farmers forcing them to adopt subsistence farming, poor transport and marketing infrastructure, poorly integrated markets, and long marketing chains translate into high transaction costs. Renkow, Hallstrom, & Karanja (2004) observed that transaction costs add about 15% ad-valorem tax on crop sales in rural Kenya. According to Platteau (2000) and Fafchamps (2004), the lack of vertical integration of markets adds considerable transaction costs associated with search, quality control, and contract monitoring and enforcement.

Africa accounts for less than 2% of global trade, mostly in primary products. United States, the European Union, and China cumulatively account for nearly 70% of African trade; given they were the hardest hit by the recession, their demand patterns shifted to the disadvantage of Africa (Arieff, Weiss, & Jones, 2009). For example, total exports to the United States from all 41 countries eligible for trade benefits under the African Growth and Opportunity Act (AGOA) declined by 63% in the first half of 2009.

More open intraregional trade between African countries offers important opportunities to exploit differences in comparative advantage, achieves greater economies of scale in marketing, and helps to stabilize food supplies in the face of adverse weather events at country levels. Yet a World Bank 2008 report indicated that Africa is the world's second most trade-restrictive region after South Asia. Freund & Rocha (2009) observed that by reducing transit time by just a day, exports could increase by 7%. National concerns about food security constitute a constraint to interregional trade. To meet national food needs at all times, a government may restrict food exports in years when national production and stocks are low. This may explain why governments sometimes backtrack on existing trade agreements by imposing trade bans. It is not surprising, therefore, that the size of intraregional trade in Eastern and Central Africa is small, estimated at US$300 million or 1.5% of total value of trade. Poor infrastructure, high transport costs, tariff and non-tariff barriers, as well as the bulky nature and perishability of many of Africa's staple food crops are the main challenges.

Reforming Input and Output Market Policies

Seed sector policies reform

Before delving into policy reform issues, it is important to acknowledge the need for government support in the estimation of seed demand for seed providers as a public-sector good. Although reliable demand estimates are crucial in planning seed production because of the inflexible time lag between production and sales, once initiated it is not possible to adjust the volume or variety mix (Gregg, 1983). Seed companies do not seem to have the capacity to estimate seed demand (Langyintuo, 2004; Langyintuo et al., 2010). In most countries, seed providers often use previous sales volumes as proxies for their demand estimates, which do not take into account demand shifters such as previous harvests. One country in which the government has been estimating demand is Ethiopia. Demand forecasts are estimated at the lowest unit of the farming communities or *kebeles*, aggregated at the *woreda* levels, then at the zonal levels, the regional levels, and finally at the national level. Even then, such estimates still ignore the possible demand shifters (Lakew & Alemu, 2012).

Key reforms that governments should pursue should include seed policies, laws, and regulations, as well as domestication of harmonized regional seed laws and regulations. Governments should promulgate or update seed policies to define the trend of seed sector development. On the basis of the policies, existing seed laws and regulations should be updated appropriately, implemented, and enforced. Given the widespread faking of seeds in many countries, the legislation should provide a strong base for the regulatory authorities to police fake seed to protect genuine seed producers and farmers. At present, most countries lack the legislative framework to deal with culprits. Where such frameworks exist, they seem outdated and impose penalties that do not seem to be punitive enough to deter others.

Variety release regulations should be reformed to shorten the time to release to not more than 2 years, as is the case in South Africa. These reforms should also take the following into consideration: (1) the DUS tests should be carried out simultaneously (and not subsequent) to NPT; (2) use of breeders' data to support variety release with minimal need for NPTs—second-year testing in NPT should only be conducted if first-year data contradict the breeders' data; (3) update variety release criteria to take into account varieties with

special traits, including stress tolerance and resistance traits, nutritional traits, specialty maize, and so forth; and (4) devise and enforce an agreed-upon roadmap between public- and private-sector actors that enables rapid variety release and scale up of seed production at reasonable costs (including procedures that allow prebasic and basic seed production in parallel to variety release). To promote branding and increased investment in advertising, it will be important to grant full or limited exclusivity for public germplasm to seed companies through transparent tender processes.

Policy makers should commit to policy reforms that facilitate harmonization of regional seed laws and regulations. Once harmonized, these should be domesticated, implemented, and enforced.

Policies on affordable credit to seed companies and farmers are imperative. Emerging seed companies in particular desperately need affordable credit to finance seed production and capacity building in seed production techniques and business management skills. The AGRA-supported Agricultural Seed Investment Fund and the West African Agricultural Inputs Fund that provide loans to seed companies to finance equipment and production are examples that support agribusiness development and should be scaled up.

The adoption rate of improved crop varieties among smallholder farmers will improve through policies that: (1) enhance extension message delivery, (2) target subsidy on seeds, (3) improve access to credit, and (4) improve grain markets. Farmers need information on the nature and types of varieties as well as the economic benefits that can be obtained from planting appropriate improved varieties. Some seed packs carry extension messages to allow farmers to make informed decisions. For example, SeedCo Ltd. uses an elephant to symbolize a long-maturing variety and a zebra for an early maturing variety (Langyintuo et al., 2010). Such innovative approaches should be emulated by all other seed companies to promote their products.

Fertilizer Sector Reforms

Policy Interventions to Promote Fertilizer Demand

Strengthening fertilizer demand at farm level requires policy interventions that: (1) encourage farmers to purchase fertilizer, (2) improve farmers' ability to purchase fertilizers, and (3) increase the profitability of fertilizers use. To encourage farmers to use fertilizer, research on crop response to fertilizer and eventual profitability is essential. In the past, research on crop response has too often led to blanket recommendations for fertilizer management that may be suboptimal for specific situations and in many countries may be very dated and need to be reestablished to focus on ecology- or crop-specific rates rather than on blanket rates. Strategies that enhance fertilizer use, such as microdosing or organic/inorganic fertilizer combinations, should be emphasized.

It is important to mention that effective extension message-delivery systems are imperative to promote fertilizer demand among farmers. Efforts to strengthen individual farmers' capacity to make sound fertilizer management decisions are critical in driving increased profitable use of fertilizer. Suffice it to say that access to fertilizer alone cannot increase productivity; fertilizer should go with complementary inputs such as improved crop varieties. With high frequency of drought, production risk constitutes an important impediment to fertilizer demand at the farm level, especially when farmers do not have access to irrigation. Crop and variety mix have differential responses to fertilizers and hence are a source of risk for farmers. Therefore, better information on weather, crop, and variety portfolios (in relation to their response to fertilizers) will help to reduce production risk for farmers and hence promote fertilizer use.

Even when farmers know the value of fertilizers and are willing to buy, they may be hindered by lack of cash or access to credit. While appreciating the economic burden on governments and development partners, it is important to provide smart subsidies to farmers to promote fertilizer demand (Jayne & Jones, 1997; Kelly, Adesina, & Gordon, 2003). In addition, innovative approaches to increase small-scale farmers' access to credit should be explored, especially that the rural financial markets are poorly developed (World Bank, 2003). These issues are explored in a separate chapter on finance.

Most African farmers are smallholders who lack the economic and political power to capture economies of scale in input procurement, production, processing, storage, and marketing (Kelly et al., 2003; Coulter, Goodlad, Tallontire, & Stringfellow, 1999). Public support is necessary to encourage formation of farmers' associations or producers' organizations to create the necessary political clout to be able to bargain for better services and prices for their products and consequently increase profitability of input use. Strong producers' organizations can improve the competitiveness and welfare of small-scale farmers while serving as social safety nets. This might require the establishment of an enabling policy environment, a facilitating legal framework, and a regulatory climate conducive to business. Additional public support often is needed to help producers' associations become established and to overcome obstacles linked to their members' lack of formal education, business management experience, and physical and financial resources. As farmers become more market-savvy, the potential benefits of collective action become more apparent and their interest in participating in producers' organizations tends to increase (World Bank, 2006).

Supply-Side Policy Reforms

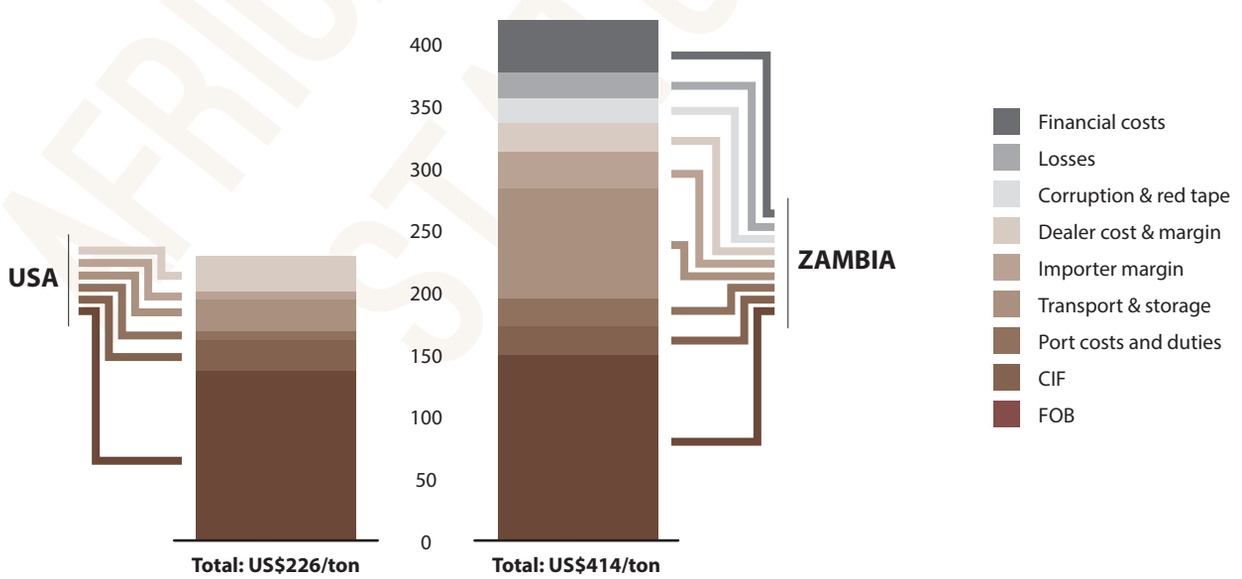
In a market economy, a stronger demand for fertilizer is expected to elicit an increased supply of fertilizer, as profit-seeking input distributors respond to new opportunities

to increase sales and income. Supply-push policies should aim at promoting increased availability and affordability of fertilizer to farmers. In the short run, increased profitability will encourage suppliers to offer more fertilizer at the prevailing market price. Over the long run, sustained high profitability will draw new firms into the market, increasing supplies. Policy interventions to increase fertilizer supply should address: (1) sourcing costs, (2) distribution costs, (3) the availability and cost of business finance and risk management instruments, and (4) the adequacy of supply chain coordination mechanisms.

Improvements to reduce cost of sourcing include improving access to foreign exchange and credit, strengthening port infrastructure, and pooling import orders. Expanding capacity in the main ports of entry to allow larger vessels to discharge is one obvious avenue for reducing the landed cost of fertilizer. As a result of the low volumes imported, most fertilizer importers forfeit economies of scale unless they pool their orders. Incentives for reducing costs through joint procurement and regional market expansion need to be developed. Governments should explore opportunities for various forms of public–private partnerships and also develop safeguards to protect consumers against the concentration of market power. In other words, government regulation is required to assure competitive supply chains, which at present are generally weak. Efforts should be made to prevent importers and wholesalers from collusive practices, including price fixing and market segmentation. For this to happen, government should institute rules for acceptable competitive practices that are enforced through penalties but avoid overregulation of the sector. Multicountry trading blocs could take advantage of common ports, rail networks, and road systems to consolidate import orders. This strategy might require some harmonization of fertilizer formulas and regulatory frameworks. This draws attention to the need to develop and adopt fertilizer laws and regulations at the country levels and harmonize at the regional- or trading-bloc levels.

Transport, handling, and storage costs all affect the farmgate price of fertilizers. Bulk shipment of fertilizers can save on freight charges and lead to a considerable reduction in fertilizer prices. These gains, however, are eroded by poor road infrastructure that represents a significant bottleneck to fertilizer supply. These bottlenecks, added to the many official and unofficial tolls, taxes, and security checks along the roads, slow delivery and import transaction costs. Figure 27 shows that fertilizer importers in Zambia face significant transaction costs (e.g., financing costs, corruption and red tape, transport and storage costs) amounting to as high is 83% of the cost consumers in the United States incur. Transport and storage cost seems to be particularly high.

FIGURE 27. DELIVERED FERTILIZER PRICE TO A FARMER IN THE UNITED STATES AND IN ZAMBIA



Product adulteration is a serious problem in Africa; therefore, governments should regulate quality as well. It might be appropriate to introduce regulations establishing clearly defined standards for recommended fertilizers, as well as penalties for distributors whose products do not conform to those standards.

Fertilizer sellers need information to decide how much product to procure to meet projected demand. If sellers are unable to match supply and demand, either they forfeit earnings because of stock shortages or they incur costs associated with holding unsold inventory. Fertilizer buyers, on the other hand, need information about the inventory levels being retained by sellers, as well as information about current and expected future prices. If buyers are unable to make informed judgments about when and where to purchase fertilizers, they may be unable to acquire sufficient quantities or may end up paying unnecessarily high prices.

Policies on information gathering and flow are important in promoting fertilizer use. This could be done by the public sector. Government should invest in collecting, compiling, and distributing market information because the private sector cannot prevent buyers of their services from reselling the information to others.

Reforming Output Markets and Trade Policies

With rapid urbanization, demand for food will increase and will have to be met through market transactions. With favorable policies, Africa's markets for food staples can grow in several ways. One is through increasing the competitiveness of Africa's farmers so that they can compete better against food imports and capture bigger shares of their growing domestic and regional markets, especially for maize and rice. Key policy reforms governments may pursue to expand trade include agroprocessing investment policies, expansion of interregional trade, and price stabilization.

Agroprocessing and Value Addition

Processing and value addition will be needed to transform several of the crops produced into a wider range of products for which there is relatively high demand (e.g., processed cereals, processed foods targeted to growing ethnic food markets, and livestock feed) in local, regional, and international markets. In Africa, agribusiness input supply, processing, marketing, and retailing add about 20% of GDP (World Bank, 2013). In terms of output, a significant share of Africa's agricultural output is made up of bulky, perishable crops that are non-tradable in unprocessed form (e.g., cassava).

New policies will be required to allow African countries to create value from these staple crops, especially through value-added processing. Some of the policy interventions needed include investment in infrastructure (e.g., roads, electricity, communications, and water) to support rural processing zones in rural towns. In general, these investments are huge, which often makes them suitable for public–private partnerships given the severe constraints on public–sector resources and capacity (World Bank, 2013). Lack of finance is recognized widely as a perennial constraint to agribusinesses development. Formal lending to agriculture is limited severely by agriculture's seasonality and high risk, the absence of formal land titles, the heterogeneity of agriculture across commodities and regions, and bankers' inexperience with agribusiness (World Bank, 2013). Governments should intervene in the financing for businesses and reduce tariffs on processing equipment to promote agribusiness development. Policies that support entrepreneurship, high-quality products, grades and standards, and certification of farmers are also important in promoting agricultural marketing on the continent.

Promotion of Intraregional Trade

Increasing the production of price-inelastic food crops in thin domestic markets, in the absence of regional trade outlets due primarily to high tariff and non-tariff barriers, ostensibly results in as much as 40% reduction of producer prices for farmers.

More open intraregional trade between African countries remains the option that offers important opportunities to exploit differences in comparative advantages, achieve greater economies of scale in marketing, and help to stabilize food supplies in the face of adverse weather events at country levels, and act as a vent for surpluses. Intraregional trade can help to reduce the thinness of domestic markets and the likelihood of price collapse from increased agricultural productivity in the absence of wider markets.

Price Stabilization

Liberalized markets have exposed many small farmers to significant price risks that can deter technology adoption and development of markets and agricultural lending. Surplus food producers are discouraged from intensifying production if they fear that increased output could lead to price collapse at harvest time, robbing them of any gains from productivity enhancement and possibly making them worse off overall. Interseasonal price troughs in years of particular abundance are the main concerns. Surplus producers generally have the resources to be able to hold back at least a proportion of their harvest and avoid the worst effects of normal intraseasonal price falls immediately after harvest. Setting up national and regional strategic grain reserves would help to stabilize domestic and regional grain prices.

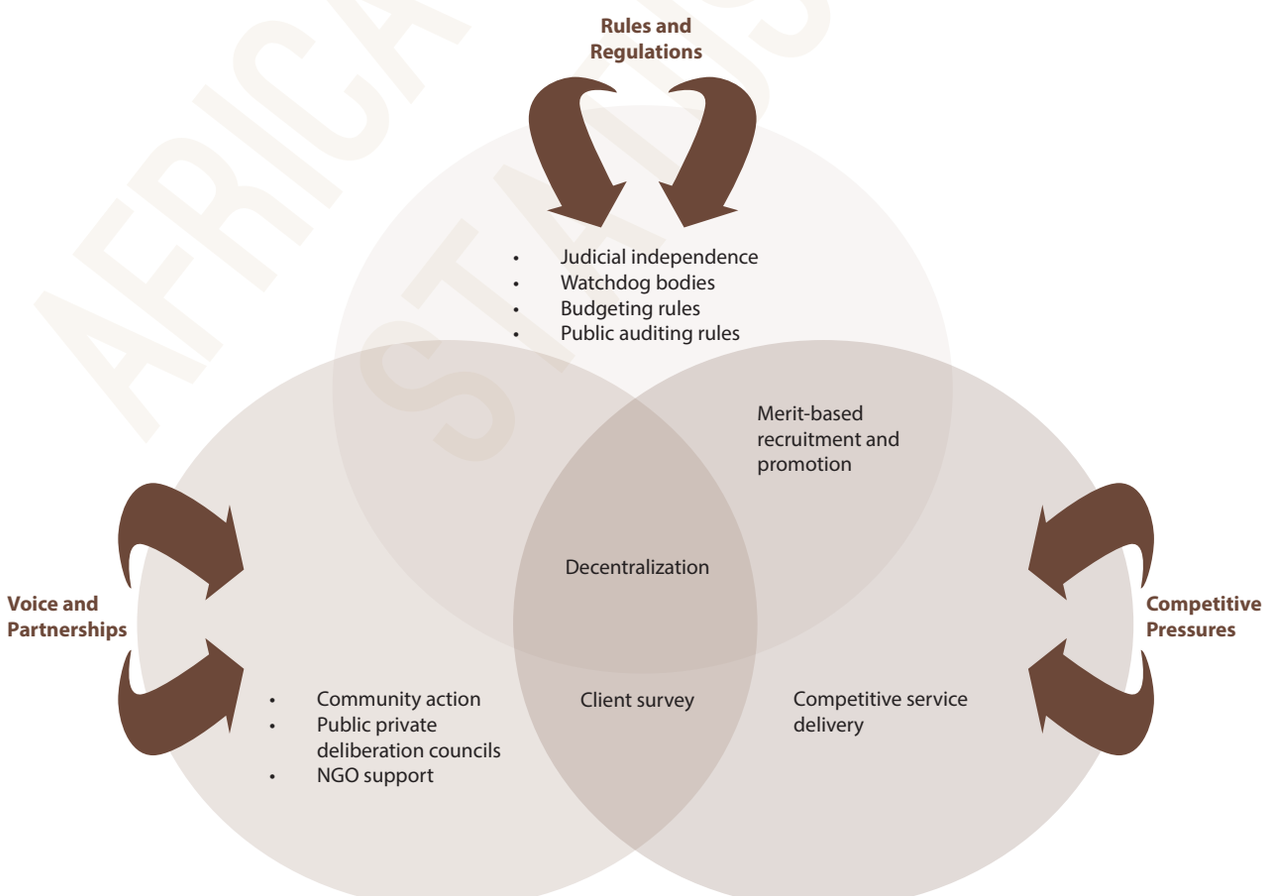
Governance for Effective Policymaking

The many economic functions of the public sector can be classified into three broad categories: (1) policymaking, (2) service delivery, and (3) oversight and accountability. Once policies are developed, governments delegate their implementation to the various government agencies and departments responsible for the respective areas. Policies, laws, and regulations that are well formulated, but not implemented effectively, will not yield desired results. For effective implementation of well-crafted policies, laws, and regulations, the responsible institutions must be strengthened to perform their duties. Equally important is the strengthening of the regulatory institutions. The incentives created by the policies, laws, and regulations shape the actions of public officials.

There are three mechanisms that promote public sector effectiveness and good governance (see Figure 28). As detailed by the World Bank (2000), these are: (1) internal rules and restraints (e.g., internal accounting and auditing systems, independence of the judiciary and the central bank, civil service and budgeting rules, and rules governing ombudsmen and other internal watchdog bodies that often report to parliaments); (2) voice and partnership (e.g., decentralization to empower communities, service delivery surveys to solicit client feedback, and notice and comment regulatory rulemaking; and (3) competition (e.g., competitive social service delivery, private participation in infrastructure, alternative dispute resolution mechanisms, and privatization of certain market-driven activities). These mechanisms may involve a fundamental rethinking of the role of the state, often a key component of reform.

In the government policymaking processes, due consideration must be given to the various institutions that are interlinked in the policy ecosystems (World Bank, 2000). Where institutions are weak or dysfunctional, policies should be simple with limited administrative demands on the institutions. Policies do not emerge from a vacuum but generally are the result of bargaining among various interest groups; this has to be recognized so that the impact of rent seekers during implementation can be minimized.

FIGURE 28. MECHANISMS TO ENHANCE STATE CAPABILITY TO GOVERN



Source: World Bank (2000).

Conclusion

Notwithstanding the important role agriculture plays in the economies of African countries, the sector has not witnessed impressive growth due to a combination of factors—including non-conducive policies. This is because of apparent weak political will (though changing) to support agriculture. Paradoxically, agriculture accounts for more than 30% of the GDP of most countries, yet government expenditures on agriculture are less than a third of that. In many countries, internal seed regulatory policies are weak, undermining the functioning of the entire seed value chains. In the main, the lack of enthusiasm to domesticate harmonized regional seed laws and regulations limits the extent of regional spillovers expected from improved seed technologies. Fertilizers are very expensive and beyond the reach of most smallholder farmers because of high transaction cost in procurement. Consequently, fertilizer use in Africa remains the lowest in the world — and well below the optimal levels of use with potential soil mining and general soil degradation effects. In addition to the poor input use policies is the lack of output markets. Many farmers face thin markets domestically but interregional markets are often inaccessible due to high tariff and non-tariff barriers.

Promotion of agricultural productivity requires reforms in seed and fertilizer policies combined with effective implementation and enforcement of the reforms. Market opportunities must be explored. The need to invest in agroprocessing and value addition is crucial in transforming the agriculture sector that hitherto has relied on marketing of primary products only. For any meaningful transformation to be sustained, it will be important to reform and strengthen the capacities of the regulatory institutions of government as well. Government institutions must be strengthened and given incentives to enact, implement, and regulate policies that support productivity growth. A complete separation of powers between policy implementers and policy regulators to avoid conflict of interest among stakeholders must be ensured.

References

Alene, A. D., Menkir, A., Ajala, S. O., Badu-Apraku, B., Olanrewaju, A. S., Manyoung, V. M., et al. (2009). The economic and poverty impacts of maize research in West and Central Africa. *Agricultural Economics, 40*(5), 535–550.

Alene, A., Yigezu, Y., Ndjeunga, J., Labarta, R., Andrade, R., Diagne, A., et al. (2011, December.) *Measuring the effectiveness of agricultural R&D in Sub-Saharan Africa from the perspectives of varietal output and adoption: Initial results from the Diffusion of Improved Varieties in Africa Project.* Paper presented at the Agricultural Science and Technology Indicators/International Food Policy Research Institute–Forum for Agricultural Research in Africa (ASTI/IFPRI-FARA) Conference, Accra, Ghana.

Arieff, A., Weiss, M. A., & Jones, V.C. (2009). *The global economic crisis: Impact on Sub-Saharan Africa and global policy responses.* Washington, DC: Congressional Research Service.

Barrett, C. (2011, May). Challenges of pro-poor market development for African agriculture. In P*roceedings of International Conference on Priority Actions Toward Market Development for African Farmers.* Nairobi, Kenya: International Livestock Research Institute.

Bishaw, Z., Sahlu, Y., & Simane, B. (2008). The status of the Ethiopian seed industry. In M. H. Thijssen, Z. Bishaw, A. Beshir, & W. S. de Boef, 2008 (Eds.). *Farmers, seeds and varieties: Supporting informal seed supply in Ethiopia* (p. 348). Wageningen, The Netherlands.

Coulter, J., Goodland, A., Tallontire, A., & Stringfellow, R. (1999). Marrying farmer cooperation and contract farming for service provision in liberalising Sub-Saharan Africa. *ODI Natural Resource Perspectives, 48.*

Dorward, A. R., & Chirwa, E. (2009). *The Agricultural Input Subsidy Programme 2005 to 2008: Achievements and challenges*. London, United Kingdom: School of Oriental and African Studies.

Dorward, A., E. Chirwa, V. Kelly, T. Jayne. 2008. Evaluation of the 2006/7 Agricultural Input Supply Programme, Malawi. Final report, School of Oriental and African Studies (SOAS), Wadonda Consult, Michigan State University, and Overseas Development Institute (ODI), undertaken for the Ministry of Agriculture and Food Security, Government of Malawi. March.

Fafchamps, M. (2004). *Market institutions in Sub-Saharan Africa: Theory and evidence*. Cambridge, MA: MIT Press.

FAO. See Food and Agriculture Organization of the United Nations.

Food and Agriculture Organization of the United Nations. (2010). *FAOSTAT database. Production: crops*. Rome, Italy: Author. Retrieved July 10, 2010, from http://faostat. fao.org/site/678/default.aspx.

Freund, C and N. Rocha. 2009. "What constrains Africa exports?" World Bank Policy Research Working Paper 5184.

Goncalves, A. R. (2001, July). *The seed production situation in Angola*. Paper presented at the 2nd Meeting of the SADC CSCU Seed Subcommittee, Pretoria, South Africa.

Gregg, B. R., (1983). Seed marketing in the tropics. *Seed Science and Technology, 11*, 129–148.

Gregory, D. I., & Bumb, B. L. (2006). *Factors affecting supply of fertilizer in Sub-Saharan Africa*. Agriculture and Rural Development Discussion Paper 24. Washington, DC: World Bank.

Haggblade, S., &. Hazell, P. B. R. (2010). *Successes in African agriculture: Lessons for the future.* IFPRI Issue Brief 63. Washington, DC: International Food Policy Research Institute.

Hassan, R. M., Mekuria, M., & Mwangi, W. M. (2001). *Maize breeding research in Eastern and Southern Africa: Current status and impacts of past investments by the public and private sectors, 1966–1997.* Mexico City, Mexico: International Maize and Wheat Improvement Center (CIMMYT).

Hazell, P. B. R., & Ramasamy, C. (1991). *The Green Revolution reconsidered.* Baltimore, MD: Johns Hopkins University Press.

Heisey, P. W., & Norton, G. (2007). Fertilizer and other farm chemicals. In. R.E. Evenson, P. Pingali, & T.P. Schultz (Eds.). *Handbook of agricultural economics*, Vol. 1, 3A: *Agricultural development: Farmers, farm production, and farm markets.* Amsterdam, The Netherlands: Elsevier.

Jayne, T. S., A. Chapoto, B. Shiferaw. (2011, May). Improving the performance of staple food markets to exploit the potential of smallholder agriculture. In *Proceedings of International Conference on Priority Actions Toward Market Development for African Farmers.* Nairobi, Kenya: International Livestock Research Institute.

Jayne, T. S., & Jones, S. (1997). Food marketing and pricing policy in Eastern and Southern Africa: A survey. *World Development 25*(9), 1505–1527.

Kelly, V., Adesina, A., & Gordon, A. (2003). Expanding access to agricultural inputs in Africa: A review of recent market development experience. *Food Policy, 28*, 379–404.

Kherallah, M., Delgado, C., Gabre-Madhin, E., Minot, N., & Johnson, M. (2002). *Reforming agricultural markets in Africa*. Baltimore, MD: Johns Hopkins University Press.

Lakew, T., & Alemu, D. (2012). Approaches and procedures of seed demand assessment in the formal seed sector. In A. Teklewold, D. Alemu, S. Kiyoshi, & A. Kirub (Eds.). *Seed demand assessment: Practices, challenges, and options.* Addis Ababa, Ethiopia: Ethiopian Institute of Agricultural Research.

Langyintuo, A. S. (2004). *Challenges of the seed sector of Southern Africa.* International Maize and Wheat Improvement Center (CIMMYT) report (p. 39). Harare, Zimbabwe: CIMMYT. Available at www.cimmyt.org/gis/rfseedsafrica/.

Langyintuo, A. S., Mwangi, W., Diallo, A. O., MacRobert, J., Dixon, J., & Bänziger, M. (2008). *An analysis of the bottlenecks affecting the production and deployment of maize seeds in Eastern and Southern Africa.* Harare, Zimbabwe: CIMMYT.

Langyintuo, A. S., Mwangi, W., Diallo, A. O., MacRobert, J., Dixon, J., & Bänziger, M. (2010). Challenges of the maize seed industry in Eastern and Southern Africa: A compelling case for private–public intervention to promote growth. *Food Policy, 35*, 323–331.

Langyintuo, A. S., & Setimela, P. (2009). Assessing the effectiveness of a technical assistance program: The case of maize seed relief to vulnerable households in Zimbabwe. *Food Policy, 34*, 377–387.

Lemonius, M. (2005, October). *The impact of seed policy and regulatory initiatives on seed Programme performance and seed supply in developing countries.* Paper presented at CIMMYT Seed Systems Learning Workshop, Rome, Italy.

Louwaars, N. P., & Engels, J. M. M. (2010). Seed policies: Enabling support to informal seed systems. In M. H. Thijssen, Z. Bishaw, A. Beshir, & W. S. de Boef, 2008 (Eds.). *Farmers, seeds and varieties: Supporting informal seed supply in Ethiopia* (p. 348). Wageningen, The Netherlands.

Morris, M., Ronchi, R., & Rohrbach, D. (2011, May). Building sustainable fertilizer markets in Africa. In *Proceedings of International Conference on Priority Actions Toward Market Development for African Farmers.* Nairobi, Kenya: International Livestock Research Institute.

Morris, M., Kelly, V. A., Kopicki, R., & Byerlee, D. (2007). *Promoting increased fertilizer use in Africa: Lessons learned and good practice guidelines*. Washington, DC: World Bank.

Mwala, M., & Gisselquist, D. (2012). Private-sector agricultural research and innovation in Zambia: Overview, impact, and policy options. Lusaka, Zambia: University of Zambia.

Olson, J. and L. Berry, 2003. Land Degradation In Uganda: Its Extent And Impact. Mimeo.

Phiri, M. A. R., Chirwa, R., & Haugen, J. M. (2004). A review of seed security strategies in Malawi. In: L. Sperling, T. Remington, J. M. Haugen, & S. Dagoda (Eds.). *Addressing seed security in disaster response: Linking relief with development.* (pp. 134–158). Cali, Columbia: International Center for Tropical Agriculture.

Platteau, J.-P. (2000). *Institutions, social norms and economic development*. Amsterdam, The Netherlands: Harwood Academic Publishers.

Pratt, A.N. and B. Yu (2008). An updated look at the recovery of agricultural productivity in Sub-Saharan Africa. IFPRI Discussion Paper 00787. IFPRI, Washington DC.

Renkow, M., Hallstrom, D. G., & Karanja, D. D. (2004). Rural infrastructure, transactions costs and market participation in Kenya. *Journal of Development Economics 73*(3), 349–367.

Rohrbach, D., Charters, R., & Nyagwera. J. (2004). *Guidelines for agricultural relief programs in Zimbabwe.* Bulawayo, Zimbabwe: International Crops Research Institute for the Semi-Arid Tropics.

Rusike, J., & Smale, M. (1998). Country case studies: Malawi. In M. L. Morris (Ed.). *Maize seed industries in developing countries* (pp. 285–302). Boulder, CO: Lynne Rienner Publishers, Inc.

Sperling, L., Cooper, D., & Remington, T. (2008). Moving towards more effective seed aid. *Journal of Development Studies, 44*(4), 586–612.

Spielman, D. J., Kolady, D., Cavalieri, A., & Chandrasekhara Rao, N. (2011). *The seed and agricultural biotechnology industries in India: An analysis of industry structure, competition, and policy options*. IFPRI Discussion Paper 01103. Washington, DC: International Food Policy Research Institute Environment and Production Technology Division.

SADC Seed Security Network. (2006). *Organization and funding for the harmonization of SADC seed regulations and harmonized systems*. Gaborone, Botswana: Author.

SSSN. See SADC Seed Security Network.

Thijssen, M. H., Bishaw, Z., Beshir, A., & de Boef, W. S. (Eds.). (2008). *Farmers, seeds and varieties: supporting informal seed supply in Ethiopia.* Wageningen, The Netherlands: Wageningen International.

Tripp, R. (1998). Regulatory issues: Varietal registration and seed control. In M.L Morris (Ed.). *Maize seed industries in developing countries* (pp. 159–174). Boulder, CO: Lynne Rienner Publishers, Inc.

Tripp, R., & D. Rohrbach. 2001. Policies for African seed enterprise development. *Food Policy, 26* (2001), 147–161.

Wanzala-Mlobela, M., & Groot, R. (2011, May). Fertilizer markets in Africa. In *Proceedings of International Conference on Priority Actions Toward Market Development for African Farmers*. Nairobi, Kenya: International Livestock Research Institute.

Wanzala-Mlobela, M., Fuentes, P., & Mkumbwa, S. (2011). *Best practices and policy options for implementing fertilizer subsidy programs successfully in Sub-Saharan Africa.* Midrand, South Africa: NEPAD Planning and Coordinating Agency.

World Bank. (2003). *Rural financial services: Implementing the bank's strategy to the rural poor.* Agriculture and Rural Development Department, Report No. 26030. Washington, DC: Author.

World Bank. (2006). *Promoting increased fertilizer use in Africa: Lessons learned and good practice guidelines.* Africa Fertilizer Strategy Assessment ESW Technical Report Discussion Draft. Washington, DC: Author.

World Bank. (2008). *Development indicators database.* Washington, DC: Author. Retrieved December 18, 2009, from http://devdata.worldbank.org/external/CPProfile.

World Bank. (2013). *Growing Africa: Unlocking the potential of agribusiness*. Washington, DC: Author.

World Bank (2012a). Agribusiness Indicators: Ethiopia. Economic and Sector Work. Report Number 68237-ET. The World Bank, Washington DC: Author.

World Bank (2012b). Agribusiness Indicators: Ghana. Economic and Sector Work. Report Number 68153-GH. The World Bank, Washington DC: Author.

World Bank (2012c). Agribusiness Indicators: Mozambique. Economic and Sector Work. Report Number 68241-MZ. The World Bank, Washington DC: Author.

CHAPTER 09

FARMERS' ORGANIZATIONS AS KEY ACTORS IN AGRICULTURAL DEVELOPMENT

By Nicholas Biekpe, AFRICRES; Fadel Ndiame, Mary Njoroge, Pauline Kamau, and Samuel Sey, AGRA

Introduction

The role of agriculture in the promotion of economic development has been discussed extensively in the economic growth and development literature. Generally, agriculture constitutes the main source of employment of most of the world's poor, contributing an estimated 53% of total employment in developing countries (Meijerink & Roza, 2007). Agriculture also expands markets for industrial output and provides food for domestic consumption (Delgado, Hopkins, & Kelly, 1998). Smallholder farmers in developing countries face a number of constraints; in Africa, these constraints include limited access to finance and markets. As a result, agricultural productivity remains very low. Moreover, poor-quality products, low skill level, and poor linkages with providers of support services constrain the productivity of smallholder farmers. Zeller & Sharma (1998) identified some of the different benefits that access to finance can provide to smallholder farmers. For example, smallholder farmers who can access finance can expand their farms, invest in agricultural technology such as high-yielding seeds and chemical inputs, and obtain intertemporal borrowing when they face seasonal adverse shocks.

Farmers' organizations are recognized as important support vehicles for raising smallholders' incomes and livelihoods by providing demand-driven and income-enhancing services to their members. Collective action gives farmers' organizations significant bargaining power and enables them to reap substantial benefits, such as enhanced productivity and income. According to Kassam, Stoop, & Uphoff (2011), farmers' organizations assist their members by enhancing participation and consultation of all stakeholders in the planning and development of farming activities. Thus, these organizations play an important role in helping to improve the productivity of smallholder farmers by reducing transaction costs through aggregation and economies of scale.

Typologies of Farmers' Organizations in Sub-Saharan Africa

Kassam et al. (2011) defined a farmers' organization as "a formal voluntary membership organization created for the economic benefit of farmers (and/or other groups) to provide them with services that support their farming activities such as bargaining with customers; collecting market information; accessing inputs, services and credit; providing technical assistance; and processing and marketing farm products. Formal membership criteria could include payment of membership fees or a percentage of farmers' production. Informal membership criteria could be based on ethnicity or gender." Thomson et al. (2008) indicate that highly effective farmers' organizations[15] have seven attributes: a clear mission, sound governance, strong leadership that is responsive and accountable, promote social inclusion and raising a voice, offer demand-driven and focused service delivery, to have high technical and managerial capacity, and to effectively engage with external actors. There are many types of farmers' organizations, although commodity-based, market-oriented, and resource-oriented organizations are common.[16] Commodity-based, market-orientated farmers' organizations specialize in a single commodity and opt for value-added products that have expanded markets. They can recruit members from among the regional growers of the focus commodity who are interested in investing some share capital to acquire the most recent and up-to-date processing technology and professional manpower. They integrate research, input supply, extension, credit, collection of produce, processing, and marketing to maximize the returns on the investments of their members. This requires a high caliber of representative and enlightened leadership from among the grower members; it is a challenging and demanding task to conceive, design, build, and nurture this type of farmers' organizations. Some successful cases include dairy farmers in Kenya, vegetable farmers in Ghana, and shallot growers in Mali. Community-based, resource-oriented farmers' organizations could either be a village-level cooperative or association dealing with inputs needed by the members to enhance the productivity of their businesses based on land, water, or animals. They are generally small with well-defined geographical areas, and are predominantly concerned about inputs. However, the client group is highly diversified in terms of crops and commodities.

In Sub-Saharan Africa, farmers' organizations exist at all levels. At the regional level, an apex organization such as the Southern African Confederation of Agricultural Unions (SACAU) represents 5 million small-scale producers across 12 countries through constituent national organizations. At the national level, organizations such as the Zambia National Farmers Union (ZNFU) or the Kenyan Federation of Agricultural Producers (KENFAP) represent a range of producer associations from horticultural growers to livestock producers. They can include small-scale farmers and large commercial producers and typically support policy activities, institutional strengthening of their members, and some delivery of technical services. At the subnational

[15] Adopted from Thompson, et al. (2008); Ethiopia, Kenya, and Malawi.
[16] Others include general interest, commodity-specific producer (farmers only), commodity industry (farmers plus other stakeholders), as well as cooperatives.

level, a myriad of local associations and producer groups engage in more technical and market-related activities for their members. In local villages, small marketing groups and cooperatives are formed for niche products, such as mushrooms or honey. As far as the different profiling has been undertaken, there are no youth farmer organizations, however, some of the existing farmer organizations have limited numbers of youth members. Some farmer organizations are increasing their women membership as demonstrated by farmer organizations profiled in Ghana and Rwanda. We also find, though limited, women farmer organizations as is the case of Kumbukani Association in Malawi which is a district association with 210 women and 140 men. The interesting reality is that the 210 women are organized into various women-only farmer groups, which then federate into this association with men-only farmer groups. Their main agricultural occupation is production and collective trading of maize, soybeans, groundnuts and beans. In the context of AGRA (Farmer Organizations Support Centre in Africa (FOSCA), the definition of a farmers' organization is expansive—it encompasses all these forms of organizations and acknowledges the very different roles and advantages of each for smallholder farmers.

The Landscape[17] of Farmers' Organizations in Africa

To enhance their competitiveness, smallholder farmers come together for efficiency gains from economies of scale along the agricultural value chain.[18] Such aggregation enables smallholders to reduce transaction and overhead costs by purchasing inputs together, reducing the cost of transport per farmer, and enjoying discounts due to bulk purchasing. Farmers' organizations largely act as primary service providers[19] to their members because they may be better placed to understand the needs of individual farmers. In cases where farmers' organizations do not have the capability to meet certain needs of members, they may employ secondary service providers with expertise in different areas, such as transporters, aggregators, banks, insurance companies, and government extension workers (see Figure 29).

FIGURE 29. ILLUSTRATION OF AN AGRICULTURAL VALUE CHAIN

Characteristics of Farmers' Organizations in Africa

Some positive features characterize farmers' organizations in Africa. For example, African farmers' organizations are characterized by cost-sharing mechanisms. In Ghana and Nigeria, AFRICRES (2012) found that selected farmers' organizations assisted farmers in acting as a group and bulking their products to reach the necessary scale to deal with buyers directly without having to go through a middleman. They thus cut the burden of transport costs by organizing common transport to help members move their products to the markets; they also have common storage facilities in the form of warehouses.

The AFRICRES study also identified good governance as another positive characteristic of some farmers' organizations. The farmers' organizations reviewed in Ghana and Nigeria were all legally registered, owned a constitution, and followed democratic methods when electing executive committee members. In addition, they had a feedback mechanism between the leadership and other members to ensure achievement of the primary mandate. The feedback mechanism took the form of high-quality meetings, as was the case in Ghana. Working together in this manner makes it easier for smallholder farmers to deal with suppliers of inputs and other service providers and to access financial services, even from banks that usually prefer to grant credit to registered organizations rather than to individuals. Thus, these organizations are characterized by a culture of working together.

[17] Landscape of farmers' organizations is the space occupied by the organizations' subsectors within the agriculture sector.
[18] Value chain describes the full range of activities required to bring a product or service through the different phases of production, including physical transformation, the input of various producer services, and response to consumer demand.
[19] These are organizations, ideally Africa-based and local, with expertise in technical, institutional, managerial, and/or policy areas. They span the spectrum from for-profit entities (e.g., local accounting firms, human resources consultants, local training centers) to nongovernmental entities (e.g., local NGOs offering a range of technical assistance), as well as farmers' organizations capable of providing peer-to-peer assistance.

Farmers' organizations also have several negative characteristics. In most developing countries, women undertake a large part of the agricultural work, yet their role in agriculture remains largely unrecognized. As a result, AFRICRES (2012) found that in Ghana and Nigeria, farmers' organizations are characterized by low representation of women and youths in their memberships. This poor level of participation by youths and women, especially in leadership roles, points to a need for programs that are designed to specifically target their improved participation in the activities of farmers' organizations. The policies can include quotas for women's and youths' participation coupled with women-only committees. Cultural and institutional change is also necessary to the operation of farmers' organizations, which tend to reflect male cultural norms. Furthermore, mentoring and coaching of youths by successful agribusiness experts can empower them about the value of agribusiness. Publicity in the form of positive media messages and portrayals can also help to promote the image of women farmers and young farmers. Donor financing bias toward women's participation within farmers' organizations should be encouraged without compromising quality of service delivery.

Future Agricultures (2009) indicated that African farmers' organizations are also characterized by meagre resources, which threaten their sustainability and constrain their ability to expand. This characteristic is supported by the findings of the AFRICRES study of farmers' organizations in Ghana and Nigeria. For example, most farmers' organizations lack a skilled human resource base and depend on external funding from donors. This situation, which can be attributed to the purpose of the farmers' organizations and the way they were established, has resulted in their dependency on external support. In many countries in Africa, farmers' organizations started as government initiatives to help farmers to work together under cooperative societies, as in Ethiopia, Kenya, and Malawi. Government involvement has thus made it difficult for the farmers' organizations to operate independently and build their leadership capacity because government served a leadership role. The case of Kenya also demonstrates another negative impact of government involvement, that is, vulnerability to corruption and political manipulation (Future Agricultures, 2009). To assist farmers' organizations in this area, there is need to strike the right balance between donor support and mobilization of resources internally (e.g., membership fees, fees for services, and value addition to members) to avoid creating a donor-dependency syndrome and for sustainability.

Even though the market for farming output is large in Africa, farmers' organizations (and their members) continue to be price takers rather than price makers. This characteristic is informed by their inadequate skills to properly account for production costs and marketing activities. Consequently, they are not able to set prices in a manner that reflects such costs. Moreover, issues of access to markets for their products, which emanates from poor marketing strategies and limited information about markets, market requirements, quantities and quality required, and so forth, deepen the problem. For example, in Ghana and Nigeria, farmers lack capacity to determine the prices for their products. As a result, retailers and wholesalers determined the prices, often to the detriment of the farmers (AFRICRES, 2012).

Opportunities for Farmers' Organizations along the Value Chain

Collion & Rondot (1999) put the role of farmers' organizations under three broad categories: (1) advocacy, (2) local development, and (3) economic and technical services. This role should adapt to the changing landscape. This dynamic environment gives farmers' organizations an edge in serving as primary service providers for capacity developments to help smallholder farmers cope with new requirements for competitiveness. For example, farmers' organizations can effectively provide agricultural support systems that increase participation by women and youth. Embracing the youth can help farmers' organizations take advantage of technological advancements and other strategic innovations to help them cope with change.

The changing environment brought about by globalization and the adoption of privatization and market liberalization policies has resulted in low or no direct government involvement in the activities of farmers' organizations. This has given farmers' organizations in Africa the opportunity to evolve into multipurpose organizations that provide a wider array of services to their members to diversify their activities for survival. As a result, farmers' organizations in Kenya successfully combine social and commercial goals to optimize their business goals. In Malawi, the organizations help farmers operate as quasi-businesses (Future Agricultures, 2009). Another opportunity for farmers' organizations in Africa is effective lobbying and networking to promote comprehensive policies and a supportive legal and institutional framework that responds to the activities of their members. Even though AFRICRES (2012) found advocacy and lobbying skills of selected farmers' organizations in Ghana and Nigeria to be weak, Future Agricultures (2009) indicated that farmers' organizations in Ethiopia, Kenya, and Malawi were successful in advocacy and policy engagement.

[20] The major issues affecting women have been discussed in detail under the chapter on gender and agricultural development.
[21] Adopted from recommendations at session from the IFAD Farmers Forum in Rome, February 2012.

Food insecurity in Africa offers farmers' organizations opportunities to help smallholder farmers reap more benefits by working together. These benefits include access to inputs, technology, and extension services at low cost. Farmers' organizations can be successful if they take advantage of such opportunities. Fortunately, there are some examples of best practice that farmers' organizations in Africa have exploited along the value chain. For example, in Ethiopia, Becho Woliso Farmers' Cooperative Union (BWFCU), which offers demand-driven services and focuses on major production side problems such as fertilizers, seeds, markets, and equipment, has gradually scaled-up to value addition and product markets. In addition, BWFCU has diversified its activities to include conservation agriculture and environmental protection initiatives. Another example is Faso Jigi from Mali, which has managed to guarantee loyalty of its members by participatory decision making achieved through effective communication channels and meetings. The organization enjoys strategic leadership that formulates short- to medium-term plans and cements ties with the grass-roots membership. Faso Jigi has also managed to influence modification of rules and conditions governing the collective marketing system, leading to the commercialization of the excess production and the introduction of a price ceiling policy.

The experience of the Commercial Farmers Union in Zimbabwe suggests that farmers' organizations should have a commercial focus for their members to be profitable and sustainable. In Kenya, the Centre for African Bio-Entrepreneurship works with local poultry and soybeans projects involving the youth in Busia, allowing young people to actively participate in farming activities and safeguard intergenerational pollination of knowledge. In addition, farmers' organizations that have young members can easily adopt technology and innovation. Moreover, strategic partnerships and linkages to institutional markets, such as school feeding programs, World Food Programme Purchase for Progress, and national strategic reserves, present opportunities for farmers' organizations to succeed. To unleash their potential and help smallholder farmers succeed, farmers' organizations can still exploit several opportunities along the value chain. One such opportunity is regional trade to open up new markets, and research for improved farmers' organizations access to better inputs and improved technology.

In addition, lobbying and networking through strategic alliances and networks with relevant and mutually beneficial institutions create synergies, and information and knowledge sharing. Increasingly, opportunities for deeper partnerships between farmers' organizations and other players such as government, financial institutions, and the private sector make it easier for farmers' organizations to represent the interests of their members in key policy debates and processes. This way, the collective voice of farmers can be heard and their advocacy can be effective. Networking done at the regional level may help famers tap into opportunities offered by regional trade.

Farmers' organizations can reap significant benefit by helping members shift to a business focus approach that makes their operations viable and move away from subsistence to commercial farming. This, however, is not easy because the organizations themselves are grappling with the basics of survival. One way to encourage a business focus is to assist farmers in registering themselves as official businesses. Farmers' organizations can introduce farmers to sustainable global value chains through contract farming and can also help members realign their production models to take advantage of diversification and the constantly evolving market trends. Farmers' organizations can take advantage of their diverse memberships to spread their services beyond just support services to farmers to cover other related activities. The Ethiopian BWFCU diversified to offer transportation and storage services to its members and opened opportunities for new markets.

To take advantage of opportunities arising from capacity building, farmers' organizations can facilitate training for farmers in areas such as contract design and management; basic record-keeping; food safety and quality measures (standardization); financial literacy; and credit requirements at financial institutions. In addition, farmer exchange visits and farmer mentoring services can achieve cross-pollination of knowledge. Farmers' organizations can help farmers by building technical and industrial capacity to make products more competitive in terms of production and packaging costs. Collective marketing also opens up a number of opportunities for farmers' organizations, which can use their diverse memberships to reduce transaction costs through collective marketing and sharing of storage facilities. This can even help them to collectively bargain for better selling prices. Farmers' organizations can provide farmers with marketing information to link them to value chains. For example, access to information is key for farmers wishing to access markets, and farmers' organizations can serve as information hubs. For example, during the annual FOSCA forum in November 2012, ZNFU shared how its members are benefitting from a short-text-message system that enables them to receive timely market information. Moreover, market requirements, because of changing consumer tastes and emerging demands, put farmers' organizations in a good position to help smallholder farmers supply timely products in the right quantities and quality. This is further supported by Agriterra (2011) who reiterates that when farmers unite in various forms of farmer organizations, such as cooperatives or federations, they have a clear voice to engage policy discussions. Lobbying can address amendments to legislation like tax regime for cooperatives (Agriterra 2011).

Using Knowledge Sharing and Learning Platforms to Enhance Capacity Strengthening of Farmers' Organizations

In practice, farmers' organizations are important levers in agricultural development. They work across the agricultural value chain—in participatory variety selection, input markets for the dissemination of improved seed and fertilizers, extension services and improved on-farm agronomic practices, market linkages to aggregate and improve the quality production, and in policy formation and implementation by providing a supporting voice to farmers.

Various organizations in the agricultural development space have adopted knowledge sharing and learning platforms as good approaches toward improving the capacity of smallholder farmers. For example, since 2005, IFAD has held a biennial farmers' forum in Rome, Italy, as a bottom-up process of consultation and dialogue on rural poverty reduction between smallholder farmers, IFAD, and governments. The 2012 forum, for example, brought together 70 leaders representing millions of smallholder farmers from all over the world to interact with IFAD and selected partners. Some of the issues discussed during the forum included food security in the context of growing competition for access to land; role of farmers' organizations in empowering smallholder farmers in value chains, and differentiated policies and investment programs in support of smallholder agriculture.

The CAADP Africa Forum is part of the CAADP framework and is coordinated by the regional farmers' organizations together with the NEPAD Planning and Coordinating Agency. The CAADP Africa Forum is a platform for people working in agriculture across the continent. It is meant mostly for farmers and farmer representatives, but is also attended by policy makers, manufacturers, traders, retailers, financiers, development workers, and others involved in African agriculture. At the November 2012 CAADP Africa Forum in Tunis, Tunisia, participants came from three levels: (1) continental level (mainly AU or NEPAD representatives), (2) regional level, and (3) country level. Participants from a single country were encouraged to come as part of a country team, under the leadership of the national farmer's organization and the CAADP focal person of the country concerned. The country teams represented the country's best practices to the forum as a whole and used the ideas collected at the forum to upscale best practices back in their own countries, thus acting as a two-way bridge between the CAADP Africa Forum and the agriculture sector stakeholders at field level.

AGRA, through FOSCA in collaboration with SACAU, organized its first annual farmers' organizations forum in 2011 with the theme Linking Farmer Organizations to Markets and Financial Services. The farmers' organizations engaged in open discussions, including discussions about financial, institutional, and market access challenges.

Conclusion

Farmers' organizations continue to be key pillars in the development of smallholder farmers in Africa because they speak and act for the farmers. Hence, it is important that all key actors in the agriculture sector, including governments, development partners, and other stakeholders, support ongoing efforts to strengthen farmers' organizations so they can increasingly and sustainably become key actors in agricultural development. While this support is recognized, it needs to be deepened, leveraged, and enhanced. Actors need to work together to complement each other's effort; reach more numbers; cover more geography; and consolidate the gains by documenting good business models, best practices, and lessons learned for continuous improvement and strengthening of capacity. There are challenges as well as immense opportunities along the agricultural value chains, and good examples of how farmers' organizations have exploited opportunities have been discussed. However, successful or strong farmers' organizations are few, which calls for a more integrated and concerted collaboration to strengthen their capabilities.

References

AFRICRES. (2012). *A profiling of farmer organisations and service providers in Ghana and Nigeria*. Nairobi, FOSCA[22].

Collion, M., & Rondot, P. (1999). Partnerships between agriculture services institutions and producers' organisation: Myth or reality? *ODI Agricultural Research and Extension Network, 80*, 1–13.

Delgado, C., Hopkins, J., & Kelly, V. A. (1998). *Agricultural growth linkages in Sub-Saharan Africa*. Washington, DC: U.S. Agency for International Development.

Future Agricultures. (2009). *Challenges and opportunities for strengthening farmers organisations in Africa: Lessons from Ethiopia, Kenya and Malawi.* Policy Brief No. 031. Brighton, United Kingdom: Future Agricultures Consortium. Available at www.future-agricultures.org.

Kassam A. H, Stoop, W., & Uphoff, N. (2011). Review of SRI modifications in rice crop and water management and research issues for making further improvements in agricultural and water productivity. *Paddy and Water Environment, 9*,163–180.

Meijerink, G., & Roza, P. (2007). *The role of agriculture in economic development*. Markets, Chains and Sustainable Development Strategy and Policy Paper No. 4. Wageningen, The Netherlands: Stichting DLO.

Rich, K. M. (2004). A Discussion Note on Value-Chain Analysis in Agriculture: Methodology, Application, and Opportunities. Ha Noi, Viet Nam, Agrifood Consulting International.

Scoones, I., and J. Thompson. 2011. The politics of seed in Africa's Green Revolution: Alternative narratives and competing pathways. IDS Bulletin 42(4): 1–23.

Zeller, M., & Sharma, M. (1998). *Rural finance and poverty alleviation: Food policy report*. Washington, DC: International Food Policy Research Institute.

[22] Farmer Organization Support Centre in Africa (FOSCA) is a Unit within AGRA, charged with the responsibility of strengthening the capacity of farmer organizations.

CHAPTER 10

CAPACITY DEVELOPMENT IN AGRICULTURE IN AFRICA

By Rufaro Madakadze, and Marie Rarieya, AGRA; Sebastian Chakeredza, ANAFE; and Wellington Ekaya, RUFORUM

Introduction

In Sub-Saharan Africa, increasing the level of farm productivity is a prerequisite for economic growth and development, especially because the priorities are to reduce hunger and increase income among inhabitants of rural areas where food shortages are most pronounced. Important enablers should be in place to ensure performance of the smallholder agriculture sector. These enablers include human capital in the form of professional, managerial, and technical skills and improvements in institutional performance. Capacity is central to guarantee that agriculture performs along the value chain and ultimately has a positive impact on livelihoods. There is a serious human and institutional capacity gap stalling development in agriculture. Sadly, there is also a dearth of documented assessments of the available capacity of agricultural development specialists (numbers and competencies), making it difficult to address the gaps in human and institutional capacity. Information is also lacking on the numbers needed for effective implementation of CAADP activities. The problem of planners in Sub-Saharan Africa planning without facts was noted as early as 1966 (Stopler, 1966) and the situation has not changed much since then.

The term capacity development refers to the process by which individuals, organizations, institutions, and societies develop abilities (individually and collectively) to perform functions, solve problems, and set and achieve objectives (UNDP, 1997). Institutional capacity is defined as the set of attributes related to both structural/systemic attributes and human capital/resources that, collectively, define the organization's ability to perform its mandated functions (http://www.afrimap.org/english/images/documents/AGFVII-Paper7-EnhancingInstitutionalandHumanCapacity.pdf).

This chapter underscores the importance of capacity development for agricultural transformation in Africa and the need to know the levels of human and institutional capacities available to inform policy makers and other key stakeholders and therefore assist in planning. Through improvement in human and institutional capacity, new technologies and innovations can be developed, research relevance increased, and problems related to low agricultural production solved. The result will be greater food security and reduced poverty in Africa.

The Need for Capacity Development

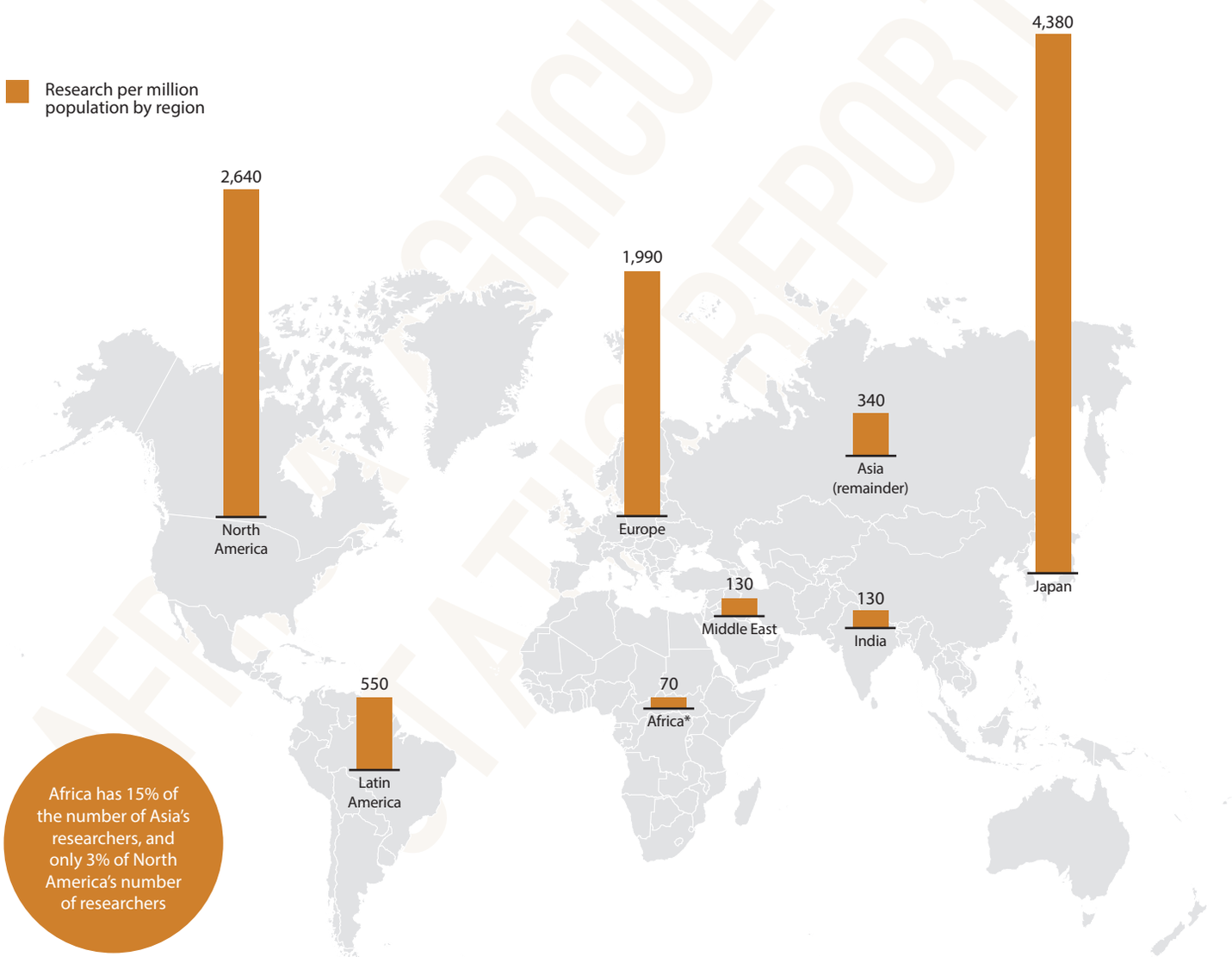
Every major review of agricultural R&D (i.e., World Summit on Sustainable Development (WSSD), Inter Academy Council [IAC], United Nations Economic Commission for Africa (UNECA), and Forum of Agricultural Research in Africa [FARA] has highlighted the urgent need to strengthen Africa's human and institutional capacity for agricultural innovation and the importance of increasing the capacity of African agricultural scientists (IAC, 2004; UNECA, 2005; FARA, 2007). All the CAADP compacts that were prepared for the different countries highlighted the lack of agricultural capacity to implement the processes. The FARA report estimated that 60% of the agricultural professionals employed in the public sector in 2006–2007 would reach retirement age in 5–8 years. The African Union Commission (AUC) and NEPAD echoed the same sentiment by according top priority to capacity development in Africa based on the tenets of the Africa-Wide Capacity Development Strategic Framework and the AUC Strategic Plan: 2009–2012, particularly Pillar 4 on institutional and capacity building (http://www.africa-platform.org/thematic_thrust/capacity-development). Regrettably, the report did not address the issue of wasted capacity. There are thousands of agricultural graduates who are jobless after completing their studies and are doing all sorts of unrelated jobs. There are also extension workers whose capacity is inadequately mobilized because they do not have the right working environment or tools (hard and soft) to fully mobilize their knowledge and skills.

It is not only the numbers that are needed; the quality of scientists has to improve to match the changes in the agricultural landscape. As NEPAD has stated, "The quality of tertiary agricultural education is critical because it determines the expertise and competencies of scientists, professionals, technicians, teachers, and civil servants and business leaders in all aspects of agriculture and related industries. Urgent action must be taken to restore the quality of graduate and postgraduate agricultural education in Africa" (World Bank Report, 2008). In the same report, the World Bank stated that building a human capital base in agriculture is critical for development (World Bank, 2008). The lack of capacity in agricultural sciences in Africa truly hampers development of relevant technologies that could lift smallholder farmers out of poverty. Eicher (2006) reported that most government and university research systems in Africa are producing only a trickle of new technologies farmers can use, mainly because of a lack of well-trained scientists with the infrastructure to develop them. This is still the same situation in most countries in Sub-Saharan Africa.

The Situation

The statistics on researchers in Sub-Saharan Africa are quite grim. Figure 30 illustrates the wide disparity in research capacity among countries and between regions. In terms of personnel engaged in research, Africa has the lowest research capacity and only 70 researchers per million population, compared with North America and Japan with 2,640 and 4,380, respectively. These numbers have possibly changed but not necessarily the proportions.

FIGURE 30. RESEARCHERS PER MILLION POPULATION BY REGION



Source: Parliamentary Office of Science and Technology (2004)

Similarly, a country-by-country analysis of researchers per million inhabitants shows that Finland with 7,992 researchers per million inhabitants stays at one end of the spectrum while Burkina Faso with 17 and Republic of Congo with 30 remain at the other end (Sanyal, 2006). The situation is equally bad in the rest of the continent. Staatz & Dembele (2008) noted that of 48 countries in Sub-Saharan Africa for which data were available, one-half of them had fewer than 100 scientists (full-time equivalents [FTE]) and 40% of the agricultural scientists were working in just 5 countries. The level of development in Africa versus the other continents highlights that the level of development and research are mutually reinforcing and can only increase when there is an increase in human capacity.

In Africa in 2007, only one-fourth of researchers held a PhD compared with nearly two-thirds in India (Regional Universities Forum for Capacity Building in Agriculture [RUFORUM], 2007). A compilation of IFPRI's ASTI data in all of Sub-Saharan Africa shows the share of public-sector researchers with PhDs to have increased from 27% to 29% (Table 19) (IFPRI, 2001, 2008). Although there was an increase in the share of public sector research staff with a PhD, this is only compiled from two points and more data would be needed for validation. The range is, however, very small. The hiring policies of most public-research sectors seem to favor master's-level scientists as the starting point. Table19 shows that most (75%) of the public-sector researchers have a postgraduate degree. The share of female researchers in the public sector is also quite low—less than 20% in Sub-Saharan Africa—but is increasing mainly due to intentional gender policies started in the government sector. This is commensurate with the share of female students in tertiary (higher) education in agriculture. The technicians and other support staff (who assist these public-sector scientists) are also indicating a need to train this level of staff ensuring a significant contribution to agricultural development. Most scientists in Africa need 2–3 technicians per person (J Ininda personal communication).

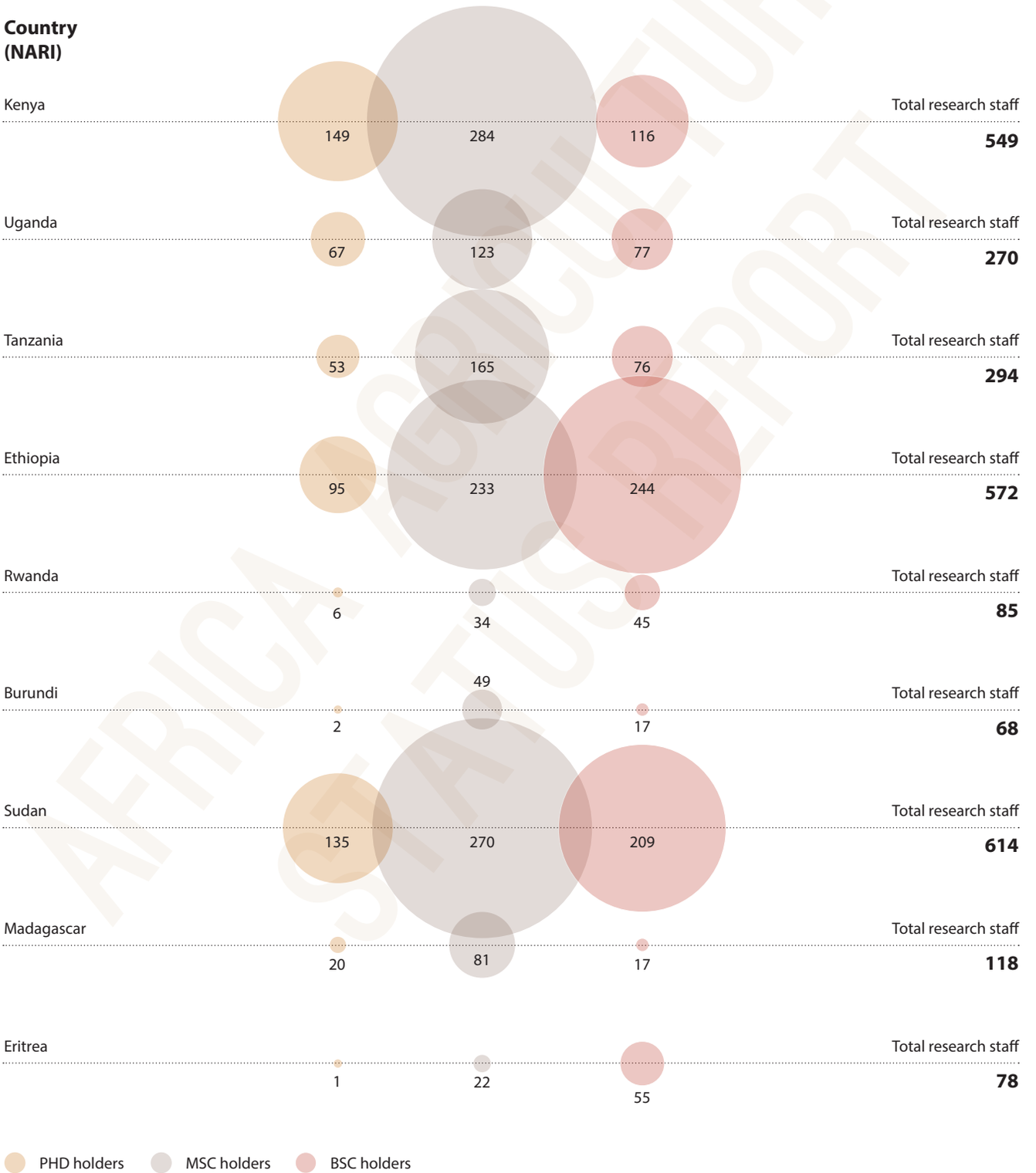
The NARS in Eastern and Southern Africa have been constrained by a low critical mass of qualified personnel and/or scientists needed to effectively carry out priority research and outreach (Methu, Ndikumana, & Waithaka, 2011). In 2011, the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) carried out a survey of the degree qualifications of research staff among the National Agricultural Research Institutes (NARI) in its 11 member countries. The results are given in Table 20.

TABLE 19. AVERAGE AGRICULTURAL PUBLIC RESEARCH CAPACITIES IN AFRICA

Indicator	2001 (%)	2008 (%)
Share of public-sector research staff with PhD qualifications	27.0	29.0
Share of public-sector research staff with both MSc and PhD	75.0	74.5
Share of female public agricultural research staff	12.0	20.0
Technical support staff per researcher (FTE)	1.5	1.1

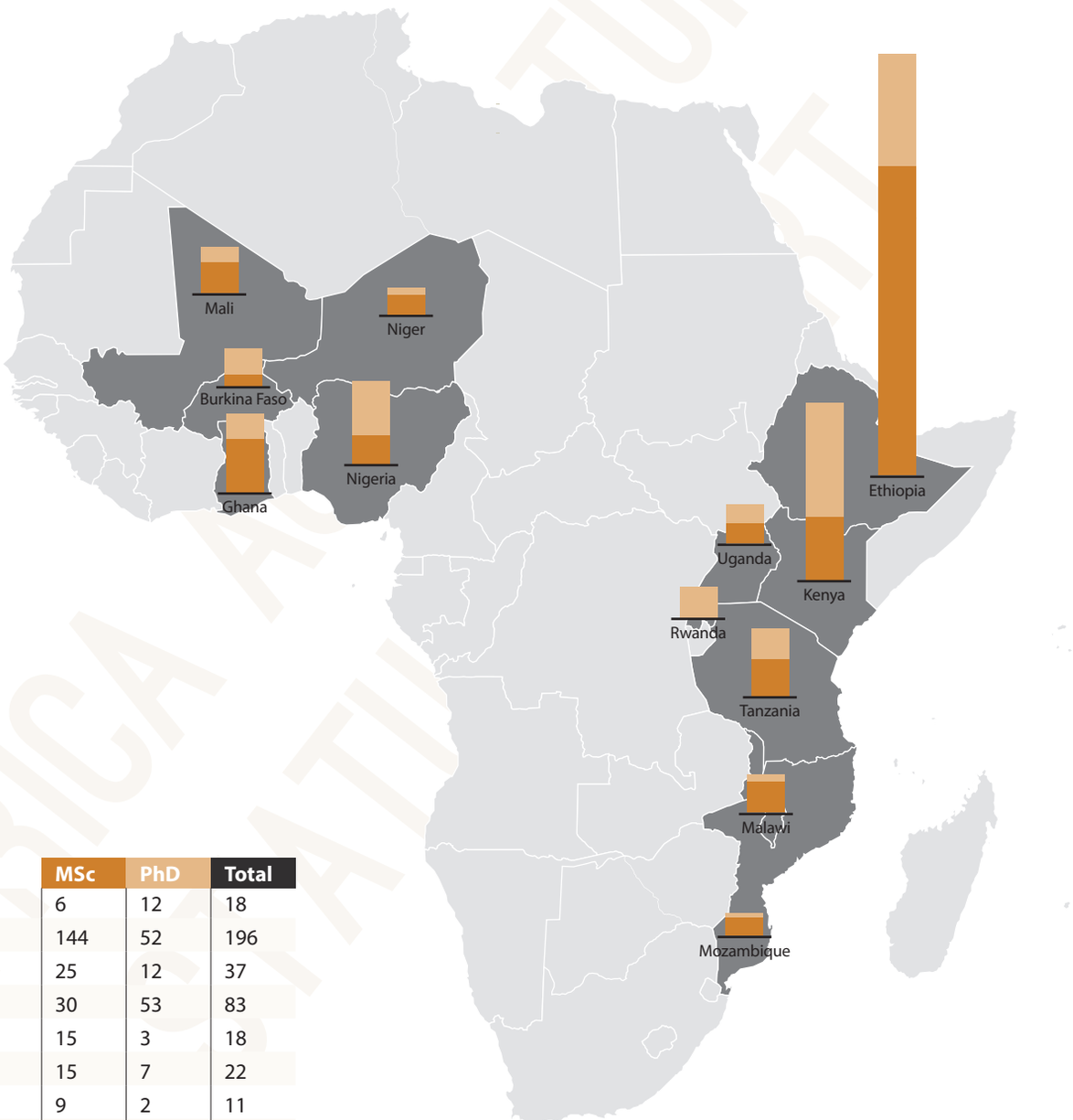
Source: IFPRI (2001, 2008).

TABLE 20. RESEARCH STAFFING IN ASARECA MEMBER NARI IN SEPTEMBER 2010



Source: Methu et al. (2011).

TABLE 21. NUMBER OF PLANT BREEDERS IN THE SELECTED COUNTRIES WORKING ON SEED SYSTEMS IN 2006 BY DEGREE



Country	MSc	PhD	Total
Burkina Faso	6	12	18
Ethiopia	144	52	196
Ghana	25	12	37
Kenya	30	53	83
Malawi	15	3	18
Mali	15	7	22
Mozambique	9	2	11
Niger	10	3	13
Nigeria	14	25	39
Rwanda		15	15
Tanzania	18	14	32
Uganda	10	9	19

Source: Compiled from the Program for Africa's Seed Systems Country case studies (2006) compiled by several consultants.

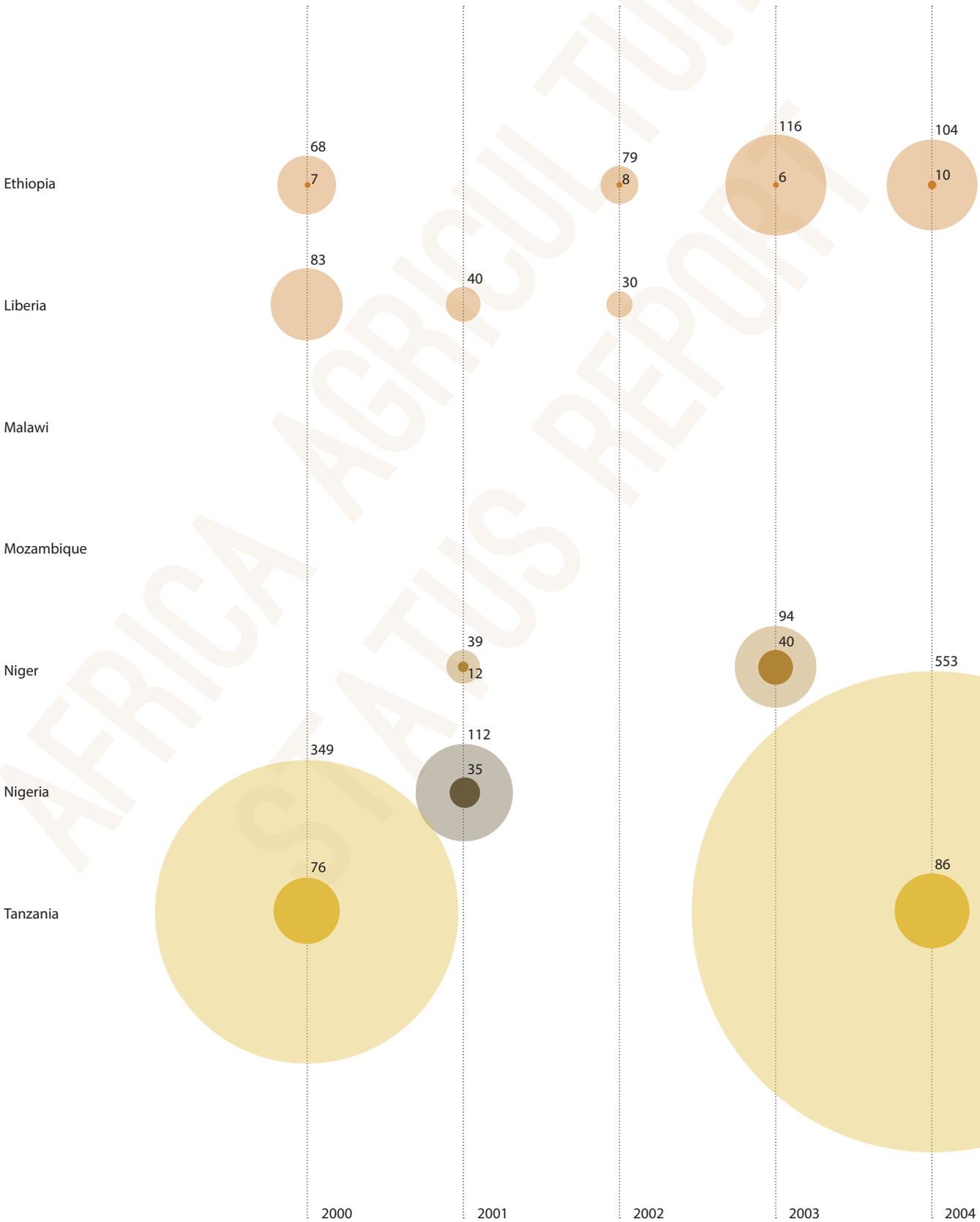
A case study for Mozambique shows that the Institute de Investigacio Agraria de Mocambique (IIAM) has 82 MSc holders, 13 staff in training MSc, 16 PhD holders, and 3 IIAM training PhDs. The levels at which scientists can generate any meaningful technologies begins at MSc level. This means the capacity to generate information in Mozambique is currently quite weak, but the government and its partners are building this capacity through several training programs.

Studies conducted by the International Service for National Agricultural Research estimates the percentage of soil science specialist researchers from 22 Sub-Saharan Africa countries to be between 5% and 10% of about 7,000 NARS researchers (Bekunda, 2006). The number of plant breeders is also quite low (Table 21), with close to 30% of the experienced plant breeders involved in administration and not actively involved in the science (PASS country studies, 2006). These numbers have possibly increased but by no more than 10 scientists per country in most of the countries, although the data have not been collated. These statistics illustrate the need to train more agricultural scientists in Africa. However, the required investment in human and institutional capacity building to ensure a generation of new scientists who can solve Africa's agriculture sector problems is scarcer in most of the countries in Sub-Saharan Africa compared to other regions (Beintema & Stads, 2010).

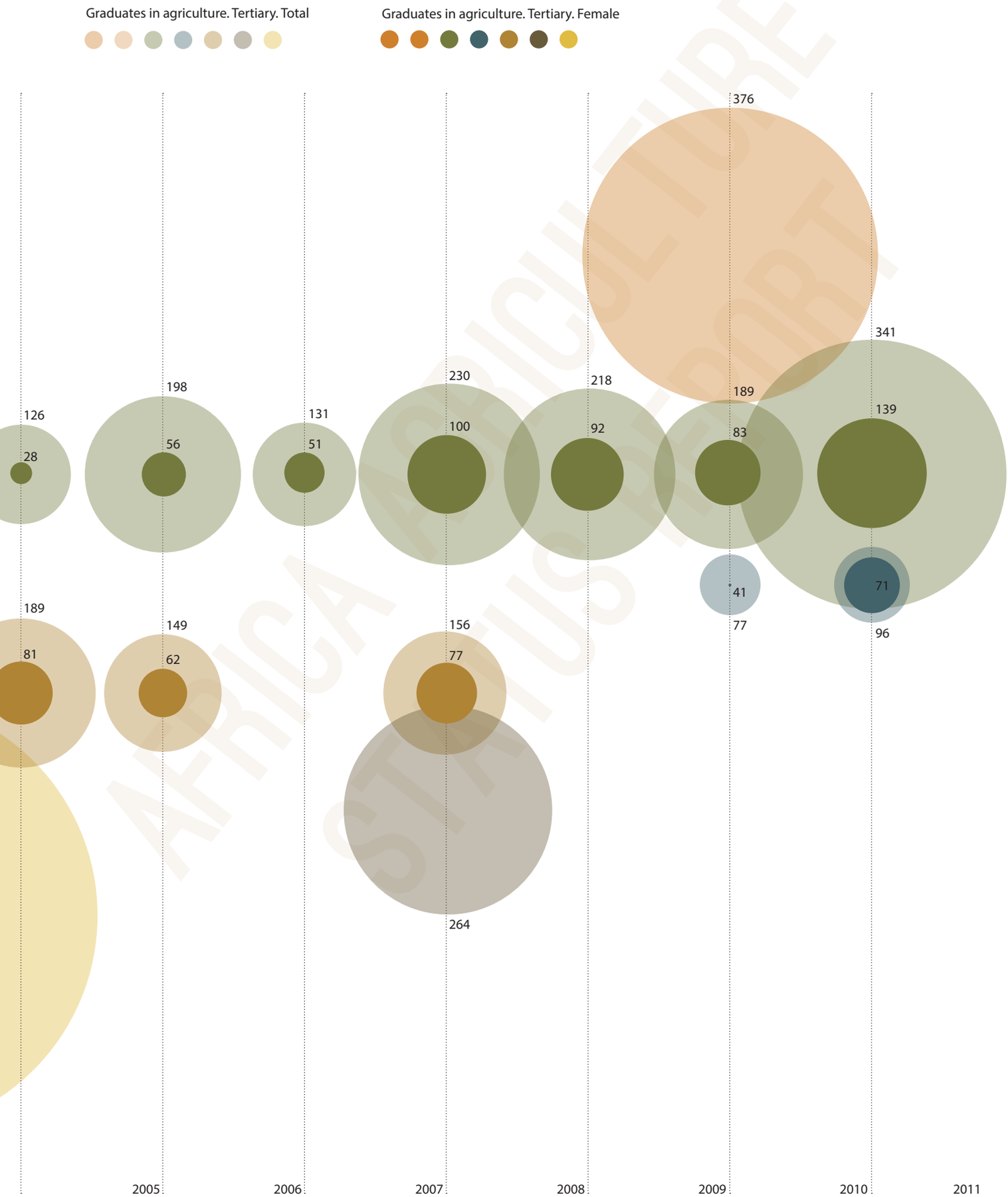
The low numbers of personnel in agricultural research is due to low numbers of agricultural scientists trained compared to other courses in universities. Under- and postgraduate training to provide high-level scientists and researchers is an essential part of human capacity improvement in Africa. Research findings indicate that expanding tertiary education may promote faster technological advancement and improve a country's ability to maximize its economic output (Bloom, Canning, & Clan, 2006). The World Bank's Africa Action Plan clearly points to tertiary education as one of the key drivers of growth to generate the knowledge and skills necessary for sustained growth in Sub-Saharan Africa (World Bank, 2008). All agricultural science disciplines are needed for effective development. Improving public and private agricultural research in Africa requires training institutions that are relevant, precise, and very practical in addressing the needs of the agriculture sector. Compounding the situation is that enrollment rates for tertiary education in Africa are the lowest in the world, with gross enrollment at only 5% compared with 19% of the population for East Asia (Paarlberg, 2009). In addition, the institutions are weak and offer little support for tertiary-level agricultural education, especially at the critical postgraduate degree levels that have the capacity to generate innovation.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has some of the most recent data on education. Data on agriculture graduates for selected countries in Africa are presented in Tables 22 and 23. Although there are some gaps in the data, there are trends of significant increases in total graduates and female student share.

TABLE 22. TOTAL GRADUATES IN AGRICULTURE IN SELECTED COUNTRIES IN AFRICA
TABLE 23. TOTAL FEMALE AGRICULTURE GRADUATES IN SELECTED AFRICAN COUNTRIES



Source: http://www.uis.unesco.org/Education/Pages/international-student-flow-viz.aspx



Currently, Sub-Saharan Africa has more than 100 universities teaching agriculture and natural resource sciences. However, the visibility of these universities and their programs is marred by the fact that their impact on agricultural development is unclear. The institutions also face critical problems, such as staffing. The institutions' capacity to deliver training and research and provide infrastructure for these activities has not been documented.

Enrollment Trends in Agriculture at Undergraduate Level

Data on tertiary-level enrollment in Sub-Saharan Africa are scattered. Kruijssen (2009) reviewed data from the UNESCO statistical database and compiled agricultural enrollment data from 21 Sub-Saharan African countries (Table 24). The results show that the changes in student enrollment in tertiary education as a whole differ greatly across countries, ranging from no change in Namibia to a 51% change in Guinea with a general increasing trend. Enrollment in the broad field of agriculture shows negative trends in the Republic of the Congo (18%) to sharp increases of up to 315% in Sierra Leone. The share of enrollment in agriculture over total enrolment ranges from less than 1% to 15%, with an average of 5%. In most countries, the share of enrollment in agriculture over total enrollment has been declining.

Vandenbosch (2006), in a review of enrollment in eight African countries, found that enrollment in agriculture lagged behind other options. Gyimah-Brempong & Ondiege (2011) carried out detailed tertiary-level enrollment studies for Botswana, Ethiopia, Kenya, South Africa, and Tunisia and found a similar trend in overall tertiary students' enrollment in agriculture.

Postgraduate Enrollment in Agriculture

The data for postgraduate enrollment in agriculture are even scarcer than for undergraduate enrollment. There is very little documented evidence of postgraduate students' enrollment in Sub-Saharan Africa, especially data broken down to agriculture. The Southern Africa's Regional University Association (SARUA) regional overview revealed that only 1% of the total student population was enrolled in doctoral programs. If the South African contribution is removed from the equation, the percentage of doctoral candidates enrolled at the SADC region's remaining 43 public universities drops to 0.2% of the total student population. These numbers are for all students enrolled, and the agriculture students likely make up a very small proportion (SARUA study 2009).

The International Association of Universities (IAU) Sub-Saharan Africa study focused on six universities, one each in Cameroon, Nigeria, Benin, Senegal, Kenya, and Rwanda. Unlike in the SADC region, where growth (particularly in South Africa) has been steady but small (just over 6%), these universities have experienced what the study report called a phenomenal growth rate in doctoral student enrollments since 2005. The period began with 373 enrollments across all six universities and ended (in 2009) with 1,454, an increase of 390%. The study attributed most of this growth to dramatic increases in female enrollment for doctoral degrees in education, the social sciences, and the humanities. The six universities are Kenyatta University in Kenya; National University of Rwanda; University of Douala in Cameroon; University Gaston Berger in Senegal; University of Ilorin in Nigeria; and Université des Sciences et Technologie du Benin (IAU Sub-Saharan Study, 2010). Unfortunately, these numbers do not disaggregate agriculture graduate students, which most likely constitute a minute proportion. According to university personnel at the respective schools, the total number of postgraduate students enrolled in agriculture at four universities in 2013 are as follows: Makerere University, 460; Lilongwe University of Agriculture and Natural Resources (formerly Bunda College of Agriculture), 65; Kwame Nkrumah University of Science and Technology, 77; and University of Ibadan, 2,500.

Quality of Training Versus Industry and Employer Needs

The African Network for Agriculture, Agroforestry and Natural Resources Education (ANAFE), with support from SADC from 2009 to 2011, carried out tracer studies and employer perception on the performance of graduating students to identify key skills gaps in graduates from agricultural programs. The study interviewed Government employees, private sector, NGOs and farmer organizations. The categories interviewed were researchers, producers, processors and financiers, among others, with PhD, MSc, and Diploma qualifications. Employers noted that graduates had poor communication skills and limited managerial capacities at BSc level. Graduates at all levels showed limited practical hands-on skills, limited financial management skills, and poor proposal and report writing skills. Summary results from the tracer studies are shown in Table 25.

TABLE 24: TERTIARY ENROLMENT STATISTICS, 1999–2007 IN 21 SELECTED SUB-SAHARAN AFRICAN COUNTRIES

	TOTAL ENROLMENT IN TERTIARY EDUCATION			TOTAL ENROLMENT IN BROAD FIELD OF AGRICULTURE, TERTIARY LEVEL			SHARE OF AGRICULTURE IN TOTAL ENROLMENT**	
Country	**Latest Number**	**Annual Growth (%)**	**Years***	**Latest Number**	**Annual Growth (%)**	**Years***	**Latest Share %**	**Annual Growth (%)**
Burkina Faso	33,459	30	1999–2007	321	..	2007	1	..
Ethiopia	210,456	38	1999–2007	17884	33	1999–2007	8.5	-0.1
Ghana	140,017	22	2000–2007	3019	8	2000–2004	4.3	0
Kenya	102,798	4	2000–2004	6969	5	2000–2001	7.4	-0.1
Malawi	6,458	13	1999–2007	490	..	1999	15.4	..
Sierra Leone	9,041	17	2000–2002	1360	315	2000–2001	15.3	10.4
Tanzania	51,080	28	1999–2005	2417	15	1999–2005	4.7	-0.3
Uganda	88,360	24	1999–2004	1403	11	1999–2004	1.6	-0.1

(..) = Not available.
* Earliest and last year for which data are available.
** Years are the same as for agricultural enrollment.
*** Based on years 2001–2003.
Source: http://stats.uis.unesco.org and modified from Kruijssen (2009)

TABLE 25. SUMMARY OF SKILLS, STRENGTHS, AND WEAKNESSES AMONG GRADUATES ACROSS BOTSWANA, LESOTHO, AND ZAMBIA

Skills Required by Employers	Professional and technical knowledge, practical skills, managerial skills, analytical skills
Strengths of Graduating Students	Adequate theory, eagerness to learn new things, good coordination of activities, good writing skills
Weaknesses of Graduating Students	Lack of practical hands-on skills, limited financial management skills, poor communication skills, lack of specialization, limited analytical skills, limited market knowledge, limited farm management skills, limited leadership skills

Source: ANAFE (2011).

These results imply that there are serious gaps in the training programs and show a serious disconnect between the content of tertiary agricultural education and the needs of the industry. The issues revolved around the need to improve linkages with stakeholders, carrying out regular curricula review, striking an appropriate balance between theory and practice, incorporating experiential learning, and improving the entrepreneurship components of the training programs.

Capacity Development, Current Activities, and the Foreseeable Future

Despite the shortcomings, Africa nevertheless seems to have turned the corner and is poised to improve human and institutional capacity development. Several recent events and initiatives are largely responsible for this turnaround. This recognition is embedded in NEPAD CAADP adopted in 2002. Pillar 4 aims to overcome the constraints to sustainable use of Africa's natural resources through improved technologies, enabling policies, better access to markets, and enhanced human and institutional capacities. Several institutions in Africa are now tackling the capacity building of agricultural researchers.

Within Africa

Several initiatives now are being undertaken by NGOs, CGIAR, and development partners to build human capacity in agricultural sciences. Institutions with some capacity building activities include AFnet, AFORNET, AICAD, ARPPIS, CMAAE, and EAPGRTC. Another institution, BioEARN, has since changed its name and no longer engages in capacity building. The data on what is being done at these institutions needs to be documented through an integrated study of all agricultural capacity building initiatives on the continent. Examples of activities at three institutions are presented in the following sections: AGRA, RUFORUM and ANAFE.

TEXT BOX F: COMPONENTS OF CAPACITY DEVELOPMENT

1. Postgraduate student training at tertiary level to boost teaching, research, analysis, and innovation
2. Vocational training for midlevel professionals in the agriculture sector (includes technicians, seed sector business personnel)
3. Institutional support to expand and upgrade existing universities and research centers (including grants for professional development, collaborative research, facility improvement, and laboratory upgrade)
4. Measures to support and enhance research networks so that knowledge generation and dissemination are responsive to stakeholders' needs and concerns, particularly to policy, agribusiness, and farmers' organizations

Alliance for a Green Revolution in Africa

In recognition of the capacity gap along the agricultural value chain, AGRA's capacity development initiatives revolve around four core components (see Text Box F).

Guided by the vision of a food-secure and prosperous Africa achieved through rapid, sustainable agricultural growth based on smallholder farmers, AGRA developed a dynamic strategy designed to address multiple challenges facing the agriculture sector—declining soil fertility, a lack of good-quality seed of improved crop varieties, poor institutional arrangements such as markets, non-conducive policies, and a lack of a critical mass of well-trained professionals constitute the main factors.

AGRA's efforts to date in capacity building are showing transformative ability in the agriculture sector. AGRA funds and gives oversight to 5 regional PhD programs and more than 20 MSc programs in 15 universities across Sub-Saharan Africa. The students who have graduated have released 66 improved varieties of beans, cowpeas, maize, sorghum, cassava, and groundnuts and are working with farmers and private seed companies to ensure adoption and commercialization of the seeds. They have also generated, with their professors, more than 100 publications in regional and international refereed journals. The soil health program supports the training of a new generation of young professionals to take the lead in ISFM approaches by translating available empirical knowledge into increased crop yields and income benefits for smallholder farmers and has already started making an impact. The policy program in AGRA has been training applied agricultural economists at MSc and PhD levels that can work in Ministries of Agriculture of various countries and provide input into the policy development process to ensure capacity in this area.

AGRA gives grants to institutions that support full scholarships for students, including research, part of staff costs as needed, and institutional and infrastructure costs. The total number of students supported in both MSc and PhD programs total 913. The students are admitted from the selected 16 countries and the students conduct their research with Africa's staple crops.

Regional Universities Forum for Capacity Building in Agriculture

RUFORUM is a consortium of 30 universities in Eastern, Central, and Southern Africa. It was started in 2005, building from the FORUM program of the Rockefeller Foundation that operated from 1994 to 2004. RUFORUM's core mission is to improve the quality of higher agricultural education and research. RUFORUM has seven strategic goals, two of which sharply focus on postgraduate training: (1) to train a critical mass of MSc and PhD graduates who are responsive to stakeholder needs and development goals, and (2) to develop collaborative research and training facilities that achieve economies of scope and scale. To this end, RUFORUM serves its member universities by helping them contribute to the productivity of smallholder farmers through strengthening human resource capacity (quality and quantity) and subsequently, agricultural research for development. RUFORUM has two key activities for capacity building:

- Regional postgraduate programs. RUFORUM supports six regional PhD programs and three regional MSc programs together with several partners.
- Competitive grants for rural innovation. Grants are given to senior academics to conduct research that also supports postgraduate student training.

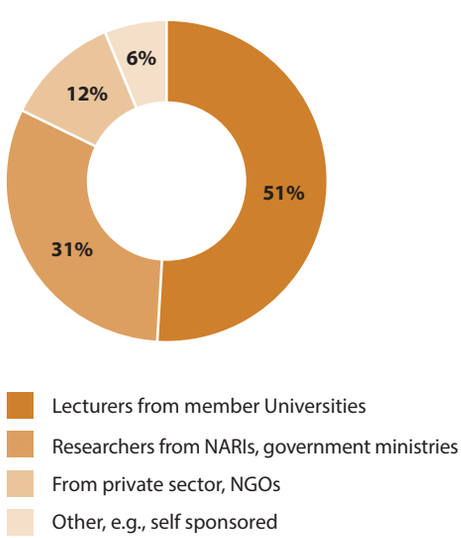
The number of students in and/or under RUFORUM programs are shown in Table 26. The RUFORUM doctoral students come from different sectors of agriculture, with the bulk of them being lecturers from academic institutions (Figure 31).

TABLE 26. POSTGRADUATE STUDENTS SUPPORTED BY RUFORUM

CATEGORY	NUMBER*
Regional MSc Students (2008–2012)	207
MSc Students (Other) 2004–2012	409
Nurturing Grants 2008–2011 (PhD and MSc)	26
Regional PhD Students (2008–2012)	106
PhD Students (Other) 2008–2012	3
Total	**751**

*Numbers may have changed by the time this chapter was published.

FIGURE 31. PERCENTAGE OF PHD STUDENTS BY CATEGORY



Source: RUFORUM Secretariat database.

African Network for Agriculture, Agroforestry and Natural Resources Education

ANAFE comprises African colleges and universities teaching agriculture and natural resource sciences and is supported by the World Agroforestry Centre in Nairobi, Kenya. The network was established in 1993 and is currently made up of 134 member institutions (universities and colleges) in 35 African countries. ANAFE's vision is to be a vibrant network leading in agricultural and natural resources education for development and to improve the quality, relevance, and application of agricultural and natural resource management education for development. ANAFE is involved in a number of activities, including the following:

- Refocusing agricultural learning objectives, including curricula review and development
- Building capacity for the development of contextualized learning materials
- Building capacity for innovation systems
- Improving agribusiness programs and, in particular, enhancing the interest of women and youths in taking up agricultural careers
- Building capacity to tackle management of risk and uncertainty
- Improving pedagogic skills with experiential learning being key to curricula delivery

Other institutions are also working on various activities and initiatives to build capacity for agriculture and natural resource management. These include the creation of interest in or commitment to agriculture and development; capacity building and skills development; direct career development; improvement of the educational system; strengthening of research and stimulation of innovation.

Outside of Africa

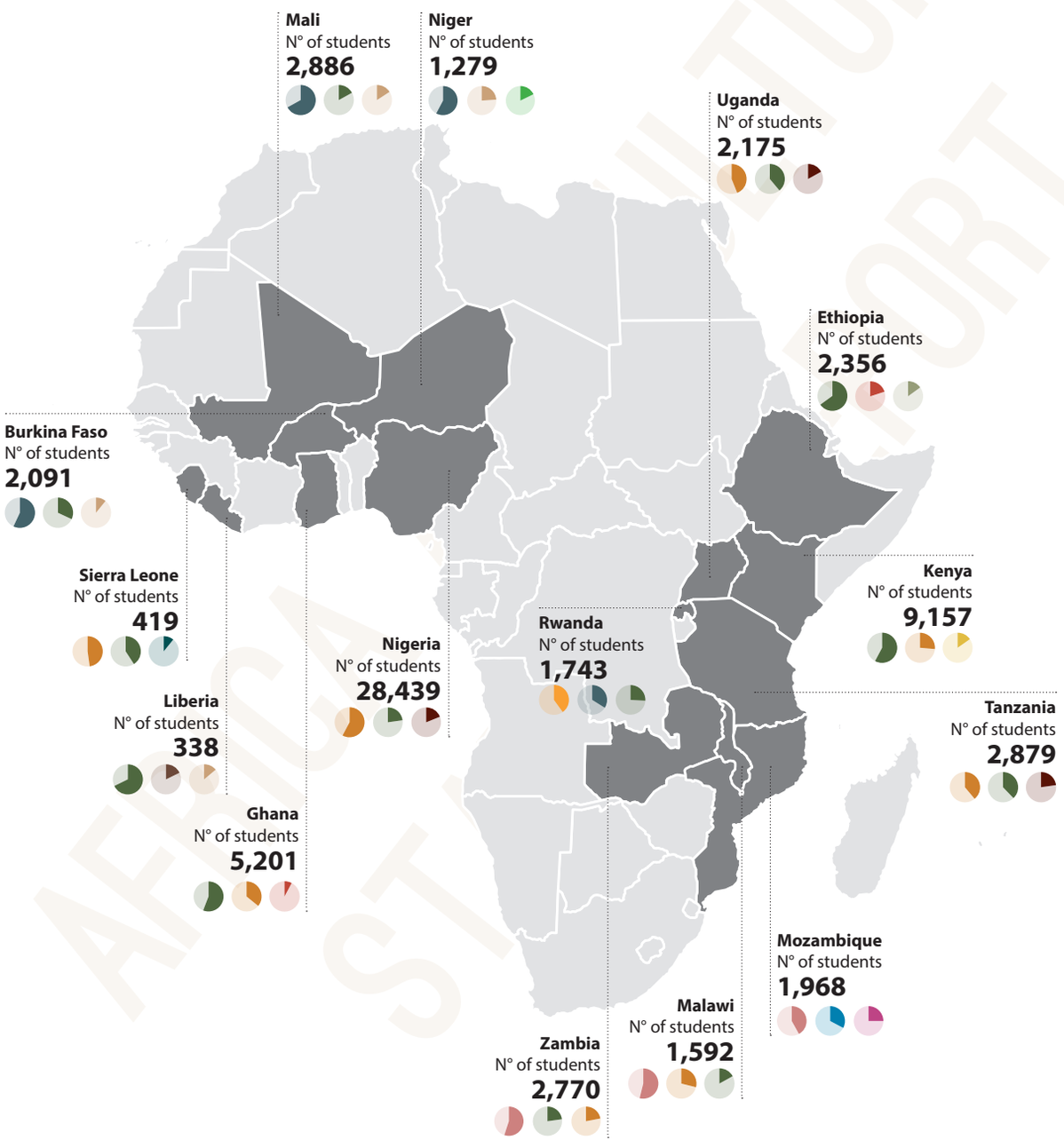
There are a myriad of organizations with programs funding African students to study in agricultural disciplines outside of Africa. These include USAID, AusAID, SIDA, CIDA, DAAD, Carnegie Foundation, and Commonwealth Scholarships, as well as countries including Japan and China. Data exist on where students go to study (Table 27), but there is no disaggregation by discipline.

Conclusions and Recommendations

This chapter highlights the dearth of documented data on human and institutional agricultural capacity available to address the problems of farmers, the agribusiness sector, and other stakeholders in the agricultural value chain. The lack of such data and the actual demand of such capacity make it difficult to justify government spending on building this capacity. For sustained productivity growth in African agriculture, the African science system needs to get more and easier access to international basic science and build the related costly science landscape to overcome science dependencies in agriculture.

The key recommendation is that studies need to be conducted to document agricultural human capacity demand versus supply, and identify the critical gaps that need to be filled. There is also a critical need to coordinate the many efforts on agriculture capacity building on the continent to avoid duplications while glaring gaps need to be filled. Other pertinent research could be done on the quality of training versus demand, as well as documenting how much capacity is wasted and where it could be used.

TABLE 9: TERTIARY LEVEL — DESTINATIONS FOR STUDENTS FROM SELECTED COUNTRIES IN AFRICA



Destinations

- United States
- United Kingdom
- Finland
- Australia
- Germany
- Norway
- Morocco
- South Africa
- France
- Angola
- Portugal
- Togo
- Malaysia
- Burundi
- Saudi Arabia

Source: http://www.uis.unesco.org/Education/Pages/international-student-flow-viz.aspx.

References

African Network for Agriculture, Agroforestry and Natural Resources Education. (2011). *Synthesis report on tracer study on effectiveness of agricultural training programmes in Botswana, Lesotho, and Zambia: Strengthening capacity for agricultural research and development in Africa (SCARDA)* (Report to SADC.) Nairobi, Kenya: Author. Department of International Development (DFID).

ANAFE. See African Network for Agriculture, Agroforestry and Natural Resources Education.

Beintema, N. M., & Stads, G-J. (2010). *Public agricultural R&D investments and capacities in developing countries: Recent evidence for 2000 and beyond.* Background note prepared for the Global Conference on Agricultural Research for Development (GCARD), Montpellier, France.

Bekunda, M. (2006). Managing Africa's agricultural soils: The future of soil science. In A. E. Hartemink (Ed.). *The Future of Soil Science* (pp. 14–15). Wageningen, The Netherlands: International Union of Soil Sciences.

Bloom D, Canning and Chan (2006) Harvard University, Human Development Sector, African Region.

UNECA. (2005, March). *Our common interest: report for the Commission for Africa.* Retrieved March 4, 2013, from http://reliefweb.int/sites/reliefweb.int/files/resources/Full_Report_1461.pdf.

Eicher, C. K. (2006). *The evolution of agricultural education and training: Global insights of relevance for Africa*. Washington, DC: World Bank.

FARA. (2007). *Africa's capacity to build human and institutional capacity for the agricultural industry.* Accra, Ghana: Author.

Gyimah-Brempong, K., & Ondiege, P. (2011). The Africa Competitiveness Report 2011, part 2: Capitalizing on Africa's resources—Reforming higher education: Access, equity and financing in Botswana, Ethiopia, Kenya, South Africa and Tunisia. Geneva, Switzerland, Washington, DC, & Tunis, Tunisia: World Economic Forum, World Bank, & African Development Bank.

IAC. See InterAcademy Council.

InterAcademy Council. (2004). *Realizing the promise and potential of African agriculture*. Amsterdam, The Netherlands: Author.

Kruijssen, F. (2009). *Youth engagement in agricultural research and development with a focus on Sub-Saharan Africa*. Wageningen, The Netherlands: Wageningen International.

Methu, J., Ndikumana, J., & Waithaka, M. (2011). *Improving the participation of weaker NARS in ASARECA activities.* Entebbe, Uganda: Association for Strengthening Agricultural Research in Eastern and Central Africa.

Paarlberg, R. (2009). Renewing American leadership in the fight against global hunger and poverty. Chicago, IL: The Chicago Council on Global Agricultural Development.

Parliamentary Office of Science and Technology. (2004, March). *Scientific capacity in developing countries*. London, United Kingdom: Author. Retrieved from http://www.parliament.uk/briefing-papers/POST-PN-216.pdf

Regional Universities Forum for Capacity Building in Agriculture. (2010). *Proceedings of the Ministerial Conference on Higher Education in Agriculture in Africa* (CHEA). Retrieved February 25, 2013, from http://www.ruforum.org/content/proceedings-ministerial-conference-higher-education-agriculture-afric.

Regional Universities Forum for Capacity Building in Agriculture. (2007, March). RUFORUM 2: *Program and extended abstracts* (p. 366). First Biennial Meeting of the Regional Universities Forum for Capacity Building in Agriculture, Mangochi, Malawi.

Sanyal, B. C.and and Varghese, N.V. (2006). *Research capacity of the higher education sector in developing countries.* Paris, France: *UNESCO: United Nations Educational, Scientific and Cultural Organisation*.

Staatz J. M. and N N Dembele (1008) Agriculture for Deevelopment in Sub-Saharan Africa. Background Paper for the World Development Report 2008.

Stolper W (1966). Planning without facts. Cambridge, Harvard University Press

SARUA Handbook (2009) A guide to public universities of Southern Africa

UNESCO. (1997). Capacity development. Technical Advisory Paper 2 . New York, NY: Author.

Vandenbosch, T. (2006). *Post-primary agricultural education and training in Sub-Saharan Africa: Adapting supply to changing demand.* Nairobi, Kenya: World Agroforestry Centre.

World Bank. (2008). *Cultivating knowledge and skills to grow African agriculture*. Washington, DC: Author.

"Education is the most powerful weapon which you can use to change the world."

Nelson Mandela
1993 Nobel Peace Prize Laureate

CHAPTER 11

THE ROLE OF WOMEN IN AFRICA'S SMALLHOLDER AGRICULTURE: STATUS, TRENDS, AND OPPORTUNITIES

By Margaret Kroma, AGRA

Introduction

Smallholder agriculture has enormous potential to make significant contributions to economic development and poverty reduction in Sub-Saharan Africa. It is the largest single source of economic livelihoods, employing up to 80% of the rural population as estimated in recent World Bank and FAO assessments (World Bank, 2012). Yet its potential has remained unrealized, largely because rural women who constitute the majority players in smallholder food production remain unrecognized and unsupported by agricultural policy and development interventions. This chapter discusses the contributions rural women make to Africa's smallholder agriculture; and explores the status of women and the gaps limiting their overall performance, which results in suboptimal contribution to rural and national economic development, despite their dominance in food production. This section articulates the urgent need for shifts in policy and practice to stimulate a gender-responsive agricultural transformation in Africa's rural economy.

Women's Contribution to Africa's Smallholder Agriculture

Women in Sub-Saharan Africa have the highest average labor-force participation rates in the world (at 65%), with rates ranging from about 20% in Latin America to almost 50% in the southern and eastern Asia subregions (World Bank, 2012). By all empirical accounts, women do the majority of the labor on Africa's small farms yet their productivity is lower than that of male farmers as illustrated in Table 28.

Aggregate data reported in the 2010–2011 State of Food and Agriculture study (FAO, 2010–2011) indicates that women make up almost 50% of the agricultural labor force in Sub-Saharan Africa. While there are considerable variations across sub-regions and between countries related to ethnicity, age, and clan—these averages have remained stable for more than two decades.

Wide-ranging empirical assessments of household labor and time allocation have also shown that women share the primary responsibility for household food provisioning, child care, and domestic chores. In general, they provide up to 80% of basic food stuff for household consumption and sale, although estimates vary. In Ghana, for example, estimates indicate that women produce 70% of the food crops, while in East Africa as a whole they make up about 51% of the agricultural labor force. In Burkina Faso, Nigeria, and Zambia it is more than 50% and in some parts of Cameroon, more than 70% (FAO, 2010–2011).

Women make more direct and critical contributions to agriculture through labor provision—in planting, weeding, postharvest processing, and marketing—although assessments indicate they cluster at the bottom end of value chains (Rubin & Manfre, 2010). Rural women (and girls) also are often responsible for transporting fuel and water supplies for domestic use and for all domestic tasks—a laborious and time-consuming task that plays an invaluable, though unacknowledged, role in the rural domestic economy. It is estimated, for example, that women

TABLE 28. FEMALE SHARE OF ECONOMICALLY ACTIVE POPULATION AND AGRICULTURAL SHARE OF ECONOMICALLY ACTIVE WOMEN IN 1980, 1995, AND 2010

	TOTAL (THOUSANDS)			FEMALE SHARE (% OF TOTAL)			AGRICULTURE SHARE OF ECONOMICALLY ACTIVE WOMEN (% OF TOTAL)		
	1980	1995	2010	1980	1995	2010	1980	1995	2010
Sub-Saharan Africa	147,699	227,175	346,919	41.8	42.4	43.8	79.1	72.7	65.0
Southeast Asia	147,907	221,405	299,123	63.2	56.0	46.8	41.9	42.7	42.5
Latin America and Caribbean	125,954	196,319	280,321	33.6	22.0	14.8	18.6	18.1	20.9

Source: FAO Statistical Annex (2010–2011).

and girls in Ghana, Tanzania, and Zambia are responsible for about 65% of all transport activities in rural households, such as collecting firewood and water and carrying grain to the grinding mill (Malmberg Calvo, 1994).

Because many of these activities are not considered in national accounts as formal economic employment, women's contributions to the household and rural economy go unreported and unaccounted for. Consequently, advances in food production are severely constrained by this invisibility factor.

Table 29 shows the gender characteristics of agriculture for two primarily agrarian countries compared to South Africa, a largely urbanized country in which agriculture contributes a very small share of GDP (FAO, IFAD, & ILO, 2010). The statistic shows that agriculture is female-intensive in both Mozambique (60% of the agricultural labor force is female) and Tanzania (54%). The data for Mozambique and Tanzania confirm African regional patterns in that agriculture in these countries is the main source of employment for both women and men. The productivity of agriculture is especially low in Mozambique where agriculture contributes only 23% of GDP but provides employment to 78% of the labor force.

Although roles may differ by region, taking account of the heterogeneity of women's contributions has significant implications for the effectiveness of national agricultural policies. Of even more serious import are the severe structural obstacles women face in agriculture that have been substantively established to have direct impact on labor productivity, yield gaps, household food availability, and incomes.

TABLE 29. GENDER STRUCTURE OF AGRICULTURE IN SELECTED SUB-SAHARAN AFRICA COUNTRIES 2003–2005 (IN PERCENTAGES)

	TANZANIA	MOZAMBIQUE	SOUTH AFRICA
Agriculture as share of GDP (%)	45.8	23.1	3.1
Employment in agriculture as share of total employment (%)	75.1	78.0	11.3
Female intensity of agriculture (%)	53.6	59.5	34.2
Female employment in agriculture as share of total female employment (%)	80.0	90.9	6.0
Male employment in agriculture as share of total male employment (%)	72.7	64.3	8.6
Rural population as share of total population (%)	76.2	66.3	41.2
Share of the rural population that is poor (%)	38.7	71.3	--

Sources: World Bank (2007a); ILO (http://laborsta.ilo.org; Tables 2B and 2E); Tanzania National Bureau of Statistics (2006) Integrated Labor Force Survey; South Africa Department of Labor (2006), Women in the South African Labor Market 1995–2005, Republic of South Africa.

Note: The female intensity of agriculture is calculated as the share of female agricultural employment in total agricultural employment. A share greater than 50% would suggest that the sector is female intensive.

Gender Barriers and Gaps Limiting Women's Productivity and Effective Participation in Food Crop Value Chains

Despite being major food producers and a key source of agricultural labor, women smallholders in Sub-Saharan Africa experience great difficulties accessing opportunities to raise their productivity and incomes. This is due in large measure to gender norms and underlying cultural factors that emphasize female subordination and male dominance over access to and control over productive resources. The constraints resulting from the unequal gender relations run the gamut from access to land, credit, agricultural technologies, and output markets.

Access to Land

Women are disadvantaged in both statutory and customary land tenure systems in Africa (Peterman. Quisumbing, Behrman, & Nkonya, 2010). Empirical evidence indicates that women are five times less likely than men to own land (Bill and Melinda Gates Foundation, 2012). When women own land, it often tends to be small, of inferior quality, and typically with less secure tenure (FAO, WFP, & IFAD, 2012). In Kenya, women account for 5% of registered landholders nationally. And in Ghana, the mean value of men's land holdings is three times that of women's land holdings (Mead & Liedholm, 1998). Text Box G presents a summary of indicative statistics on women's land access in Africa.

Similar assessments of the female smallholder experience with respect to land use and productivity have shown that such households are more vulnerable, lacking a whole range of productive assets critical for production (Chimhowu & Woodhouse, 2006). Lack of secure tenure affects long-term investment and thereby productivity and sustainability. Land tenure and property arrangements often dictate who within a household has access to economic assets. Land tenure is also an essential leverage point for accessing services, such as financial services.

Access to Agricultural Technologies

African women smallholders have relatively less access than men to input technologies, including improved seeds and fertilizers, with consistently similar patterns of disparities among a number of countries. In Ghana, for example, only 39% of female farmers adopted improved crop varieties (compared with 59% of male farmers) (Doss & Morris, 2001). In Malawi, a study on gender and intra-household fertilizer use in the input subsidy program found the incidence of application of fertilizers to the disadvantage of female-controlled plots when households have access to fertilizers, regardless of source of fertilizers (Chirwa, Mvulaa, Dorward, & Matitac, 2013).

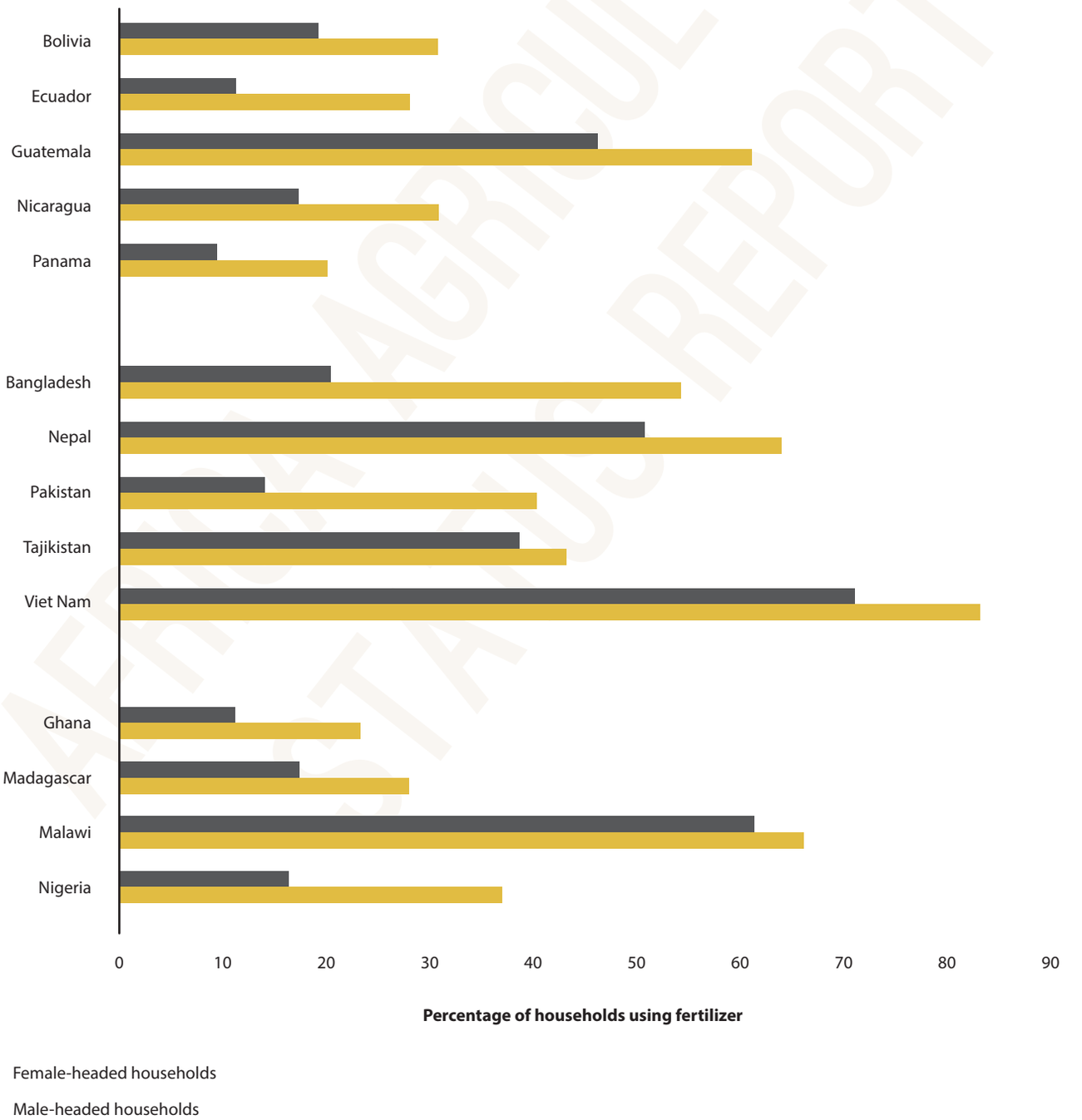
TEXT BOX G: WOMEN'S ACCESS TO AGRICULTURAL LAND IN SUB-SAHARAN AFRICA: INDICATIVE STATISTICS

- In Sub-Saharan Africa, women's land ownership rates lag behind those of men with an estimated average of 15%.
- Aggregate data mask wide intercountry variations: 3% in Zimbabwe, 11% in Benin, 5% in Mali, and 25% in the Democratic Republic of the Congo.
- Women's landholdings are also smaller than men's. For example, the average size of women's landholdings in Zimbabwe is 1.86 ha (compared with 2.73 ha) and 0.98 ha in Benin (compared with 1.76 ha for men).

Excerpted from
Barrett, K., C. Manfre, & D. Rubin (2009). *Promoting gender equitable opportunities: Why it matters for agricultural value chains.* GATE. Document produced for review by USAID. Washington, DC. and FAO (2011). *State of food and agriculture: Women in agriculture—Closing the gender gap in agricultural development.* Rome, Italy: Author.

Veteran development practitioners assert that women are just as efficient agricultural producers as men and can achieve similar yields when given equal access to technologies, including improved seeds and inorganic fertilizers. The 2012 WDR and FAO (2010–2011) reports validate these claims, drawing on empirical evidence showing that if, for example, women farmers in Malawi and Ghana were to have the same access as men to fertilizers and other inputs, maize yields on their plots would increase by almost one-sixth (Figure 32).

FIGURE 32. FERTILIZER USE BY FEMALE- AND MALE-HEADED HOUSEHOLDS



Sources: FAO Rural Income Generating Activities Database (2010); RIGA team, & Anriquez (2010)

Similar studies of Africa's small-farm agriculture reported in the 2010–2011 FAO study The State of Food and Agriculture show that providing women the same access to productive resources as men could increase yields on their farms by 20%–30%. An increase in productive resources controlled by women is associated with intergenerational health, nutrition, and educational benefits (Agénor, Canuto, & da Silva, 2010).

Gender inequity also underlies women's poor access to agricultural services, including financial services, extension services, and market information. Significantly, these constraints and their impact on women can be further exacerbated and reinforced by clan, age, ethnicity, and religion.

Access to Financial Services

Access to financial services remains a key impediment for women entrepreneurs. Female small-scale farmers do not have the financial capacity to increase their market access, increase production, use transportation, rent stalls, or access warehouses for storage. Women need access to a range of financial services, including savings, credit, and crop insurance, to finance their business growth. Yet, their access to finance is limited in most developing countries. For example, in Kenya, women represent 48% of business owners but receive only 7% of formal credit; they provide approximately 75% of total agricultural labor but they own only 1% of the land: without land, women often do not receive credit (Blackden & Woden, 2006). Without land titles as collateral, women experience greater difficulty obtaining loans, which further compromises their ability to diversify their livelihoods.

There is widespread awareness, given the substantial evidence now available, that African women make significant contributions to agricultural production and family food security, yet the share of female smallholders who can access credit has remained 5–10 percentage points lower than for male smallholders (African Union Commission and GIZ, 2012). In addition to the common risks specific to the agriculture sector, women are also perceived as particularly high risk clients because of lack of assets including land, lower financial literacy, and limited capacity to participate effectively in value chains.

Access to Markets

Studies have shown that investing in women farmers increases overall crop production. But this potential will only be actualized if rural women have better and fairer access

CASE STUDY: BOX 6

TANZANIA:
A Successful Example — Cooperatives Taking Action to Enhance Women's Participation (COOPAFRICA)

Through funding from the ILO COOPAFRICA–United Nations Joint Programme Challenge Fund, United Peasants of Tanzania embarked on a project to strengthen an agricultural cooperative, Muungano AMCOS, in southern Tanzania by improving its governance system and attracting new members, especially poor women. The project focused on training the leadership on cooperative management; awareness raising on gender equality, and the benefits of joining a cooperative; and subsidizing the fees and shares of interested potential members.

The members, who engage in cashew nut farming and processing, also were trained in good agricultural practices and provided with agricultural inputs, such as spray pumps, to improve their productivity.

According to the independent evaluation, the project resulted in a 46% increase in women's membership, bringing women's share in the cooperative from 8% to 24%. A change of mindset among men was also recorded, with men showing greater willingness to encourage and support women to join cooperatives.

In terms of productivity, the cooperative experienced an increase in the collection of crops from 434,300 kg to 768,872 kg. The price of cashew nuts also rose from TZS1,405 per kg to TZS2,160 per kg, with a positive income impact for members.

Excerpt from COOPAFRICA Challenge Fund Project Independent Evaluations (2012), Cooperative Programme (EMP/COOP).

to markets to sell their products. Female membership in agricultural marketing cooperatives is particularly critical, although women traditionally face obstacles to membership in organized producer networks. Baden (1998) showed how female membership in marketing cooperatives can increase access to important information on prices for marketing systems. This is particularly significant for poor female farmers who occupy particular niches in the marketing systems.

A study of women's organizations in Zambia, for example, showed that improving women's access to value- adding technologies (processing, packaging, and storage) and market opportunities for processed products can have tremendous direct income and other significant ancillary benefits at the household level (Tamele, 2010). Although women's presence in agricultural cooperatives in Africa is limited, a growing number are choosing to organize cooperatively, and there is emerging evidence that cooperative membership enhances productivity, incomes, and the quality of life for members as illustrated in the case study example of COOPAFRICA in Box 6.

Recent studies have also illuminated the important role of mobile phones in facilitating access to agricultural information. This was the case in Zambia, where women's associations effectively used the technology to both access inputs and sell their crops at a good price to the Food Reserve Agency (Tamele, 2010). Evidence showed that association members improved their livelihoods by millions of kwachas. To be sustainable, however, access to finance needs to accompany, or even follow, the resolution of more fundamental constraints that affect production, processing, and marketing.

Women's Access to Extension and Rural Advisory Services

Extension services (also known as rural advisory services) refer to the range of information, training, and agriculture-related knowledge provided by government, NGOs, and other sources that increase farmers' ability to improve productivity (Peterman, Behrman, & Quisumbing, 2011). Rural extension is the major institutional vehicle for farmers to access agricultural innovations and training (World Bank, FAO, & IFAD, 2009). Targeting women smallholder farmers in the provision of extension services is important, because they provide most of the agricultural labor and are the dominant players in food production. Evidence demonstrates, however, that the development and dissemination of agricultural innovations rarely take gender-specific characteristics and requirements into account (Action Aid & CARE, 2012).

Peterman et al. (2011) reported on a comprehensive and extensive review of primary survey data in Ghana, Ethiopia, and India by a team of more than 16 researchers for the World Bank and IFPRI that found large gender inequalities in access to extension services. Although the type of extension varied by country, mean differences were especially prominent in Ghana, where an average of less than 2% of female heads of household and female spouses in male-headed households had contact with extension agents, whereas nearly 12% of men did (Peterman et al., 2011).

In most African countries, there is the widely recognized difficulty of male extension agents having any type of contact with individual female smallholders due to entrenched norms and cultural difficulties in engaging in face-to-face communication (Swanson & Rajalahti, 2010). In Mozambique, farmers and extension workers recognized that when women are provided with technologies and inputs, productivity on women's farms is generally higher than on men's farms, and they tend to be more innovative farmers than men (Gender Aware Approaches in Agricultural Programs, 2010).

Gender Inequalities in Agricultural Research and Development

Empirical evidence has linked the relevance of agricultural innovations to the diversity of actors in research (Beoku-Betts, 2005). Yet African women scientists and development practitioners do not have a significant presence in technology generation or in the setting of research priorities, as shown by Beintema and Di Marcantinio (2009) in a 10-country sample study in Africa. Their study found that African female professionals' participation in African R&D institutions tend to diminish with advancements in agricultural science professions, with the proportion of female professionals steeply declining at later stages with movements into more senior positions (Figure 33).

The low representation of women in agricultural R&D implies that the region is not taking advantage of the full range of human capacities it so critically needs. And the concern goes beyond parity considerations. Relevance in agricultural innovation — in a region where deep-rooted cultural factors challenge conventional modes of interaction with farming households — demands that the complementary insights of the female researcher and extension service provider are harnessed. Both technology innovations and agricultural policies can then be aligned to the needs and interests of Africa's predominantly female smallholders and rural entrepreneurs.

Tackling Africa's hunger requires tackling the dynamics that keep women outside of research institutions and leadership bodies where agricultural policy decisions are made. Therefore, building the capacities of women in agricultural science and development and nurturing institutional cultures that help to retain them is crucial. There is also a need for R&D institutions to mainstream gender into their programs, which is not only done by including women among the staff.

Engendering the Environment for Smallholder Agriculture: Recommended Policy and Development Responses

Household and societal payoffs of reducing women's constraints in productive activities are significant. Few assessments have illustrated these payoffs more compellingly than the World Bank's World Development Report on Gender and Agriculture (2012) and the FAO report on the State of Food and Agriculture (2010–2011), with both converging on the conclusion that closing the agricultural gender gap would result in significant gains for the agriculture sector as well as society as a whole. Creating the necessary enabling environment for women smallholders and improving food security outcomes requires thoughtful agricultural policies, resources, and programs that recognize the potential of women's multiple roles as food producers and providers.

Closing the gender gaps also requires concerted efforts by policy makers, development practitioners, the private sector, and civil-society organizations, given the multifaceted and complex nature of Africa's smallholder agriculture. First, policy interventions and development responses that remove barriers to women's access to productive inputs and agricultural services (including extension and financial services) will generate substantial productivity gains for women. Unfortunately, important gaps in data availability and analytical work in many key areas handicap policy makers' efforts to address these crucial issues adequately. Gathering sex-disaggregated data at household, community, and national levels for policy design and monitoring should be a significant part of the policy reform process in the following key areas of intervention.

Gender-responsive R&D: Diversity in staffing and gender-responsive R&D are essential ingredients for a sustainable agricultural revolution in Africa. Policy interventions that increase incentives for greater involvement of women in agricultural research and higher education could help to close the technology gap with more effective alignment of technology innovation to the specific interests and needs of women as well as men.

Gender-responsive land and private property rights: A worldwide comparison of agricultural census data shows that less than 20% of landholders are women. To confidently invest their time and resources in their work, women need access to and control over the land and crops they manage. Secure land tenure is critical in this effort. One key policy step is to eliminate discrimination under the law by reviewing and reforming national legislation that relates to land and natural resources. It is prudent, however, that customary land rights and the role of community leaders in decision making are considered in the larger effort. This is what will ensure that women's rights are protected.

Promoting female access to financial services and financial literacy training: Efforts by financial institutions, governments, and NGOs to redress gender gaps in access to credit and financial services are pivotal in the transformation of livelihoods for female farmers and rural female entrepreneurs in Africa. Each has complementary but mutually reinforcing roles including policy innovations by government, capacity building, awareness raising, and training, as well as innovative programming that NGOs and financial institutions could support. Strategies could include information dissemination through women-preferred channels, simplifying application procedures and adapting them to women's literacy and numeracy levels, simplifying insurance contracts, and employing language that less-literate women can easily understand.

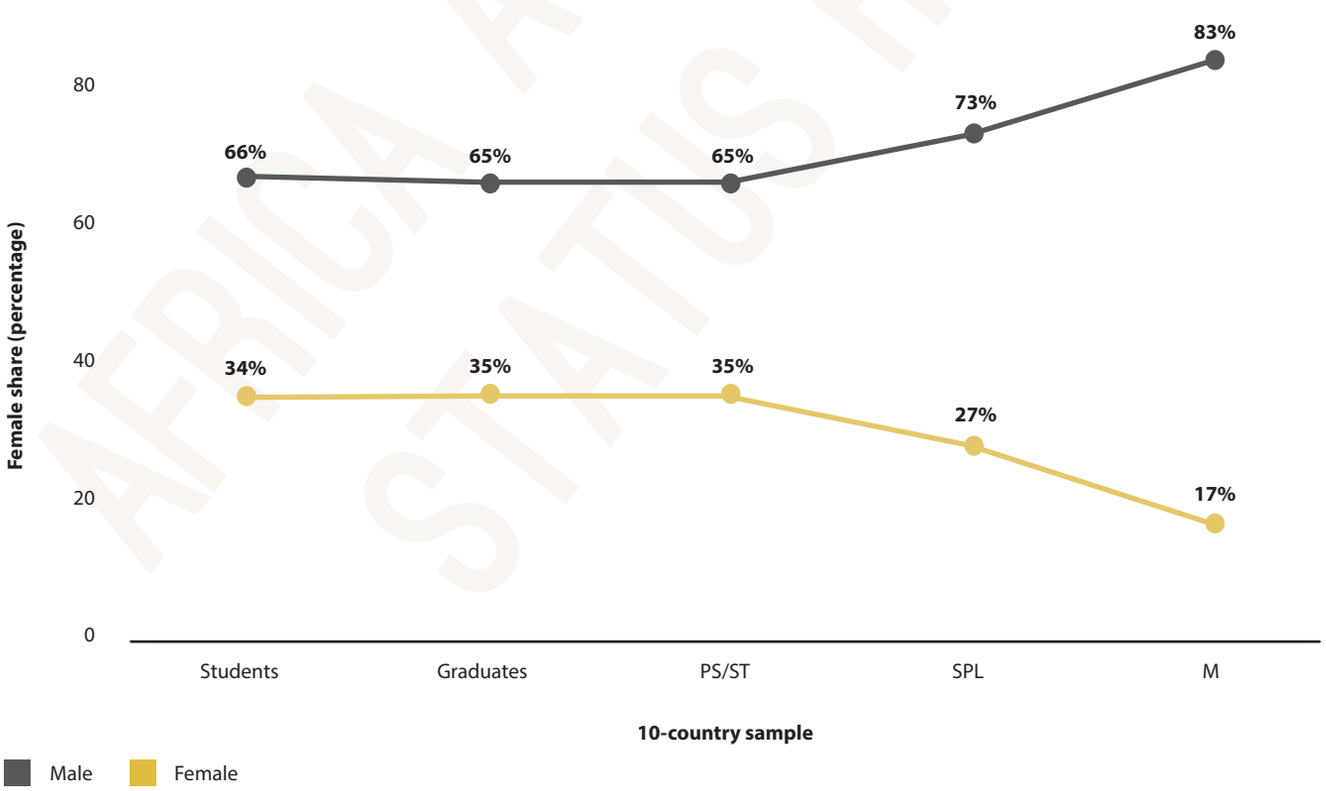
A good practice example creating an enabling business environment for women entrepreneurs is the Gender Entrepreneurship Markets (GEM) unit of the International Finance Corporation (IFC) that works in collaboration with the Foreign Investment Advisory Service and the Africa Region of the World Bank. GEM has worked with IFC financial markets to put in place lines of credit for on-lending to women entrepreneurs through commercial banks. In Nigeria, a US$15-million line of credit was provided to Access Bank to lend to women entrepreneurs; US$4.5 million was disbursed to 33 women-owned businesses. Through GEM-facilitated projects, women clients receive

tailored training in how to prepare a bankable business, product development, and access to markets. GEM has benefited more than 280 stakeholders in Ghana, Kenya, Tanzania, and Uganda—including government staff, lawyers, entrepreneurs, and members of civil society —who have been trained in public-private dialogue, advocacy, and media issues (World Bank, 2009).

Promoting policies and programs that improve women's access to productive technologies: Government support of actions that target the technology gap—women's lack of access to improved seeds, soil fertility enhancing technologies, labor-saving farm implements, postharvest and processing technologies—would substantially improve farm productivity. With recent forecasts estimating a 50% population increase by 2050 in Africa, matching this rate of population growth with sustainable increases in food production and incomes for women would mean transforming the lives of millions of Africans. Women's control of incomes from productive labor has strong positive impact on nutrition and education of their children, leading to sustained intragenerational benefits on society. Mainstreaming gender-responsive projects is the most strategic way to effectively address women's needs and improve their socio-economic status alongside those of men.

Leveling the playing field—strengthening women's agency: Where women and men have equal chances to become socially and politically active, make decisions, and shape policies, change is likely to lead over time to more-representative and more-inclusive institutions. Gender-aware policy support and well-designed development projects undergird women's empowerment.

FIGURE 33. GENDER-DISAGGREGATED SHARES OF TERTIARY-LEVEL STUDENTS AND TECHNICAL STAFF* IN AGRICULTURAL SCIENCE IN SUB-SAHARAN AFRICA



* PS/ST—Professional, technical support staff: SPL—Scientists, professors, lecturers; M—Management: Directors, deans, heads of department.
Source: Beintema & Di Marcantonio (2009)

References

Action Aid & CARE. (2012). *What works for Women: Proven approaches for empowering women smallholders and achieving food security.* Retrieved from http://www.actionaidusa.org/publications/

African Union Commission and GIZ. (2012). *Making finance work for Africa.* Policy brief on agricultural finance in Africa.

Agénor, P-R., Canuto, O., & da Silva, L. P. (2010). *On gender and growth: The role of intergenerational health externalities and women's occupational constraints.* Rome, Italy: Food and Nutrition Organization of the United Nations.

Baden, S. (1998). *Gender issues in agricultural liberalization*. Topic paper prepared for Directorate General for Development (DGVIII) of the European Commission. *Bridge (Development-Gender)* Report, Number 41. Brighton, United Kingdom: Institute of Development Studies. Available online at http://www.ids.ac.uk/bridge/Reports/re41c.pdf.

Beintema, N., & Marcantino, F. (2009). *Women's participation in agricultural research and higher education: Key trends in Sub-Saharan Africa.* Washington, DC, & Nairobi, Kenya: Agricultural Science & Technology Indicators, International Food Policy Research Institute, and CGIAR Gender & Diversity Program. Retrieved from http://www.asti.cgiar.org/pdf/ASTI-AWARD-brief.pdf.

Beoku-Betts, J. (2005). A lot of them thought I wouldn't last out there: African women and career advancement in academic scientific careers. *Journal of Technology Transfer, 30, 397–407*.

Bill and Melinda Gates Foundation. (2012). *Women in agriculture: If we invest in them, we can feed the world. Seattle, WA: Author.* Retrieved November 17, 2012, from http://www.gatesfoundation.org/infographics/Pages/women-in-agriculture-info.aspx.

Blackden, M., & Wodon, Q. (2006). *Gender, time use, and poverty in Sub-Saharan Africa.* World Bank Working Paper No.73. Washington, DC: World Bank.

Chimhowu, A., & Woodhouse, P. (2006). Customary vs. private property rights? Dynamics and trajectories of vernacular land markets in Sub-Saharan Africa. *Journal of Agrarian Change, 6*(3), 346–371.

Chirwa, E., Mvulaa, P. M., Dorward, A., & Matitac, M. (2013). Gender and intra-household use of fertilizers in the Malawi Farm Input Subsidy Program. FAC Working Paper 028. Brighton, United Kingdom: Futures Agriculture.

Doss, C., & Morris, M. (2001). How does gender affect the adoption of agricultural innovations? The case of improved maize technology in Ghana. *Agricultural Economics, 25*(1), 27–39.

FAO (2010–2011). *The state of food and agriculture 2010–2011: Women in agriculture: Closing the gender gap for development.* Rome, Italy: Author.

FAO, IFAD, & ILO. (2010). *Gender dimensions of agricultural and rural employment: Differentiated pathways out of poverty*. Status, trends, and gaps. Rome, Italy: Food and Agriculture Organization of the United Nations.

FAO, WFP, & IFAD. (2012). *The state of food insecurity in the world 2012: Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition.* Rome, Italy: Food and Nutrition Organization of the United Nations.

Gender Aware Approaches in Agricultural Programs. (2010). *Mozambique country report: Special study of the National Agricultural Development Program (ProAgri II)*. UTV working paper.

ILO. (2009). *Global employment trends for women 2009*. Geneva, Switzerland: Author.

Malmberg Calvo, C. (1994). *Case study on the role of women in rural transport: access of women to domestic facilities.* Sub-Saharan Africa Transport Policy Program Working Paper No. 12. Washington, DC: World Bank.

Mead, D. C., & Liedholm, C. (1998). The dynamics of micro and small enterprises in developing countries. *World Development, 26*(1), 61–74.

Mehra, R., & Rojas, M. H. (2009). *Food security and agriculture in a global marketplace: A significant shift.* Washington, DC: International Center for Research on Women.

Peterman, A., Behrman, J., & Quisumbing, A. (2011). *A review of empirical evidence on gender differences in non-land agricultural inputs, technology and services in developing countries.* ESA Working Paper No. 11-11. Rome, Italy: Food and Agriculture Organization of the United Nations.

Peterman, A., Quisumbing, A., Berhman, J., & Nkonya, E. (2010). *Understanding gender differences in agricultural productivity in Uganda and Nigeria.* IFPRI Discussion Paper. Washington, DC: International Food Policy Research Institute.

Rubin, D., & Manfre, C. (2010). *A guide to integrating gender into agriculture value chains.* Bethesda, MD: Cultural Practice LLC.

Swanson, B., & Rajalahti, R. (2010). *Strengthening agricultural extension and advisory systems: Procedures for assessing, transforming, and evaluating extension systems*. Agricultural and Rural Development Discussion Paper. Washington, DC: The World Bank.

Tamele, M. (2010). *Participation of women in agriculture value chains: A case study of Zambian farmers.* Hogeschool/Utrecht, The Netherlands: Kofi Annan Business School.

World Bank, FAO, & IFAD. (2009). *Gender in agriculture sourcebook*. Washington, DC: World Bank.

World Bank. (2012). *Gender equality and development*. World Development Report. Washington, DC: Author.

CHAPTER 12

EXTENSION AND ADVISORY SERVICES FOR FACILITATING SHARING OF AGRICULTURAL INNOVATIONS

By Kristin Davis, GFRAS/IFPRI and Margaret Kroma, AGRA

Introduction

This chapter gives an overview of extension and advisory services in Africa. It takes the perspective of extension's role in facilitating the sharing of agricultural knowledge and innovation among different actors in the agricultural innovation system. The chapter also provides a definition of extension and advisory services, gives a brief history and overview of the current status in Africa, discusses innovative approaches, and concludes with a critical review of capacity strengthening needs at individual, organizational, and system levels.

Situating Extension and Advisory Services in the African Context

Extension and advisory services are defined as systems that facilitate the access of farmers, their organizations, and other value chain and market actors to knowledge, information, and technologies; facilitate their interaction with partners in research, education, agribusiness, and other relevant institutions; and assist them to develop their own technical, organizational, and management skills and practices and improve the management of their agricultural activities (Birner et al., 2009; Christoplos, 2010).

According to the Global Forum for Rural Advisory Services (GFRAS) (2010), extension and advisory services work with farmers and other stakeholders in rural economies. These services provide rural people with the skills and knowledge needed to improve their livelihoods and well-being. Modern extension and advisory services promote interaction among farmers and other rural actors, the private sector, research institutes, education centers, and government. At the same time, they help actors to improve their market access, deal with changing patterns of risk, and protect the environment. Extension and advisory services also are called rural or agricultural advisory services.

Extension and advisory services are integral to the agricultural innovation system, where they play a brokering role in linking key actors, including producer organizations, research services, and higher education (Davis & Heemskerk, 2012).

Changing Landscapes, Changing Approaches

Extension and advisory services are currently at a crossroads in Africa. There has been a shift from traditional linear, exclusively public–sector technocentric approaches to the more complex innovation systems approach, a focus on facilitation, brokering, knowledge/learning, and pluralism with more inclusive public–private orientations. Innovations such as information and communications technologies (ICT) offer much promise, yet we should be cautious of viewing them as yet another silver bullet to solve the problems of rural development.

Extension services in Africa today are pluralistic, with many different providers and models, but still mainly dominated by public extension service provision under the Ministry of Agriculture. Existing public models are typically a general or modified training and a visit model housed in the Ministry of Agriculture, although many countries have a wide variety of other models and providers. Text Box H gives a brief history of extension services' evolution in Africa.

TEXT BOX H. HISTORY OF EXTENSION SERVICES IN AFRICA

Formal extension services started in most countries under colonial rule, with a focus on large-scale export crops and regulatory functions. Following independence, the focus became more general, particularly on smallholder staple crops to deal with issues of poverty and food insecurity. This approach was grounded in the transfer of technology approach and diffusion of innovations theory (Rogers, 1995): developing technologies at research stations that were meant to be disseminated to farmers via extension.

The 1980s were somewhat of a heyday for extension services, with the World Bank and other development partners pouring large sums of money to support the training and visit system. That system held the premise that extension services would be improved through regular training and professionalization of the extension force and regular visitation of farmers by agents. Under this system the extension workforce was vastly expanded, and extension agents undertook regular trainings and made regular visits to contact farmers.

This large (and somewhat inefficient) workforce could not be sustained without substantial outside support. Following structural adjustment programs in response to economic crises in the 1980s and 1990s, African governments were forced to cut spending but did not necessarily reduce the workforce, leading to a large workforce with no funds to operate. Extension programs were then criticized for failing to adequately serve their clientele and thus address

needs of rural poverty, environmental sustainability, and food insecurity (Eponou, 1996; Venkatesan & Kampen, 1998; Gautam, 2000; Republic of Kenya, 2001). Extension also has been criticized for poor governance, ineffective supervision, and weak incentive mechanisms for stimulating effective service delivery among staff.

Another significant criticism of conventional extension and advisory services is the typical conceptualization of the African rural household as a homogeneous unit with male and female actors of various age categories working toward common/unitary goals, when in reality the household is a complex social entity with different members with often competing interests (Okali, 2011; Jiggins, Samanta, & Olawoye, 1997). The one-size-fits- all technology orientation driven by this assumption invariably failed to respond to or address the specific needs and constraints of women smallholders.

One result of the criticisms of extension and advisory services mentioned in Text Box H was a move to non-state actors to deliver extension services, leading to rapid expansion of the private sector and civil society/NGO providers throughout the continent. The increasing number of providers makes the issues of coordination and regulation crucial and underlines the need for the government to play important roles, such as coordinating and regulating, ensuring food security, regulating food quality and safety, and conserving the environment, among others (Rivera & Alex, 2004).

A second result was the implementation of reforms in most African countries. Today, most African countries are experimenting with reforms to existing systems. Reforms include pluralism with regard to providers and approaches, decentralization/devolution, privatization, contracting in and out, cost-sharing, demand-driven/participatory approaches, fee for service, and use of ICT. However, there is limited evidence as to the impact and outcomes of extension services reform, especially in reaching the more vulnerable segments of the smallholder farming populations—women and youths. A large number of assessments have shown that rural extension and advisory services in Africa are rarely relevant to women farmers (Jiggins et al., 1997; Swanson & Rajalahti, 2010). Most advisory services are overwhelming staffed by men, and there is often a tendency for them to focus on productive activities in which men specialize.

Snapshots of Extension and Advisory Services in Africa Today

In terms of numbers of extension services agents in Africa (public or otherwise), data are very difficult to obtain. Swanson (1990) reported that there were 58,958 extension services workers in Africa, based on a survey done for FAO in the late 1980s. However, according to Sasakawa Global 2000, in the mid-1990s there were about 150,000 extension services workers in Sub-Saharan Africa from the private, public, and civil-society sectors. While there is no good idea of the current continental ratio of extension services agents to farmers, it is estimated at about one extension services agent for every 1,500–3,000 farmers; it should be about 1:300 (Pye-Smith, 2012).

An attempt has been made by FAO, GFRAS, IFPRI, and other organizations during the past few years to collect empirical data on the human and financial resources of agricultural extension and advisory systems worldwide, as well as other important information on the following:

- The primary extension service providers in each country (e.g., public, private, and/or NGO)
- The types and groups of farmers who are the primary target groups (e.g., large-, medium-, and/or small-scale farmers, including rural women) for each extension organization
- The way each organization's resources are allocated to key extension and advisory service functions
- The ICT capacity and resources of each organization
- The role, if any, that different categories of farmers play in setting extension services' priorities and/or assessing performance

However, due to the pluralistic and decentralized nature of extension systems today, this data collection was much more difficult to do than in the 1980s (Swanson, 1990). For more information, including available data, country profiles, and subregional overviews.

Many African countries have reawakened to the idea that extension and advisory services are crucial to dealing with food insecurity and poverty, as well as linking farmers to markets, helping them to deal with risks such as climate

change and rebuilding after emergencies, and organizing farmers' groups around economic opportunities (P. Guenette, February 25, 2013, GFRAS New Extensionist e-discussion).

Extension services' responsiveness to the challenges of increasing farm incomes and improving rural livelihoods in Africa requires a fundamental transition to more facilitative approaches that embrace diversity and inclusion as critical elements in complex and risk-prone (Chambers, 1997) smallholder farming systems. Such approaches engender the possibility of otherwise unorganized farmers coming together to form groups and networks as platforms for innovation and adoption of improved management and marketing skills and knowledge.

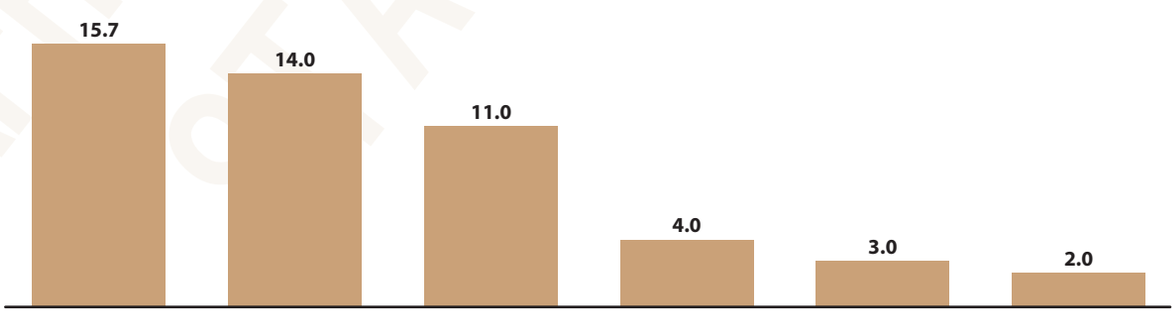
For instance, the African Forum for Agricultural Advisory Services, AFAAS (http://www.afaas-africa.org/) was started in 2004 to help African countries share experiences and network. AFAAS is working together with FARA on CAADP Pillar 4 to share information and technology.

With the renewed focus on extension services due to the food price crisis and other global challenges, companies and governments are searching for good practices and developing extension services policies. Kenya, Liberia, South Sudan, Malawi, and other countries have developed policies on extension services, and many other countries are seeking to do the same. GFRAS and the project, Modernizing Extension and Advisory Services, have held several events on extension policy and a GFRAS working group has been formed under the leadership of AFAAS.[23]

The difficulty in discerning and identifying evidence of the impact of implemented reforms points particularly to the urgency for clearly formulated extension services policies to guide these processes in most African countries. The NEPAD-CAADP platform has provided a unique entry point for countries to galvanize and respond to policy gaps, including in extension and advisory services.

Some governments, such as Ethiopia's, invested heavily in human and physical capital in the past decade, putting farmer training centers in every local administrative area (there are 18,000) and three extension services agents at every training center. Between 2000 and 2008, the number of extension services agents increased to at least 45,000, with a goal of reaching about 66,000. Reaching that goal would probably give Ethiopia the world's highest ratio of extension services agents to farmers (Figure 34) (Davis & Heemskerk, 2012). This does not, however, guarantee more effective targeting of women smallholders, unless intentional strategies are put in place to recruit female extension services workers and design innovative approaches that increase access to a greater diversity of smallholders.

FIGURE 34. EXTENSION AGENT NUMBERS AND RATIOS



	Ethiopia	China	Indonesia	Tanzania	Nigeria	India
Total # of agents	45 k	700 k	54 k	7 k	5 k	60 k
Agent: Farmer	1 : 635	1 : 714	1 : 909	1 : 2500	1 : 3333	1 : 5000

Source: Davis et al. (2010)

[23] See http://www.meas-extension.org/workshops and http://www.g-fras.org/en/community/working-groups/policy-for-extension-and-ras.

The challenge for extension and advisory services today is huge, and there are major areas that need to be addressed to make them effective. They include sustainable financing, capacity strengthening, and monitoring and evaluation of extension services systems. These issues are addressed in the next sections.

Some Innovative and Popular Approaches

Many innovative approaches are being used in extension and advisory services in Africa today, almost more than can be catalogued here, with more new ones appearing all the time. Before presenting key innovative extension approaches being employed across Africa, we provide a framework for reviewing and analyzing them.

Birner et al. (2008) distinguished between organizations from the public, private, and civil-society sector that can be involved in providing and financing agricultural advisory services (Figure 35). The analytical framework they developed disentangles major characteristics of advisory services on which policy decisions have to be made: (1) governance structures; (2) capacity, management, and organization; and (3) advisory methods. The framework identifies four sets of frame conditions that should be considered when deciding on these characteristics: (1) the policy environment; (2) the capacity of potential service providers; (3) the type of farming systems and nature of market access of farm households; and (4) the nature of the local communities, including their ability to cooperate. The framework supports a shift from a one-size-fits-all to a best fit approach in the reform of public services.

Davis et al. (2013) have applied this framework to the search for global good practices or innovative extension approaches by looking at the following dimensions of extension services: governance structures; policies; capacities and management; advisory methods; and cross-cutting issues such as gender.

Within each dimension, critical themes can be assessed using case studies. In seeking good practice cases, these dimensions are applied across different country typologies. The framework looks across countries at the socio-economic and political contexts (e.g., agrarian, transition, post-conflict) and within countries at organizational (e.g., types of providers) and ecological (e.g., commodity base, population density) contexts.

By comparing experiences in implementing extension services approaches across different contexts, it is possible to draw conclusions about how and why they work effectively in particular settings and contexts and thus guide designers and implementers in finding best-fit approaches.

Among these innovative approaches, a number of common elements stand out:

- The recognition that smallholder agriculture is complex, often demanding knowledge-intensive practices and skills building
- A common aim to transform the way smallholder farmers interact with markets and the way they make farming and value chain decisions
- A shift from narrow technology dissemination toward building learning organizations and facilitating coalition building among different stakeholders

See Text Boxes I through M for further information.

TEXT BOX I: FARMER FIELD SCHOOLS FOR PARTICIPATION, EMPOWERMENT, AND GROUP LEARNING (DIMENSIONS OF CAPACITIES AND APPROACHES)

Farmer field schools (FFS) were introduced into Sub-Saharan African in the mid-1990s. They are in place in at least 27 Sub-Saharan Africa countries (Braun et al., 2006). FFS came from Asia, where they were developed to promote integrated pest management programs. In Africa, FFS are being used for a variety of activities, including food security, animal husbandry, and soil and water conservation. They are even moving beyond agriculture into health (HIV/AIDS) and other relevant rural topics.

FFS are a participatory method of learning, technology development, and dissemination based on adult learning principles such as experiential learning. Groups of 20–25 farmers typically meet weekly in an informal setting in their own environment with a facilitator. The defining characteristics of FFS include discovery learning, farmer experimentation, and group action. The approach is an interactive and practical method of training and empowers

farmers to be their own technical experts on major aspects of their farming systems. The facilitator leads farmers to conduct their own research, diagnose and test problems, and come up with solutions. Both to ensure sustainability and to enhance the sense of ownership and responsibility, FFS programs are encouraging cost sharing. In East Africa, self-financed and semi-self-financed schools are in place, and schools use commercial plots to repay loans to run the schools. Group members may also cover the cost of travel of the extension staff.

Source: Davis (2008)

TEXT BOX J: MOBILE TELEPHONY FOR DELIVERING ANIMAL HEALTH SERVICES (DIMENSIONS OF GOVERNANCE AND APPROACHES)

FARM-Africa, an NGO working in Kenya in conjunction with the government and other stakeholders, developed a decentralized animal health care system in its Kenya Dairy Goat and Capacity Building Project (KDGCBP). To link key participants in the system, the project approached Safaricom Corporation, the corporate social responsibility arm of the mobile phone company Safaricom. The KDGCBP system works with a community animal health worker, who purchases a veterinary drug kit and mobile phone at a subsidized price. The project also installs community phones, which have solar panels and batteries for areas where there is no electricity, at veterinary shops. The owner of the community phone is responsible for repairs and can make a profit by charging for its use; for the private veterinarians, the phone is a means of diversifying income. Animal health assistants and veterinarians working with the project also receive mobile phones from KDGCBP. The phone system allows animal health care providers to update one another, share information, and conduct referrals. This system has reduced transaction costs and increased the efficiency of animal health care in the area.

Sources: Kithuka, Mutemi, & Mohamed (2007); Davis & Heemskerk (2012).

TEXT BOX K: ACCESS AGRICULTURE: FARMER-TO-FARMER VIDEO SHARING (DIMENSION OF APPROACHES)

Access Agriculture is a new international NGO registered in Kenya to enhance the distribution and use of quality agricultural training videos in multiple languages by universities, colleges, extension service providers, and farmers' organizations. The series of videos on one subject in local languages proved a powerful way to reach out.

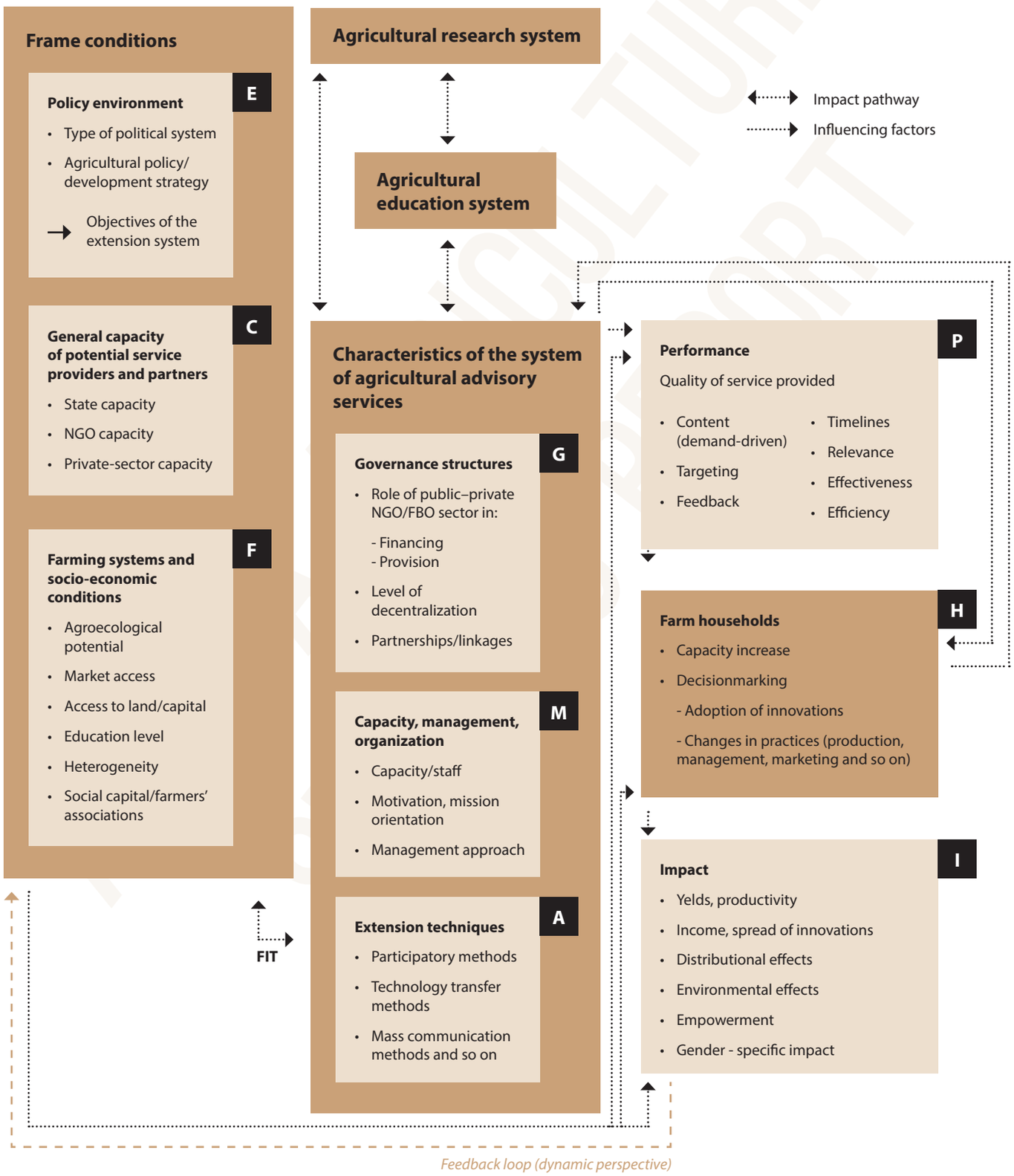
Rice Advice: Videos in 40 African languages were used by about 1,000 organizations, of which more than 50 were educational institutes across Africa.

Fighting Striga: Videos in eight languages were distributed in West Africa on 30,000 multilanguage DVDs.

Those videos proved to be powerful in changing farmers' behavior and well-being, and in improving the quality of agricultural training curricula across borders.

Source: P. van Mele, Access Agriculture, www.accessagriculture.org.

FIGURE 35. FRAMEWORK FOR DESIGNING AND ANALYZING EXTENSION



Source: Devised by authors.
Note: NGO indicates nongovernmental organization; FBO, farmer-based organization

TEXT BOX L: FARMERS PAYING FOR SERVICES (DIMENSIONS OF POLICIES AND GOVERNANCE)

The One Acre Fund has 130,000 smallholder farmer clients in Kenya, Rwanda, and Burundi. It offers farmers seed and fertilizer on credit, paired with extension services and market facilitation. Farmers pay for everything —the inputs, interest on the loan, and a fee for the extension services. However, the extension service fee is bundled into the seed and fertilizer loan and seems to be successful at convincing farmers to pay for extension services. The fee structure is transparent—farmers know that they are paying for training—but at the same time, they cannot opt out of the extension fee. A farmer who wants a loan has to pay for extension services.

Source: S. Hanson (2013) GFRAS e-discussion on the New Extensionist

TEXT BOX M: ONE-STOP CENTRE ASSOCIATION APPROACH (DIMENSIONS OF APPROACHES)

The One Stop Centre Association (OSCA) approach was initiated in Uganda by the Sasakawa Africa Association (SAA) in 2000. The objective of the OSCA approach is to help scale up technology transfer and empower rural communities to access rural and agricultural services. Services may include input delivery, production, agroprocessing and marketing, rural finance, literacy, and health care.

An OSCA is a multipurpose community facility that enables a farmers' organization to aggregate demand for agricultural services within a specified catchment area. Such services address all aspects of increasing agricultural productivity and principally aim to reduce transaction costs for production, postharvest management, and marketing. The premise for achieving access to such services rests on an inherent capacity of the farmers' organization to manage itself and some of the services on a cost-recovery basis while permitting the emergence of private entrepreneurs to run private good services on a commercial basis. The approach of the OSCA is participatory, collaborative, and market oriented and integrates social and economic issues for the development of rural communities that are difficult to reach. The OSCA approach aims to bridge the gap between the poor and rich by bringing services closer to everyone in the community. It is a community-based initiative whose target is to strengthen the institutional arrangements for agricultural advisory services.

Source: Wathum & Gitta (2008).

Capacity Building at Individual, Organizational, and System Levels

Probably the most critical issue in extension and advisory services today is the lack of capacity for the job at hand. Extension services agents typically are trained in technical issues, such as animal or crop production and natural resource management. Training tends to be classroom based and little practical experience is included in many programs (Angsreitch & Zinnah, 2007; Davis et al., 2008).

Recent assessments have detailed the needs for capacity at three levels: individual, organizational, and system (Alex et al., 2004; Anstreich & Zinnah, 2007; GFRAS 2012). Extension and advisory services agents, organizations, and systems should have capacity to perform a range of innovation management functions. They should also have technical and functional capacity to promote new agricultural technologies, apply participatory approaches, help organize producers, understand markets and value chains, and address new forms of climatic, social and economic vulnerability (Sulaiman & Davis, 2012). An early effort to address the capacity gaps of extension services agents was the Sasakawa Africa

Fund for Extension Education (SAFE) model, which was aimed at reforming the agricultural extension curricula in African universities and bringing about reforms of the institutions themselves (Zinnah, 2000; Deola, 2000).

A number of universities and higher institutions of learning in Eastern, Central, Southern, and Western Africa have reviewed their curricula to focus on extension services courses. SAFE has supported several initiatives in Ethiopia, Uganda, Malawi, Benin, and Nigeria to develop curricula that provides students opportunities to participate in supervised experiential learning internships while still at university. Makerere University has launched a bachelor's degree in agricultural and rural innovation, which balances technical and extension services issues; Mekelle (Ethiopia) and Lilongwe University of Agriculture and Natural Resources (Malawi) have similar programs. Internship is also a necessity for all degree programs at Makerere University's College of Agricultural and Environmental Sciences. Despite these small but laudable efforts, capacity still needs to be built, especially at the organizational/institutional and system levels.

Summary

African agriculture is at a turning point with growing momentum to transform. Agricultural extension and advisory services are an important institution for development in Africa. A revitalized extension and advisory service, anchored by an innovation systems platform is pivotal in this effort. Extension services have not always performed according to plan for a number of reasons, yet it is absolutely essential as an institutional platform to Africa's agricultural transformation. Strengthening the capacities of key actors in the wider innovation system and agriculture value chains is fundamental in bringing about needed transformations in agricultural productivity and rural livelihoods in the majority of African countries.

African governments, the private sector, and other key actors need to recognize the role that extension services play in linking knowledge sharing within the agricultural innovation system. Extension services are not something to think about after technologies have been developed; it must be involved in all aspects of innovation and knowledge sharing, linking farmers to other parts of the innovation system.

References

Alex G., Byerlee, D. M. Collion, and W. Rivera. 2004. Extension and rural development: converging views on institutional development approaches. Agricultural and rural development paper No. 4. Washington, DC: World Bank.

Angstreich M., M. M. Zinnah 2007. A Meeting of the Minds: Farmer, Extensionist, and Researcher. *Journal of International Agricultural Extension and Education* 14(3):85-95

Birner, R. K., Davis, J., Pender, E., Nkonya, P., Anandajayasekeram, J., Ekboir, A., et al. (2009). From best practice to best fit: A framework for analyzing agricultural advisory services worldwide. Journal of Agricultural Extension and Education, 15(4), 341–¬355.

Braun, A., Jiggins, J., Röling, N., van den Berg, H., & Snijders, P. (2006). *A global survey and review of farmer field school experiences.* Nairobi, Kenya: International Livestock Research Institute.

Chambers, R. (1997). *Whose reality counts? Putting the last first.* London, United Kingdom: Intermediate Technology Publications.

Christoplos, I. (2010). *Mobilizing the potential of rural and agricultural extension*. Rome, Italy: Food and Agriculture Organization of the United Nations and the Global Forum for Rural Advisory Services.

Davis, K. (2004). *Technology dissemination among small-scale farmers in Meru Central District of Kenya: Impact of group participation.* Unpublished doctoral dissertation, University of Florida, Gainesville, Florida.

Davis, K. (2008). Extension in Sub-Saharan Africa: Overview and assessment of past and current models and future prospects. *Journal of International Agricultural and Extension Education, 15*(3), 15–28.

Davis, K., J. Ekboir and Spielman, D. J. 2008. Strengthening Agricultural education and training in Sub-Saharan Africa from an innovation systems perspective: A case study of Mozambique. *Journal of Agricultural Education and Extension* 14(1): 35-51. Journal article of the year.

Davis, K., S. Franzel, E. Boa, D. Romney, & T. Harris. 2013. A Framework for Analyzing "Best-fit" Practices in Extension. Paper accepted for the Association for International and Extension Education Annual Conference, Fort Worth, Texas.

Davis, K., & Heemskerk, W. (2012). *Investment in extension and advisory services as part of agricultural innovation systems. Module 3 of agricultural innovation systems: An investment sourcebook.* Washington, DC: World Bank. Available at http://siteresources.worldbank.org/INTARD/Resources/335807-1330620492317/9780821386842_ch3.pdf.

Davis, K., Swanson, B., Amudavi, D., Mekonnen, D. A., Flohrs, A., Riese, J., et al. (2010). *In-depth assessment of the public agricultural extension system of Ethiopia and recommendations for improvement*. IFPRI Discussion Paper 1041. Washington, DC: International Food Policy Research Institute.

Deola, N. (2000). *The Sasakawa African Fund for extension Education (SAFE) Initiative in Sub-Saharan Africa: Challenges and opportunities.* A workshop on Bringing African Universities and Colleges More into Agricultural Development, Cape Coast, Ghana.

Eponou, T. (1996). *Partners in technology generation and transfer: Linkages between research and farmers organizations in three selected African countries.* ISNAR Research Report No. 9. The Hague, Netherlands: International Service for National Agricultural Research.

Gautam, M. (2000). *Agricultural extension: The Kenya experience.* An impact evaluation. Washington, DC: World Bank.

GFRAS. (2010). *GFRAS: Making a difference by improving rural advisory services.* Lindau, Switzerland: GFRAS.

Jiggins, J., Samanta, R. K., & Olawoye, J. E. (1997). *Improving agricultural extension: A reference manual* (Chap. 9). Rome, Italy: Food and Nutrition Organization of the United Nations.

Okali, C. (2011). *Gender and other social differences; Implications for FAC.* Discussion Paper 014. Brighton, United Kingdom: Future Agricultures.

Pye-Smith, C. (2012). *Agricultural extension: A time for change. Linking knowledge to policy and action for food and livelihoods.* Policy Pointer from the international conference Innovations in Extension and Advisory Services, Linking Knowledge to Policy and Action for Food and Livelihoods, Nairobi, Kenya.

Rivera, W. M. & Alex, G. (2004). *The continuing role of government in pluralistic extension systems*. Paper presented at the 20th annual Conference of the Association of International Agricultural and Extension Education, Dublin, Ireland.

Republic of Kenya. (2001). *Poverty Reduction Strategy Paper for the Period 2001–2004* (Vol. 1). Nairobi, Kenya: Ministry of Finance and Planning.

Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York, NY: The Free Press.

Swanson, B. E. (Ed.). (1990). *Global consultation on agricultural extension*. Rome, Italy: Food and Nutrition Organization of the United Nations.

Swanson, B., & Rajalahti, R. (2010). *Strengthening agricultural extension and advisory systems: Procedures for assessing, transforming, and evaluating extension systems.* Agriculture and Rural Development Discussion Paper 44. ARD. Washington, DC: World Bank.

Sulaiman, R., & Davis, K. (2012). *The new extensionist: Roles, strategies, and capacities to strengthen extension and advisory services.* GFRAS Position Paper. Lindau, Germany: GFRAS.

Wathum, P., & Gitta, E. (2008). *Profiling of One Stop Center Associations (OSCAs) in Uganda in terms of functional attributes and economic viability.* CIMMYT/SG 2000. Monitoring and Impact Assessment (IA) Uganda. Nippon IA Research Report No. 4 2008.

Zinnah, M. (2000, October). T*he philosophy and approach of an innovative agricultural extension training initiative in Sub-Saharan Africa.* Paper presented at the national workshop on innovative degree program for mid-career agricultural extension workers, Zaria, Nigeria.

CHAPTER 13
CONCLUSION

The persistence of low levels of agricultural production, increased food insecurity, unstable agricultural prices and increasing costs of inputs contribute to the challenges facing African agriculture. Even though these challenges are worldwide, for Africa, where farming is dominated by smallholders, most of them women—these could mean losing the gains in achieving the Millennium Development Goals—specifically being unable to feed the population adequately. Ensuring a food secure and prosperous Africa in a sustainable way requires a unique Green Revolution where increased agricultural productivity is guaranteed through investments in research and technology, infrastructure, as well as providing the enabling environment for the private sector, including farmers to promote agribusiness. It will require rethinking agriculture to involve a value chain approach from the supply or production side to demand or the consumption side. Investing in agricultural value chains that address the constraints and vulnerabilities faced by the farmers, especially the resource poor is paramount. Institutions for linking farmers to input and output markets should ensure that the farmers have adequate, appropriate, affordable and timely inputs, as well as knowledge on appropriate agronomic practices and technology packages that will enhance productivity in an environmentally sustainable way. At the same time, mechanisms for minimizing the transaction costs in accessing domestic, regional or international markets should be in place.

Productivity related issues addressed in this report show varied success levels on a country by country case. It is evident that the interventions pursued by the countries are not misguided. However, much more still needs to be done to ensure success of a unique Green Revolution in Sub-Saharan Africa. Attention needs to be focussed on investing in research and technology and to provide the enabling environment for adoption of the technologies to close the existing yield gaps for almost all commodities. Linking farmers to input and output markets must be given priority as well.

Given the inherent complexity of land tenure systems, the limited capacity of the state, and the cost of tenure reform, the need to monitor and learn from progress made with land reforms in the region, and to redirect policy design and implementation cannot be overemphasized. It is imperative to analyze the implementation and impact of the land policies and laws recently adopted by many African countries, so as to learn lessons for land policy design and implementation in Africa. A secure land tenure arrangement provides farmers with the incentive in sustainable productivity increasing measures, including environmental conservation.

Addressing the soil infertility problem is important in addressing food insecurity in Africa. This can be achieved through appropriate fertilizer use and other integrated soil fertility management (ISFM) technologies. However there are challenges of high cost of quality fertilizer and inability of smallholder farmers to obtain sufficient quantities of organic matter to improve soil health. Farmers should be linked to value chain actors to access credit to enable purchase and application of appropriate fertilizer and other inputs in a timely manner.

Ensuring that the smallholder farmer is equipped with affordable improved seeds, agronomic practices, and technology packages, as well as affordable financing, will lead to increased crop production beyond subsistence. As farmers achieve surplus production, there is need to guarantee access to the right markets for the surplus. In order for the smallholder farmer to sell at a good price, it is necessary to bulk. This enables them to have bargaining power as well as sell when the market is right. It is therefore important to support farmer organizations by providing capacity building initiatives that will lead to competitive farmer organizations.

A good investment climate for agriculture is a cornerstone in these efforts. Enabling environment for the actors in the agricultural commodity value chains must include research and technology as well as promotion of innovation platforms. Improved infrastructure, information and communication technologies institutions, as well as access to input and output markets, reduce the transaction costs. These improvements create the environment to undertake agriculture as a business and facilitate the transformation of the sector from being dominated by subsistence production to commercial orientation. The need to invest in agro-processing and value addition is critical in transforming the agriculture sector that hitherto relies mainly on marketing of primary products. For any meaningful transformation to be sustained it is important to reform and strengthen the capacities of the regulatory institutions of government. Government institutions must be strengthened and incentivized to enact, implement and regulate policies that support productivity growth. A public–private partnership approach to investment, taking into account the competitive advantages of the actors along the value chain should be promoted.

Transforming African agriculture by improving output markets and building effective market institutions is critical. The efficient grain marketing systems, which effectively absorb surplus grain, especially at harvest, are important in maintaining remunerative producer prices which will drive sustained growth in grain output and productivity in Africa

and contribute to attainment of pro-poor, agriculture-based growth and development goals.

Grain output markets remain inefficient in most African countries decades after liberalization because, in addition to poor transport infrastructure, institutional infrastructure that reduce uncertainty and transaction costs are either missing or under-developed. Market institutions such as market information systems (MIS), standardized grades and measures, warehouse receipt systems (WRS) and structured trading systems—including commodity exchanges—are often promoted as bespoke projects by donors and governments with progress being frustratingly slow across the continent. Measures encouraging collective action not only reduce transaction costs, but more importantly enable the numerous smallholder farmers (geographically spread out) to enjoy the economies of scale along the value chain brought about by this arrangement. The few success cases, as in Tanzania's WRS for export crops, demonstrate the potential of these systems.

Governments' frustration with effects of inefficiencies in grain output markets tends to encourage ad hoc market interventions sometimes mirroring the "controls of the past." These interventions have often proved costly, undermined market development and weakened producer incentives. The way forward is in sustained investments by governments, donors and private sector players in a public-private partnership fashion to develop market institutions that complement each other and foster efficient trade. Key to this is avoiding the disabling policies that undermine the development of these systems and also hamper market efficiency.

Rural women are important actors in Africa's smallholder agriculture, making up almost 50 percent of the agricultural labor force; yet they face severe obstacles to production and participation in value chains. Unequal access to agricultural land is one of the most severe obstacles women face. Land ownership is an essential leverage point for accessing credit or making long-term investments in productivity. Investing in women increases overall production, especially if women have fairer and better access to markets and extension services. Closing gender gaps requires concerted efforts by policy makers, development practitioners, private sector and civil society organizations, given the multi-faceted and complex nature of Africa's smallholder agriculture. Policy interventions and development responses that remove barriers to women's access to productive inputs and agricultural services (including extension and financial services) will generate substantial productivity gains for women. Policy interventions that increase incentives for greater involvement of women in agricultural research and higher education could help close the technology gap with more effective alignment of technology innovation to the specific interests and needs of women as well as men in the production arena. Mainstreaming gender-responsive projects appears the most strategic way to effectively address women's needs and improve their socio-economic status alongside those of their male counterparts across agriculture value chains.

Extension and advisory services are integral to the agricultural innovation system (AIS), where now more than ever they play a brokering role, linking key actors, including producer organizations, research services, and higher education. Capacity building in extension at all levels—individual, organizational, and system levels—is fundamental in strengthening key technical, functional competencies needed to drive effective service delivery and enable learning. Design and delivery of appropriate extension and advisory services, sensitive to local contexts, taking into account gender specific characteristics and requirements need to be promoted. Wide ranging sector reforms have been implemented in recent years that include pluralism in approaches and provide the following:

- Decentralization/devolution
- Privatization
- Contracting in and out
- Cost-sharing
- Demand-driven/participatory approaches
- Fee-for service
- Use of ICTs

However, there is limited evidence of impacts and outcomes, especially in reaching the more vulnerable segments of the smallholder farming populations—women and youth.

SECTION II

STATUS OF AGRICULTURAL STATISTICS

Status of Agricultural Statistics

Naman Keita, FAO

The availability of timely, relevant, and reliable data on the agriculture sector is necessary for effective planning, monitoring, and evaluation of agricultural and rural development policies and programme results. However, several studies point to a steady decline in the quality of agricultural statistics in many developing countries, particularly African countries.

Declining trend in quality of agricultural statistics in African countries

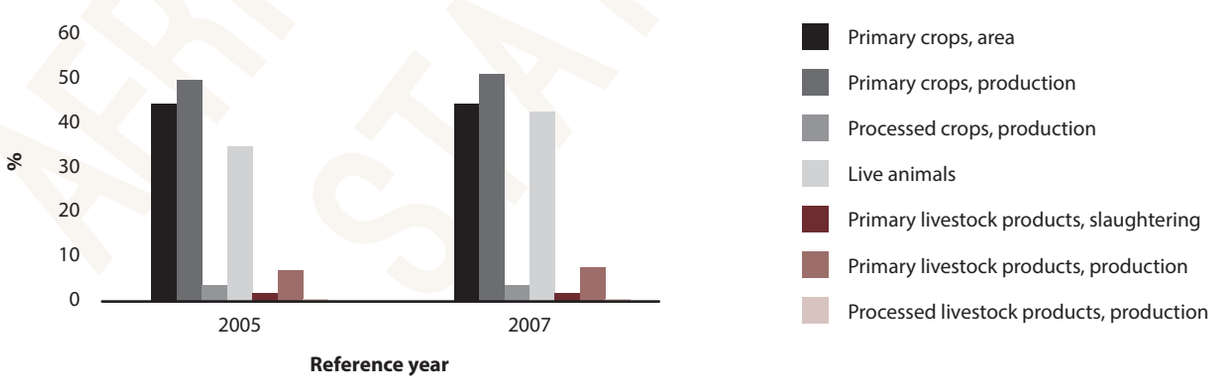
A report of the Independent External Evaluation of the Food and Agriculture Organisation concluded that "the quantity and quality of data coming from national official sources has been on a steady decline since the early 1980s, particularly in Africa" (FAO, 2006). The steady decline in availability and quality of agricultural data is attributed to limited capacity of African countries to gather, compile and analyse information on the food and agriculture sector. This is happening at a time when more than ever, reliable data are needed on this sector.

Since attaining independence, beginning in the 1960s, most African countries conducted data collection activities on the agriculture sector. But many of these activities, such as agricultural censuses and surveys, were conducted on an irregular basis and conditioned by the availability of donor funding.

Most countries have not developed a sustainable capacity to produce regularly relevant and reliable data on the agriculture sector. In cases where countries have conducted surveys, there often has not been consistency in the survey questions making it difficult to show a trend or changes on selected indicators. In several countries, data is collected but is not easily accessible, nor is it fully analyzed, and hence not usable.

As a consequence, many African countries are still not able to report even the most basic data on the agriculture sector as shown in Figure 36 and Table 30, which was compiled from responses to FAO questionnaires by African countries[1]:

FIGURE 36. OFFICIAL DATA COVERAGE RATE BY DOMAIN OF AGRICULTURAL PRODUCTION.



From the Figure above, only about 50% of the data on primary crops production available for AFCAS member countries in FAOSTAT (FAO Global Database on Food and Agriculture) come from official sources. Official data for other agricultural activities show much lower proportions, particularly livestock data.

Only a few countries have good data on producer prices as shown in Table 31 (focus countries are highlighted in red):

[1] Source: FAO Statistics Division paper at the 22nd Session of the African Commission on Agricultural Statistics (AFCAS), Addis Ababa, Ethiopia, 30 November to 3 December 2011: "Review of the Availability and Quality of Official Data from AFCAS Member Countries" (RAF/AFCAS/11-5b).

TABLE 30. DATA QUALITY AND COVERAGE ASSESSMENT REPORT FOR AFRICAN PRODUCERS PRICES, 2002-2010

COUNTRY GROUPS	GOOD COVERAGE AND DATA QUALITY	LIMITED COVERAGE AND GOOD DATA QUALITY	POOR DATA QUALITY AND COVERAGE
Central Africa	Congo, Rep		Cameroon, Central Africa Republic, Chad, Democratic Republic of Congo, Equatorial Guinea, Gabon, Sao Tome Principe
Eastern Africa	Kenya, Madagascar, Malawi, Mauritius, Mozambique, Ethiopia	Zimbabwe, Rwanda, Somalia, Zambia	Eritrea , Burundi, Comoros, Djibouti, Seychelles,Tanzania, Uganda, Mayotte
Northern Africa	Egypt, Morocco	Algeria, Sudan	Libya
Southern Africa	South Africa	Botswana, Namibia	Lesotho, Swaziland Angola
Western Africa	Cape Verde, Ghana, Cote D'Ivoire, Mali, Togo	Guinea, Liberia, Mauritania, Senegal, Burkina Faso	Guinea-Bissau Benin, Gambia,

(No information available for Niger, Sierra Leone.)

An assessment of the quality and quantity of data available at CountrySTAT website: www.countrySTAT.org and country capacity in agricultural statistics conducted for countries covered by FAO CountrySTAT illustrate the following results for the focus countries:

TABLE 31. STATUS OF AGRICULTURAL STATISTICS IN THE SELECTED COUNTRIES COVERED BY COUNTRYSTAT FOR SUB-SAHARAN AFRICAN COUNTRIES (APRIL 2013)

SELECTED COUNTRIES COVERED BY COUNTRYSTAT	NUMBER OF TABLES/DATA AVAILABLE (NATIONAL AND SUB-NATIONAL)	DATA QUALITY				INSTITUTIONAL FRAMEWORK		
		Compliance with International Standards[2]	Existence of Metadata	Correspondence Table[3]	Consistency Checks[4]	Secretariat		Technical Working Group Collaboration
						Technical Capacity of National Staff[5]	Institutional Commitment to CountrySTAT[6]	
Burkina Faso	39	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Kenya	50	✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓	✓✓✓
Mali	44	✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓
Niger	36	✓✓✓	x	✓✓✓	✓✓	✓✓✓	✓✓	✓✓
Uganda	38	✓✓	✓✓	x	x	✓✓✓	✓✓	✓✓✓
Ethiopia	41	✓✓✓	x	x	x	✓✓✓	✓✓	✓✓
Ghana	32	✓✓	✓✓	✓✓	✓✓	✓✓✓	x	x
Mozambique	27	x	x	✓✓✓	✓✓	✓✓	x	x
Tanzania	47	✓✓	x	x	✓✓	✓✓	x	✓✓
Zambia	39	x	x	x	✓✓	✓✓✓	x	xx
Rwanda	34	x	x	x	✓✓	✓✓	x	xx
Nigeria	29	x	x	x	✓✓	✓✓	x	xx
Malawi	40	x	x	x	✓✓	✓✓	x	xx

✓✓✓: Good ✓✓: Fair x: Slow progress xx: Weak inter-institutional collaboration and strong goverment support required

2 Compliance with International Standards: It also includes the harmonization with sources.
3 The correspondence table ensures the appropriate linkages between country and FAO classifications on commodities.
4 A consistency check is done at the national level to ensure there are no conflicts in the data presented on the site.
5 Technical capacity of staff includes skills related to statistical and IT subjects.
6 Institutional commitment to CountrySTAT is closely linked to the project's activities being included in Government work plans and budget availability for the sustainability of the system.

The data on the structure of agriculture are obtained from the agricultural census that should be conducted at least once every 10 years. According to FAO records, 25 African countries conducted an agricultural census during the 2000 round of the World Programme for Agricultural Census (WCA2000 covering the period 1996–2005). The table below shows the participation of the focus countries to the 2000 round (WCA2000) and to current round of World Programme for Agricultural Census 2010 (WCA 2010 covering the period 2006-2015).

TABLE 32. THE SELECTED COUNTRIES CONDUCTING AN AGRICULTURAL CENSUS DURING WCA 2000 AND WCA2010 ROUNDS

NO	COUNTRY NAME	WCA2000	WCA2010
1	Burkina Faso		Census conducted in 2010
2	Ethiopia	2002	No information available
3	Ghana		Tentatively planned for 2013-2014)
4	Kenya		Tentatively planned for 2013-2014)
5	Liberia		No information available
6	Malawi		Census conducted in 2006/2007
7	Mali	2005	No information available
8	Mozambique	2000	Census conducted in 2009/2010
9	Niger		Agricultural Census 2004 - 2008 (various modules)
10	Nigeria		Planned for Agricultural Census 2013
11	Rwanda		National Agricultural Survey 2008
12	Sierra-Leone		No information available
13	Sudan		Agricultural census 2013/2014
14	Tanzania	2003	Census conducted in 2007/2008
15	Uganda	2002	Census of agriculture 2008/09 (Crop Census 2009; Livestock Census 2008)
16	Zambia	2000	No information available

( ) Blank cell means no censuses were conducted in the respective countries.

Global Strategy to Improve Agriculture and Rural Statistics: *A unique opportunity for substantially improving the quality of the data on food and agriculture sectors in Africa*

To address the root causes of capacity weaknesses in National Agricultural Statistics Systems in developing countries, FAO in collaboration with the World Bank and other key partners—including African regional partners —and under the auspices of the United Nations Statistical Commission (UNSC), have developed a "*Global Strategy to Improve Agricultural and Rural Statistics*". http://www.fao.org/economic/ess/ess-capacity/ess-strategy/en/).

The global strategy has been adopted by the UNSC and translated into a formal action plan, which is being implemented in various regions of the world. This initiative is the most comprehensive capacity building initiative ever undertaken by the international community regarding agricultural statistics. The implementation of the strategy is being supported by a Global Trust Fund, hosted by FAO, with a global governance mechanism that includes:

- country representatives
- civil society
- donor agencies
- technical institutions that specialize in agricultural statistics.

FAO in collaboration with African Development Bank (AfDB) and other regional institutions (United Nations Economic Commission for Africa (UNECA), African Union (AU)/CAADP), has developed an action plan; *Improving Statistics for Food Security, Sustainable Agriculture, and Rural Development: Action Plan for Africa 2011–2015* as part

of a global initiative to improve agricultural statistics and implementation of the global strategy. This partnership programme aims to substantially improve the quality of the data on the food and agriculture sector in Africa. Access the Action Plan for Africa 2011-2015 at: http://www.fao.org/fileadmin/templates/ess/documents/meetings_and_workshops/Resource_Partners_Oct2011/AfDB_Agriculture_long_web_PrintVersion_Final_04July2011.pdf.

The implementation of the global strategy is most advanced in the Africa region under the leadership of AfDB and UNECA with FAO's technical support. This Action Plan for Africa targets 40 countries for the next 5 years, starting with 12 countries in 2013 (work has already started in Tanzania). It will enhance the technical capacity of the countries to produce more reliable data using cost-effective and scientific methods, as well as digital and mobile technology, and remote sensing information.

References

AfDB, UNECA, FAO, African Union., (2011).: Improving Statistics for Food Security, Sustainable Agriculture, and Rural Development —- An Action Plan for Africa 2011-2015. Retrieved from http://www.fao.org/fileadmin/templates/ess/documents/meetings_and_workshops/Resource_Partners_Oct2011/AfDB_Agriculture_long_web_PrintVersion_Final_04July2011.pdf

FAO, World Bank, UNSC, . (2012): Action Plan of the Global Strategy to Improve Agricultural and Rural Statistics for Food Security, Sustainable Agriculture, and Rural Development. Retrieved from http://www.fao.org/docrep/016/i3082e/i3082e.pdf

Food and Agriculture Organization of the United Nations. (2006). **FAO, 2006:** Independent External Evaluation of the FAO, Inception Report submitted to the Council Committee for the Independent External Evaluation (CC-IEE) by the Independent External Evaluation Core Team, May 2006. Retrieved from ftp://ftp.fao.org/docrep/fao/meeting/012/k1080e.pdf

Food and Agriculture Organization of the United Nations. (2008). **FAO, 2008.** Independent External Evaluation of

FAO's Role and Work in Statistics. Retrieved from http://s3.amazonaws.com/zanran_storage/www.fao.org/ContentPages/41662790.pdf

Food and Agriculture Organization of the United Nations. (2011). **FAO, 2011:** Paper at the 22th 22nd Session of the African Commission on Agricultural Statistics (AFCAS), Addis Ababa, Ethiopia, 30 November to 3 December 2011: "Review of the Availability and Quality of Official Data from AFCAS Member Countries" (RAF/AFCAS/11-5b). Retrieved from http://www.fao.org/fileadmin/templates/ess/ess_test_folder/Workshops_Events/AFCAS_22/AFCAS_DOC_5b.pdf

Food and Agriculture Organization of the United Nations. (2013). **FAO, 2013:** CountrySTAT Phase Project. http://www.fao.org/economic/ess/ess-capacity/countrystat/projects/en/

Food and Agriculture Organization of the United Nations. **FAO**, World Bank., **UN**, (2010).: Global Strategy to Improve Agricultural and Rural Statistics. Retrieved from http://www.fao.org/fileadmin/templates/ess/documents/meetings_and_workshops/ICAS5/Ag_Statistics_Strategy_Final.pdf

Technical Notes

Key

The following conventions are used in the Tables:
.. or ( )= data not available or missing
0 or 0.0 = nil or negligible

Fertilizer consumption (kilograms per hectare of arable land)
Source: Africa Development Indicators (ADI), World Bank

Arable land (hectares)
Source: Africa Development Indicators (ADI), World Bank

Arable Land per capita (Ha per capita)
Source: Africa Development Indicators (ADI), World Bank

Arable land (% of land area)
Source: Africa Development Indicators (ADI), World Bank

Cereal cropland (% of land area)
Source: Africa Development Indicators (ADI), World Bank

Cereal production index (1999-2001 = 100)
Source: Africa Development Indicators (ADI), World Bank

Crop production index (1999-2001 = 100)
Source: Africa Development Indicators (ADI), World Bank

Cereal exports quantity (FAO, tonnes)
Source: Africa Development Indicators (ADI), World Bank

Cereal imports quantity (FAO, tonnes)
Source: Africa Development Indicators (ADI), World Bank

Real agricultural GDP growth rates (%)
Source: Africa Development Indicators (ADI), World Bank

Agriculture, value added (% of GDP)
Source: Africa Development Indicators (ADI), World Bank

Cereal Import (Quantity MT)
Source: World Development Indicators (WDI), World Bank

Tables with FAO data are from FAOSTAT website: http://faostat.fao.org

National Production data (Tonnes)
Source: FAOSTAT

Crop Yield Kg/Ha
Source: FAOSTAT

Tables with the data on Research and Development were obtained from Agricultural Science and Technology Indicators (ASTI) at www.asti.cgiar.org

- Public Agricultural R&D Expenditures as % of Agriculture GDP
- Agricultural R&D Spending per Researcher (Millions 2005 pppUS$)
- Agricultural R&D Spending per capita (2005 PPPUS$)
- Public Agricultural Research Staff per million Population
- Share of Crop Research in Total Agriculture Research (%)
- Research Staff (FTEs) Public Sector

Table with data on agriculture expenditure is from Regional Strategic Analysis and Knowledge Support System (ReSAKSS) and accessible at http://www.resakss.org/index.php?pdf=53180.

* Kenya 2010, 2011, 2012 data is from Central Bureau of Statistics

* Mali, Tanzania, and Uganda 2009, 2010, 2011, 2012 data are from the Countries Bureaus of Statistics and Ministries of Agriculture

Agriculture Expenditure (% Share of Total Expenditure) – ReSAKSS

Data on agriculture share of total ODA is from the OECD database and accessible at http://www.oecd.org

Agriculture share to total ODA gross disbursements (%).

Micro Indicators:

- Crop Production (kg) per Household
- Number of Agricultural Plots per Household
- Average Size of Agricultural Land (ha) per Household
- Fertilizer Use
- Use of Improved Seeds

Data on the following micro indicators Tables were provided by:

- Burkina Faso : "Enquête Agricole Permanente"
- Ghana Living Standards Survey and Ministry of Agriculture
- Kenya Ministry of Agriculture and Central Bureau of Statistics
- Malawi Ministry of Agriculture and Food Security (MoAFS)-- Agricultural Statistical Bulletins, Agricultural Crop Production Estimates (APES); Malawi Socio-Economic Database (MASEDA)/National Statistical Office
- Mali : "Enquête agricole de conjoncture"
- Mozambique *Instituto Nacional de Estatísticas (INE) (National Statistics Institute); Trabalho do Inquérito Agrícola* (TIA) (Annual agricultural survey), Direcção de Economia, Ministério da Agricultura, Maputo, Moçambique
- Niger "Enquête Prévision et Estimation des Récoltes"
- Rwanda National Agricultural Survey and Ministry of Agriculture and Animal Resources (MINAGRI)
- Sierra Leone Statistics Office
- Tanzania Ministry of Agriculture, Food Security and Cooperatives/Statistics Unit
- Uganda National Household Survey 2009/2000; Uganda Census of Agriculture 2008/2009;
- Zambia Ministry of Agriculture and Livestock, Agriculture Statistics Bulletin, Central Bureau of Statistics

AGRICULTURE DATA FOR THE SELECTED 16 COUNTRIES

TABLE 1: TOTAL POPULATION

Country	2000	2001	2002	2003	2004	2005
Burkina Faso	12,294,012	12,648,474	13,015,435	13,395,599	13,789,736	14,198,463
Ethiopia	65,577,897	67,303,731	69,040,669	70,784,012	72,526,620	74,263,861
Ghana	19,165,490	19,632,265	20,114,361	20,610,897	21,119,911	21,639,806
Kenya	31,253,701	32,076,186	32,927,864	33,805,301	34,702,176	35,614,576
Liberia	2,847,290	2,939,296	2,996,082	3,037,412	3,092,721	3,182,539
Libya	5,231,189	5,331,311	5,434,293	5,541,062	5,652,797	5,769,709
Malawi	11,228,756	11,529,337	11,833,102	12,144,945	12,472,794	12,822,587
Mali	11,295,324	11,639,798	12,001,887	12,380,104	12,772,264	13,176,642
Mozambique	18,200,656	18,691,461	19,200,021	19,721,009	20,246,287	20,770,013
Niger	10,922,421	11,308,134	11,706,182	12,118,322	12,546,945	12,993,884
Nigeria	123,688,536	126,704,722	129,832,447	133,067,097	136,399,438	139,823,340
Rwanda	8,098,344	8,456,968	8,696,378	8,857,859	9,009,655	9,201,727
South Sudan	6,631,346	6,824,267	7,009,780	7,198,267	7,401,951	7,632,757
Tanzania	34,038,161	34,917,073	35,832,494	36,788,281	37,786,946	38,831,024
Uganda	24,213,120	24,984,181	25,794,397	26,641,627	27,521,632	28,431,204
Zambia	10,201,562	10,449,825	10,693,471	10,938,261	11,192,422	11,462,365

TABLE 1: TOTAL POPULATION CONTINUED

Country	2006	2007	2008	2009	2010	2011
Burkina Faso	14,622,202	15,061,127	15,515,258	15,984,479	16,468,714	16,967,845
Ethiopia	75,993,403	77,718,436	79,446,419	81,187,751	82,949,541	84,734,262
Ghana	22,170,556	22,712,403	23,264,176	23,824,402	24,391,823	24,965,816
Kenya	36,540,948	37,485,246	38,455,418	39,462,188	40,512,682	41,609,728
Liberia	3,313,718	3,477,197	3,658,460	3,835,929	3,994,122	4,128,572
Libya	5,893,738	6,023,053	6,149,620	6,262,667	6,355,112	6,422,772
Malawi	13,195,329	13,589,404	14,005,113	14,442,290	14,900,841	15,380,888
Mali	13,592,796	14,020,786	14,459,990	14,909,813	15,369,809	15,839,538
Mozambique	21,290,952	21,811,326	22,332,900	22,858,607	23,390,765	23,929,708
Niger	13,460,138	13,945,662	14,450,007	14,972,257	15,511,953	16,068,994
Nigeria	143,338,939	146,951,477	150,665,730	154,488,072	158,423,182	162,470,737
Rwanda	9,441,406	9,710,531	10,004,092	10,311,275	10,624,005	10,942,950
South Sudan	7,968,599	8,438,853	8,976,845	9,507,428	9,948,304	10,314,021
Tanzania	39,923,609	41,068,185	42,267,667	43,524,738	44,841,226	46,218,486
Uganda	29,370,251	30,339,895	31,339,392	32,367,909	33,424,683	34,509,205
Zambia	11,750,105	12,055,384	12,379,612	12,723,746	12,926,409	13,474,959

TABLE 2: RURAL POPULATION

Country	2000	2001	2002	2003	2004	2005
Burkina Faso	10,100,268	10,298,059	10,500,697	10,708,469	10,921,692	11,140,540
Ethiopia	55,912,371	57,254,476	58,599,372	59,943,016	61,279,337	62,604,435
Ghana	10,741,491	10,856,250	10,972,384	11,089,075	11,204,958	11,318,917
Kenya	25,036,715	25,581,207	26,143,012	26,719,101	27,304,227	27,895,117
Liberia	1,585,058	1,626,166	1,647,276	1,659,551	1,679,131	1,716,948
Malawi	9,588,235	9,834,663	10,083,270	10,338,214	10,606,215	10,892,275
Mali	8,123,823	8,301,364	8,487,206	8,679,988	8,877,899	9,079,497
Mozambique	12,904,629	13,218,938	13,544,002	13,875,978	14,209,087	14,539,217
Niger	9,154,518	9,465,451	9,785,853	10,117,151	10,461,291	10,819,747
Nigeria	71,305,204	72,182,666	73,081,905	73,998,080	74,923,938	75,854,162
Rwanda	6,983,040	7,228,560	7,367,676	7,437,749	7,497,330	7,587,836
Sierra Leone	2,658,761	2,749,549	2,865,444	2,994,642	3,121,043	3,233,111
South Sudan	5,536,909	5,689,118	5,834,660	5,982,192	6,141,843	6,323,434
Tanzania	26,444,588	26,995,925	27,568,733	28,165,549	28,787,834	29,437,023
Uganda	21,287,691	21,907,329	22,557,613	23,236,401	23,939,747	24,664,638
Zambia	6,651,214	6,775,249	6,894,508	7,012,738	7,135,169	7,265,764

TABLE 2: RURAL POPULATION CONTINUED

Country	2006	2007	2008	2009	2010	2011
Burkina Faso	11,352,239	11,568,602	11,789,269	12,013,775	12,241,689	12,469,839
Ethiopia	63,901,789	65,188,048	66,469,482	67,754,750	69,049,686	70,313,846
Ghana	11,440,406	11,560,068	11,677,081	11,790,506	11,899,551	12,016,447
Kenya	28,482,134	29,076,031	29,682,737	30,310,196	30,963,438	31,629,968
Liberia	1,776,120	1,851,573	1,935,289	2,015,742	2,084,892	2,139,335
Malawi	11,195,999	11,517,074	11,855,692	12,211,649	12,584,803	12,966,765
Mali	9,279,720	9,482,650	9,687,644	9,894,092	10,101,500	10,307,453
Mozambique	14,863,043	15,184,478	15,504,750	15,825,882	16,149,452	16,459,906
Niger	11,184,190	11,562,962	11,955,589	12,361,215	12,779,367	13,197,722
Nigeria	76,829,385	77,810,219	78,797,273	79,791,853	80,794,239	81,860,556
Rwanda	7,761,478	7,958,033	8,173,183	8,397,935	8,625,630	8,850,746
Sierra Leone	3,325,042	3,401,568	3,466,567	3,526,600	3,586,473	3,643,125
South Sudan	6,590,446	6,967,488	7,399,039	7,822,978	8,171,736	8,451,907
Tanzania	30,098,648	30,790,132	31,512,997	32,268,544	33,057,400	33,858,554
Uganda	25,367,086	26,088,669	26,828,400	27,585,227	28,358,170	29,133,016
Zambia	7,398,501	7,539,775	7,690,240	7,850,246	7,920,657	8,197,437

TABLE 3: RURAL POPULATION (% OF TOTAL POPULATION)

Country	2000	2001	2002	2003	2004	2005
Burkina Faso	82.156	81.4174	80.6788	79.9402	79.2016	78.463
Ethiopia	85.261	85.0688	84.8766	84.6844	84.4922	84.3
Ghana	56.046	55.298	54.55	53.802	53.054	52.306
Kenya	80.108	79.7514	79.3948	79.0382	78.6816	78.325
Liberia	55.669	55.325	54.981	54.637	54.293	53.949
Malawi	85.39	85.3012	85.2124	85.1236	85.0348	84.946
Mali	71.922	71.3188	70.7156	70.1124	69.5092	68.906
Mozambique	70.902	70.7218	70.5416	70.3614	70.1812	70.001
Niger	83.814	83.7048	83.5956	83.4864	83.3772	83.268
Nigeria	57.649	56.9692	56.2894	55.6096	54.9298	54.25
Rwanda	86.228	85.4746	84.7212	83.9678	83.2144	82.461
Sierra Leone	64.173	63.8858	63.5986	63.3114	63.0242	62.737
South Sudan	83.496	83.366	83.236	83.106	82.976	82.846
Tanzania	77.691	77.3144	76.9378	76.5612	76.1846	75.808
Uganda	87.918	87.6848	87.4516	87.2184	86.9852	86.752
Zambia	65.198	64.836	64.474	64.112	63.75	63.388

TABLE 3: RURAL POPULATION (% OF TOTAL POPULATION) CONTINUED

Country	2006	2007	2008	2009	2010	2011
Burkina Faso	77.637	76.811	75.985	75.159	74.333	73.491
Ethiopia	84.0886	83.8772	83.6658	83.4544	83.243	82.9816
Ghana	51.6018	50.8976	50.1934	49.4892	48.785	48.1316
Kenya	77.9458	77.5666	77.1874	76.8082	76.429	76.0158
Liberia	53.599	53.249	52.899	52.549	52.199	51.8178
Malawi	84.8482	84.7504	84.6526	84.5548	84.457	84.3044
Mali	68.2694	67.6328	66.9962	66.3596	65.723	65.0742
Mozambique	69.8092	69.6174	69.4256	69.2338	69.042	68.7844
Niger	83.0912	82.9144	82.7376	82.5608	82.384	82.1316
Nigeria	53.5998	52.9496	52.2994	51.6492	50.999	50.3848
Rwanda	82.2068	81.9526	81.6984	81.4442	81.19	80.8808
Sierra Leone	62.4144	62.0918	61.7692	61.4466	61.124	60.7442
South Sudan	82.7052	82.5644	82.4236	82.2828	82.142	81.9458
Tanzania	75.3906	74.9732	74.5558	74.1384	73.721	73.2576
Uganda	86.37	85.988	85.606	85.224	84.842	84.421
Zambia	62.9654	62.5428	62.1202	61.6976	61.275	60.8346

TABLE 4: AGRICULTURE, VALUE ADDED (% OF GDP)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Africa	15.3	15.7	16.9	16.3	15.1	14.4	14.1	13.8	12.2	13.3	12.4	12.8
Burkina Faso	29.3	37.0	38.6	37.1	34.5	39.0	36.7	32.7	40.2	35.6	35.4	33.8
Ghana	39.4	39.3	39.2	40.2	41.5	40.9	30.4	29.0	31.0	31.8	29.8	25.6
Kenya	32.4	31.3	29.1	29.0	28.0	27.2	26.8	25.0	25.8	27.2	25.1	28.5
Liberia	76.1	77.4	80.1	73.5	66.1	67.0	63.8	65.6	67.2	58.0	57.3	53.1
Malawi	39.5	38.8	36.7	35.7	34.6	32.6	31.6	31.8	30.7	32.1	30.1	30.2
Mali	41.6	37.8	35.0	38.8	36.4	36.6	36.9	36.5	39.7	38.9		
Mozambique	24.0	22.5	27.8	28.0	26.7	26.4	27.1	27.0	28.5	29.0	29.8	29.8
Niger	37.8	40.0	39.6	39.6								
Nigeria			48.6	42.7	34.2	32.8	32.0	32.7				
Rwanda	37.2	37.3	35.4	38.3	38.6	38.4	38.4	35.6	32.4	33.9	32.2	31.9
Sierra Leone	58.4	48.7	49.6	49.6	51.8	52.5	53.6	55.6	57.2	59.1	57.1	57.6
Tanzania	33.5	32.9	32.5	32.5	33.3	31.8	30.4	30.0	29.7	28.8	28.1	27.7
Uganda	29.4	29.7	24.9	26.1	22.9	26.7	25.6	23.6	22.7	24.7	24.2	23.4
Zambia	22.2	22.0	22.1	22.8	23.4	22.8	21.6	20.8	21.0	21.6	20.4	19.5
Sub-Saharan Africa excluding South Africa	27.8	28.0	30.9	29.7	27.4	26.8	25.9	25.4	23.9	25.1	23.2	22.7

Source: World Development Indicators (WDI/ADI), World Bank

TABLE 5: REAL AGRICULTURAL GDP GROWTH RATES (%)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Africa	0.1	6.0	1.5	4.8	3.3	1.8	5.0	1.3	3.9	6.1	3.2	3.3
Burkina Faso	-3.7	20.5	5.7	7.3	-3.3	10.5						
Kenya	-1.3	11.7	-3.5	2.4	1.7	6.9	4.5	2.3	-4.3	-2.5	6.3	1.6
Liberia		25.1	32.0	-40.3	-16.0	7.4	5.7	13.3	14.0	13.7	10.5	9.0
Malawi	5.3	-6.0	5.9	3.9	2.8	-7.6	-0.4	11.1	4.2	13.1	2.0	6.9
Mali	-10.4	11.3	-3.6	17.7	-4.7	7.6	5.7	2.4	13.2			
Mozambique	-11.8	9.7	11.2	5.4	4.8	6.5	10.2	8.2	9.1	5.9	5.9	8.7
Niger	-8.4	13.2	1.9	6.0								
Rwanda	7.5	8.8	16.8	-2.9	2.1	6.5	3.0	2.6	6.4	7.7	5.0	4.7
Sierra Leone	7.8	-37.5										
Tanzania	4.5	4.9	5.0	3.2	5.9	4.4	3.9	4.0	4.6	3.2	4.1	3.4
Uganda	-0.4	7.9	7.1	2.1	1.6	2.0	0.5	0.1	1.3	3.5	0.3	2.7
Zambia	1.6	-2.6	-1.7	5.0	4.3	-0.6	2.2	0.4	2.6	7.2	6.6	7.7
Sub-Saharan Africa excluding South Africa	0.7	5.8	0.6	0.7	2.9	4.5	3.8	3.8	3.4	4.6	4.8	4.0

Source: Africa Development Indicators, World Bank

TABLE 6: PUBLIC AGRICULTURAL R&D EXPENDITURES AS % OF AGRICULTURE GDP

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008
Burkina Faso	0.8	0.4	0.9	0.6	0.7	0.5	0.4	0.4	0.4
Ethiopia	0.3	0.6	0.7	0.6	0.5	0.4	0.4	0.3	0.3
Ghana	0.6	0.5	0.5	0.6	0.6	0.6	0.7	0.8	0.9
Kenya	1.3	1.4	1.2	1.1	1.1	1.2	1.4	1.4	1.3
Mali	1.0	1.0	0.9	0.6	1.0	0.7	0.6	0.7	0.6
Mozambique					0.6	0.7	0.5	0.4	0.4
Niger	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3
Nigeria	0.2	0.3	0.3	0.3	0.4	0.3	0.4	0.4	0.4
Rwanda						0.6	0.6	0.6	0.5
Sierra Leone		0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.3
Uganda	0.8	0.7	1.0	1.3	1.4	1.1	1.0	1.1	1.2
Tanzania	0.4	0.2	0.3	0.4	0.3	0.2	0.3	0.4	0.5
Zambia	0.7	0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.3
Sub-Saharan Africa	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	0.9
Average 16 countries	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.6	0.6

Source: IFPRI/ASTI (Agriculture Science and Technology Indicators)

TABLE 7: AGRICULTURAL R&D SPENDING PER CAPITA (2005 PPPUS$)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008
Burkina Faso	2.0	1.3	2.9	2.0	2.0	1.6	1.5	1.3	1.3
Ethiopia	0.8	1.4	1.5	1.3	1.2	1.1	1.1	1.0	0.9
Ghana	2.1	2.0	2.0	2.6	2.6	2.4	2.9	3.3	4.1
Kenya	4.8	5.0	4.0	3.6	3.4	3.7	4.6	4.5	4.4
Malawi	1.2	1.6							
Mali	3.2	3.2	2.6	2.0	3.1	2.4	2.1	2.2	1.9
Mozambique					0.9	1.1	1.0	0.8	0.8
Niger	0.4	0.4	0.4	0.4	0.6	0.5	0.4	0.4	0.4
Nigeria	1.5	2.3	2.2	2.1	2.2	1.8	2.0	2.1	2.7
Rwanda						1.9	1.8	1.8	8.5
Sierra Leone		0.7	0.9	1.0	0.9	0.8	1.1	0.9	1.1
Uganda	1.6	1.6	2.0	2.7	2.6	2.5	2.3	2.6	2.8
Tanzania	1.3	0.8	1.1	1.5	1.4	0.8	1.2	1.6	1.8
Zambia	1.4	0.9	0.9	0.8	0.8	0.6	0.6	0.8	0.6
Sub-Saharan Africa	3.0	3.6	3.8	3.6	3.5	3.6	3.3	3.1	3.2
Average 15 countries	1.8	1.8	1.9	1.8	1.8	1.6	1.7	1.8	2.4

Source: ASTI (Agriculture Science and Technology Indicators) IFPRI

TABLE 8: AGRICULTURE SHARE TO TOTAL ODA GROSS DISBURSEMENTS (%)

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010
Burkina Faso	7.4	9.2	7.2	7.3	2.5	7.3	8.4	7.2	8.6
Ethiopia	3.6	4.8	4.1	3.4	1.0	3.3	2.3	10.2	4.0
Ghana	3.0	3.6	1.7	4.0	1.0	6.1	8.9	7.2	11.5
Kenya	6.5	6.1	4.7	3.2	7.3	6.2	6.9	4.4	5.9
Liberia	0.0	44.4	19.1	28.7	19.7	9.6	4.0	12.1	4.6
Malawi	2.9	10.1	11.8	12.1	2.2	6.3	11.2	18.5	19.3
Mali	8.7	5.4	5.4	9.9	2.3	6.1	13.5	8.2	9.6
Mozambique	1.4	2.8	3.5	3.7	1.4	2.4	2.1	1.7	3.1
Niger	7.0	1.2	1.5	3.1	2.4	5.5	4.7	7.5	10.5
Nigeria	1.1	3.0	2.9	0.3	0.2	1.4	3.2	2.0	5.1
Rwanda	2.5	0.3	0.8	0.6	0.2	0.5	1.0	1.7	4.5
Sierra Leone	0.5	2.3	2.0	3.5	1.9	2.1	3.5	2.1	2.4
South Africa	1.7	15.8	21.5	12.3	12.5	10.1	13.2	12.7	17.6
Tanzania	2.4	1.8	3.6	5.6	1.5	5.2	4.9	4.2	2.2
Uganda	2.0	2.7	2.1	3.1	0.8	2.8	3.3	2.5	2.3
Zambia	1.7	2.7	2.0	1.9	0.9	4.6	4.9	3.5	4.2

Source: OECD database

TABLE 9: AGRICULTURE EXPENDITURE (% SHARE OF TOTAL EXPENDITURE)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Burkina Faso	25	18	23.8	33	20	12	20	16	14	9	11		
Ethiopia	10.4	4.0	5.6	8.4	13.6	16.5	17.5	14.6	11.7				
Ghana	3.2	4.7	6.9	5.8	8.8	9.8	10.3	9.9	10.2	9.0			
Kenya*	6.8	6.6	5.4	4.1	5.1	6.6	5.9	4.4	4.8	1.9	6.7	8.7	6.8
Liberia							4.0	5.5	8.6	2.3			
Malawi	8.8	4.9	8.7	6.6	7.0	11.1	11.0	13.2	31.6	24.7			
Mali*	8.9	12.8	8.9	9.6	11.4	15.5	10.6	11.0	12.7	16.9	13.9	23.9	
Mozambique					6.2	4.4	3.4	3.9					
Niger		15.8	16.6	16.4	19.5	14.5	15.1	15.4	12.2	12.1			
Nigeria	1.6	6.0	3.5	1.9	3.1	3.4	4.1	4.4	4.6	5.3	5.7		
Rwanda		6.2	8.6	3.9	4.0	3.4	3.3						
Sierra Leone		2.4	2.3	3.1	3.0	2.3	2.9				1.2	0.2	
Tanzania*			4.5	6.8	5.7	4.7	5.8	5.8	2.5	7.6	7.8	6.8	
Uganda*	2.6	1.6	2.6	2.3	2.1	2.0	3.0	3.0	3.2	4.5	3.8	3.1	4.5
Zambia	8.6	6.2	5.2	6.1	6.1	7.2	9.3	13.2	12.5	9.3			

Source: ReSAkss (Regional Strategic Analysis and Knowledge Support System)
*Kenya 2010, 2011, 2012 data is from Central Bureau of Statistics
*Mali, Tanzania, and Uganda 2009, 2010, 2011, 2012 data is from the Countries Bureaus of Statistics

TABLE 10: NATIONAL CROP PRODUCTION (TONNES)

Country	Crop	2000	2001	2002
Burkina faso	Cassava	2,147	3,492	4,200
	Cow peas, dry	127,682	444,712	441,015
	Groundnuts, with shell	169,146	220,525	265,322
	Maize	423,494	799,052	1,076,750
	Millet	725,613	1,196,250	828,741
	Rice, paddy	103,087	93,516	240,866
	Sorghum	1,016,280	1,552,910	1,505,540
	Soybeans	3,475	6,500	23,056
	Sweet potatoes	27,366	70,815	140,061
Ethiopia	Beans, dry	147,210	160,000	340,280
	Groundnuts, with shell	11,929	34,150	71,607
	Maize	2,682,940	3,911,870	4,986,130
	Millet	320,090	397,390	634,826
	Rice, paddy	15,000	11,244	90,412
	Sorghum	1,188,080	2,200,240	3,959,900
	Soybeans	4,500	3,812	15,824
	Sweet potatoes	300,000	408,796	592,396
Ghana	Cassava	8,106,800	9,567,000	14,240,900
	Groundnuts, with shell	209,000	420,000	465,103
	Maize	1,012,700	1,171,000	1,683,980
	Millet	169,400	185,000	183,921
	Rice, paddy	248,700	287,000	463,975
	Sorghum	279,800	305,000	287,069
	Sweet potatoes	92,059	95,000	130,000
Kenya	Beans, dry	331,426	382,307	577,674
	Cassava	418,621	347,819	679,167
	Cow peas, dry	38,264	36,184	81,534
	Groundnuts, with shell	30,000	21,000	12,803
	Maize	2,160,000	2,905,560	3,376,860
	Millet	44,623	53,101	73,396
	Pigeon peas	65,604	96,092	84,313
	Rice, paddy	52,349	62,677	111,229
	Sorghum	81,536	149,656	159,877
	Soybeans	2,384	3,101	4,335
	Sweet potatoes	527,954	671,709	759,471
Liberia	Cassava	440,500	532,614	495,000
	Groundnuts, with shell	4,800	5,500	5,100
	Rice, paddy	183,400	154,800	300,000
	Soybeans	3,138	4,127	3,100
	Sweet potatoes	21,946	21,939	22,000

TABLE 10: NATIONAL CROP PRODUCTION (TONNES) CONTINUED

Country	Crop	2000	2001	2002
Malawi	Beans, dry	58,227	85,759	288,414
	Cassava	2,794,620	2,197,640	4,259,300
	Cow peas, dry	54,000	51,309	31,928
	Groundnuts, with shell	122,281	141,078	304,868
	Maize	2,501,310	1,225,230	3,699,150
	Millet	19,508	15,970	32,911
	Pigeon peas	99,261	63,883	195,516
	Rice, paddy	71,601	41,270	117,733
	Sorghum	36,799	18,175	73,330
	Soybeans		40,000	69,596
Mali	Cassava	14,787	56,062	45,900
	Cow peas, dry	100,126	94,642	132,500
	Groundnuts, with shell	193,073	279,503	316,000
	Maize	214,548	634,464	1,298,230
	Millet	759,114	1,157,810	1,462,140
	Rice, paddy	742,599	945,823	1,741,470
	Sorghum	564,661	629,127	1,191,020
	Soybeans	2,302	2,124	1,900
	Sweet potatoes	47,077	133,129	207,000
Mozambique	Cassava	5,361,970	4,782,420	6,267,160
	Groundnuts, with shell	124,290	93,000	67,000
	Maize	1,180,430	942,000	2,090,790
	Millet	31,698	15,000	57,292
	Rice, paddy	180,806	65,000	192,934
	Sorghum	193,112	115,000	502,875
	Sweet potatoes	430,000	915,000	860,858
Niger	Beans, dry	8,000	9,500	10,849
	Cassava	164,515	119,600	97,812
	Cow peas, dry	268,700	586,100	1,517,140
	Groundnuts, with shell	113,216	139,100	395,669
	Maize	3,920	951	6,366
	Millet	1,679,170	2,652,400	2,926,180
	Rice, paddy	60,453	59,902	21,729
	Sorghum	370,716	943,900	807,268
	Sweet potatoes	46,649	49,900	56,203
Nigeria	Cassava	32,010,000	41,565,000	52,403,500
	Cow peas, dry	2,150,000	2,815,000	1,860,800
	Groundnuts, with shell	2,901,000	3,478,000	2,962,760
	Maize	4,107,000	5,957,000	9,180,270
	Millet	6,105,000	7,168,000	1,271,100
	Rice, paddy	3,298,000	3,567,000	4,567,320
	Sorghum	7,711,000	9,178,000	6,897,060
	Soybeans	429,000	565,000	563,810
	Sweet potatoes	2,468,000	3,205,000	2,725,000

TABLE 10: NATIONAL CROP PRODUCTION (TONNES) CONTINUED

Country	Crop	2000	2001	2002
Rwanda	Beans, dry	215,347	199,648	331,166
	Cassava	820,992	781,639	2,579,400
	Groundnuts, with shell	7,032	10,099	14,756
	Maize	62,501	97,251	525,679
	Millet	4,000	4,000	8,624
	Rice, paddy	11,654	62,194	80,541
	Sorghum	155,106	227,927	151,754
	Soybeans	13,922	23,703	37,426
	Sweet potatoes	1,032,920	885,648	845,099
Sierra Leone	Cassava	240,891	330,000	512,912
	Groundnuts, with shell	14,704	104,730	85,530
	Maize	8,902	39,051	41,553
	Millet	3,636	20,000	32,926
	Rice, paddy	199,134	738,000	1,078,010
	Sorghum	8,100	23,000	36,657
	Sweet potatoes	28,091	27,000	39,532
Uganda	Beans, dry	420,000	478,000	464,105
	Cassava	4,966,000	5,576,000	4,753,430
	Cow peas, dry	64,000	71,000	86,701
	Groundnuts, with shell	139,000	159,000	175,000
	Maize	1,096,000	1,170,000	2,551,000
	Millet	534,000	672,000	984,000
	Pigeon peas	78,000	85,000	94,861
	Rice, paddy	109,000	153,000	233,000
	Sorghum	361,000	449,000	437,000
	Soybeans	120,000	158,000	180,000
	Sweet potatoes	2,398,000	2,604,000	2,554,000
Zambia	Cassava	815,248	1,056,000	1,266,300
	Groundnuts, with shell	51,971	74,218	174,728
	Maize	1,040,000	866,187	2,496,430
	Millet	46,875	29,583	38,000
	Rice, paddy	13,936	13,337	46,130
	Sorghum	30,245	18,714	24,765
	Soybeans	28,311	45,000	13,000
	Sweet potatoes	52,000	66,926	236,611

TABLE 11: CROP YIELD (KG/HA)

Country	Crop	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Burkina Faso	Cassava	1,900	2,496	2,545	2,696	2,772	2,798	2,949	2,303	1,756	1,302	1,367	1,355
	Cow peas, dry	470	470	466	470	470	470	470	470	470	470	470	470
	Groundnuts, with shell	714	910	945	886	696	803	694	590	938	722	830	683
	Maize	1,754	1,812	1,738	1,528	1,267	1,806	1,944	1,174	1,666	1,529	1,434	1,536
	Millet	637	763	716	842	778	913	960	817	796	774	843	725
	Rice, paddy	2,568	1,880	1,901	2,000	1,505	1,779	2,572	1,700	2,436	2,315	2,024	1,768
	Sorghum	830	928	925	960	973	1,092	1,139	937	986	920	1,004	895
	Soybeans	852	1,305	1,112	1,151	1,155	1,099	1,142	1,125	2,729	1,454	1,256	887
	Sweet potatoes	13,317	7,842	6,171	13,304	6,917	8,333	12,573	9,064	11,091	12,697	10,274	19,033
Ethiopia	Beans, dry	672	626	490	647	728	664	846	997	1,043	1,235	1,487	1,434
	Groundnuts, with shell	880	884	821	1,449	1,073	963	1,228	1,376	1,112	1,123	1,117	1,444
	Maize	1,620	1,743	1,875	1,532	1,613	2,006	2,640	1,969	2,137	2,224	2,199	2,493
	Millet	887	912	1,088	1,001	1,059	1,186	1,279	1,061	1,213	1,373	1,421	1,548
	Rice, paddy	1,829	1,843	1,818	1,806	1,846	1,802	1,869	1,843	1,880	2,038	2,160	2,009
	Sorghum	1,175	1,139	1,365	1,336	1,310	1,455	1,576	1,484	1,510	1,736	1,836	1,842
	Soybeans	918	834	962	445	320	1,142	920	920	1,076	1,267	1,532	1,405
	Sweet potatoes	10,000	11,317	9,967	10,591	9,942	8,125	7,293	8,443	7,948	8,431	9,013	8,954
Ghana	Cassava	12,281	12,344	12,249	12,685	12,423	12,756	12,200	12,764	13,515	13,807	15,433	16,013
	Groundnuts, with shell	959	1,016	1,354	945	903	933	1,083	883	1,341	1,442	1,502	1,304
	Maize	1,458	1,315	1,490	1,627	1,579	1,561	1,499	1,544	1,737	1,697	1,887	1,646
	Millet	814	696	804	851	789	1,000	825	695	1,064	1,315	1,240	1,029
	Rice, paddy	2,159	2,019	2,280	2,041	2,025	2,392	2,000	1,702	2,274	2,410	2,713	2,350
	Sorghum	969	850	938	976	963	1,000	984	743	1,200	1,312	1,285	1,179
	Sweet potatoes	1,361	1,365	1,406	1,401	1,397	1,387	1,417	1,495	1,558	1,638	1,635	1,769
Kenya	Beans, dry	430	381	518	478	353	370	534	508	413	484	567	557
	Cassava	6,945	7,768	7,344	7,902	11,100	9,101	9,586	7,419	13,736	11,643	5,252	11,231
	Cow peas, dry	382	385	486	310	234	498	542	640	324	484	430	412
	Groundnuts, with shell	1,765	1,713	1,190	1,129	1,039	1,129	1,325	1,506	902	1,039	565	603
	Maize	1,440	1,701	1,513	1,622	1,929	1,641	1,720	1,813	1,393	1,294	1,725	1,584
	Millet	479	428	609	588	446	575	575	934	724	516	544	660
	Pigeon peas	382	448	567	535	541	533	564	619	430	393	651	608
	Rice, paddy	3,771	3,409	3,462	3,757	3,728	3,932	2,806	2,872	1,308	1,933	4,238	3,968
	Sorghum	666	857	801	854	564	1,223	801	947	522	572	727	629
	Soybeans	913	996	861	793	1,010	991	827	840	781	715	950	2,500
	Sweet potatoes	8,838	9,000	8,500	10,000	9,412	27,649	9,670	13,280	14,252	11,961	9,974	12,269

TABLE 11: CROP YIELD (KG/HA) CONTINUED

Country	Crop	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Liberia	Cassava	6,575	6,621	6,750	6,533	6,719	6,783	6,024	7,051	7,671	7,836	8,020	7,984
	Groundnuts, with shell	600	624	564	694	639	683	600	609	617	686	676	680
	Rice, paddy	1,278	1,115	917	833	917	1,290	1,262	1,449	1,553	1,184	1,179	1,200
	Soybeans	413	419	429	445	445	465	403	410	401	400	388	422
	Sweet potatoes	12,032	12,072	12,126	10,000	9,855	10,388	10,000	7,051	10,000	10,425	9,025	10,747
Malawi	Beans, dry	404	508	432	472	365	367	484	494	479	602	530	1,032
	Cassava	15,461	16,942	14,964	15,745	16,164	14,300	17,312	18,772	19,076	20,291	20,431	21,541
	Cow peas, dry	634	694	631	674	550	434	496	688	646	517	392	452
	Groundnuts, with shell	723	856	767	827	704	568	830	1,014	914	1,031	1,008	1,045
	Maize	1,743	1,185	1,046	1,226	1,046	809	1,481	2,655	1,650	2,227	2,016	2,208
	Millet	570	597	611	635	464	388	652	719	725	632	512	710
	Pigeon peas	724	781	754	792	672	410	872	987	893	1,048	1,014	1,027
	Rice, paddy	1,645	1,858	1,643	1,621	1,168	842	1,758	1,948	1,820	2,126	1,863	1,913
	Sorghum	669	680	720	762	645	266	769	859	831	797	609	818
	Soybeans	-	-	-	759	645	580	764	897	872	980	976	981
Mali	Cassava	11,589	8,991	11,589	11,524	17,898	14,680	18,018	16,224	15,754	18,075	15,392	15,300
	Cow peas, dry	388	352	276	355	328	308	333	222	320	470	539	530
	Groundnuts, with shell	967	710	700	850	733	1,079	794	981	981	897	933	929
	Maize	1,332	1,158	1,146	1,424	1,313	1,493	1,730	1,683	1,973	3,186	2,682	1,404
	Millet	704	694	511	667	672	780	755	741	897	915	939	640
	Rice, paddy	2,105	2,010	1,971	2,297	1,592	2,285	2,553	2,762	3,366	2,307	3,359	2,097
	Sorghum	837	737	695	886	664	845	839	826	1,037	1,343	1,031	707
	Soybeans	1,648	1,615	1,447	1,807	1,736	1,717	1,603	1,215	621	627	688	679
	Sweet potatoes	9,921	12,409	15,804	14,756	16,523	15,967	18,652	19,060	20,234	19,123	18,805	18,818
Mozambique	Cassava	5,791	7,163	5,810	5,882	6,002	4,328	7,770	7,752	3,382	4,522	6,000	6,424
	Groundnuts, with shell	461	460	361	299	307	317	291	349	277	191	237	233
	Maize	940	958	877	869	809	766	852	1,098	1,132	1,199	1,194	1,293
	Millet	586	526	530	540	538	536	399	435	453	450	455	523
	Sweet potatoes	7,167	6,923	5,738	7,310	7,200	7,078	7,265	7,294	7,076	7,143	7,077	7,720
Nigeria	Cassava	9,700	9,601	9,901	10,402	11,001	10,990	12,000	11,203	11,800	11,768	12,216	14,023
	Cow peas, dry	600	600	630	660	660	680	690	624	680	1,022	1,178	583
	Groundnuts, with shell	1,500	1,550	1,520	1,530	1,550	1,590	1,720	1,293	1,230	1,127	1,362	1,265
	Maize	1,300	1,400	1,490	1,500	1,600	1,660	1,818	1,705	1,957	2,196	1,850	1,528
	Millet	1,050	1,300	1,311	1,380	1,450	1,530	1,550	1,600	1,848	1,302	1,185	440
	Rice, paddy	1,500	1,300	1,340	1,410	1,420	1,430	1,483	1,300	1,754	1,931	1,839	1,771
	Sorghum	1,120	1,100	1,100	1,156	1,220	1,260	1,350	1,160	1,223	1,115	1,440	1,410
	Soybeans	830	840	859	890	900	940	960	909	970	1,516	1,011	926
	Sweet potatoes	2,999	3,001	3,000	3,129	3,141	3,241	3,391	2,150	3,000	2,871	2,896	2,899

TABLE 11: CROP YIELD (KG/HA) CONTINUED

Country	Crop	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Rwanda	Beans, dry	646	704	690	672	621	638	795	919	915	944	1,026	969
	Cassava	6,815	5,791	7,904	7,478	5,720	6,756	6,436	6,492	6,524	11,167	12,043	12,352
	Groundnuts, with shell	522	653	655	612	571	631	557	584	549	666	699	646
	Maize	702	767	876	767	767	889	800	723	1,153	1,950	2,342	2,053
	Millet	800	862	753	800	800	800	800	726	915	1,251	1,270	1,604
	Rice, paddy	2,732	3,067	3,266	3,667	3,796	4,467	4,484	4,132	4,443	5,618	5,183	5,520
	Sorghum	890	949	1,073	954	913	1,159	1,100	1,010	1,006	1,193	1,209	1,272
	Soybeans	471	553	546	553	497	563	641	793	825	822	789	780
	Sweet potatoes	5,914	6,000	6,615	5,901	5,570	5,963	5,725	5,699	5,517	6,510	7,488	8,054
Sierra Leone	Cassava	5,182	5,455	4,815	5,417	5,431	5,156	5,000	5,000	5,000	5,000	5,171	5,777
	Groundnuts, with shell	773	769	768	766	759	765	768	680	686	700	740	706
	Maize	929	1,031	787	1,004	974	976	814	840	840	920	1,450	1,066
	Millet	908	885	907	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,068	1,008
	Rice, paddy	1,087	1,000	1,005	1,013	1,004	1,135	1,432	1,360	1,430	1,780	1,870	1,785
	Sorghum	1,300	1,083	1,072	1,050	1,347	1,046	667	909	956	1,182	1,262	1,191
	Sweet potatoes	2,640	2,500	2,466	2,476	2,455	2,455	2,500	2,500	2,500	2,500	2,128	2,642
Uganda	Beans, dry	601	699	699	673	560	577	499	500	491	489	489	406
	Cassava	12,384	13,500	13,500	13,457	13,514	14,408	12,997	12,883	12,744	12,601	12,728	11,154
	Cow peas, dry	1,000	908	894	1,000	986	1,000	1,000	1,042	1,068	1,091	1,063	950
	Groundnuts, with shell	699	702	701	602	701	707	670	702	709	731	732	742
	Maize	1,742	1,801	1,800	1,831	1,440	1,500	1,536	1,495	1,469	2,500	2,300	2,400
	Millet	1,391	1,501	1,490	1,600	1,600	1,600	1,601	1,675	1,748	1,828	1,921	2,033
	Pigeon peas	1,000	1,000	1,000	1,000	1,000	1,000	1,023	1,023	1,023	1,011	947	1,025
	Rice, paddy	1,514	1,500	1,500	1,535	1,301	1,500	1,363	1,361	1,390	2,393	2,507	2,589
	Sorghum	1,289	1,500	1,498	1,452	1,400	1,527	1,429	1,452	1,486	1,101	1,101	1,201
	Soybeans	1,132	1,134	1,099	1,133	1,097	1,097	1,207	1,197	1,203	1,200	1,167	1,200
	Sweet potatoes	4,321	4,397	4,401	4,387	4,402	4,414	4,500	4,502	4,519	4,542	4,577	4,803
Zambia	Cassava	4,941	6,192	5,775	5,800	5,800	5,867	5,792	5,792	5,783	5,804	5,817	6,228
	Groundnuts, with shell	393	382	682	682	682	686	872	482	581	591	643	728
	Maize	1,772	1,378	1,410	1,726	1,924	1,859	1,899	2,334	2,244	2,069	2,587	2,410
	Millet	717	748	749	583	674	755	750	490	973	875	945	967
	Rice, paddy	1,133	1,256	1,286	1,409	1,375	1,286	973	1,513	1,383	1,639	1,678	1,678
	Sorghum	770	771	764	549	580	859	601	659	298	678	959	894
	Soybeans	1,707	604	1,125	1,200	1,297	1,324	1,371	1,601	1,827	1,600	1,608	1,300
	Sweet potatoes	14,857	14,722	17,002	14,722	14,883	14,872	14,470	14,551	14,592	15,419	16,858	18,390

TABLE 12: CEREAL YIELD (KG PER HECTARE)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Africa	1,270	1,293	1,322	1,323	1,382	1,341	1,453	1,361	1,457	1,532	1,534	1,546
Burkina Faso	859	968	943	996	941	1,127	1,204	936	1,040	1,002	1,063	995
Ghana	1,309	1,186	1,349	1,396	1,373	1,432	1,335	1,317	1,598	1,660	1,814	1,594
Kenya	1,375	1,640	1,489	1,594	1,806	1,646	1,647	1,773	1,418	1,243	1,710	1,514
Liberia	1,278	1,115	917	833	917	1,290	1,262	1,449	1,553	1,184	1,179	1,200
Malawi	1,676	1,176	1,046	1,209	1,021	778	1,445	2,467	1,599	2,124	1,907	2,094
Mali	1,007	986	792	979	864	1,090	1,125	1,101	1,398	1,588	1,617	996
Mozambique	868	880	827	818	773	741	782	988	978	1,010	1,006	1,110
Niger	290	401	412	442	347	437	451	426	488	380	490	378
Nigeria	1,172	1,234	1,255	1,309	1,373	1,422	1,508	1,400	1,598	1,530	1,527	1,331
Rwanda	848	914	1,027	944	959	1,184	1,118	1,015	1,279	1,748	1,930	1,950
Sierra Leone	1,078	998	996	1,012	1,011	1,118	1,348	1,290	1,350	1,658	1,768	1,669
Tanzania	1,442	2,047	1,903	860	1,370	1,100	1,339	1,449	1,325	1,110	1,647	1,361
Uganda	1,539	1,641	1,639	1,678	1,468	1,532	1,523	1,525	1,538	2,063	1,997	2,099
Zambia	1,682	1,403	1,419	1,703	1,816	1,902	1,816	2,255	2,184	2,070	2,537	2,359
Sub-Saharan Africa excluding South Africa	1,011	1,054	1,037	1,033	1,087	1,070	1,178	1,151	1,177	1,189	1,271	1,263

Source: Africa Development Indicators, World Bank

TABLE 13: CEREAL PRODUCTION (METRIC TONS)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Africa	111,648,038	116,404,405	119,022,355	132,824,718	133,423,673	141,961,977	149,609,819	138,844,715	155,251,486	160,078,666	164,520,095	157,096,146
Burkina Faso	2,286,232	3,109,089	3,119,049	3,564,283	2,901,971	3,649,529	3,680,674	3,108,809	4,358,519	3,626,640	4,560,543	3,666,398
Ghana	1,710,619	1,626,669	2,155,214	2,040,843	1,830,246	1,948,024	1,919,026	1,672,835	2,296,824	2,607,169	2,906,717	2,618,987
Kenya	2,591,351	3,370,458	3,045,522	3,351,499	3,199,023	3,585,081	3,937,106	3,614,396	2,866,391	2,898,900	4,346,745	4,057,825
Liberia	183,400	145,000	110,000	100,000	110,000	154,800	164,000	231,800	295,150	293,000	296,090	300,000
Malawi	2,631,033	1,865,671	1,710,582	2,143,179	1,717,994	1,302,375	2,786,285	3,440,140	2,845,839	3,807,969	3,610,284	3,924,974
Mali	2,309,976	2,583,937	2,531,977	3,402,383	2,845,036	3,398,787	3,693,414	3,885,586	4,814,961	6,334,621	6,415,655	5,777,886
Mozambique	1,587,046	1,506,705	1,360,634	1,510,923	1,324,957	1,139,300	1,747,080	1,883,911	2,364,550	2,546,575	2,505,600	2,846,177
Niger	2,127,605	3,161,875	3,243,543	3,568,096	2,730,417	3,669,196	4,046,849	3,857,105	4,803,822	3,451,311	5,203,231	3,773,305
Nigeria	21,370,000	20,090,000	21,373,000	22,736,000	24,321,000	26,031,000	28,864,000	27,171,000	30,209,000	21,228,630	24,589,770	22,047,750
Rwanda	239,705	285,527	308,447	297,669	318,944	413,314	365,674	356,533	465,966	621,861	745,579	857,282
Sierra Leone	222,472	334,600	466,479	496,093	618,853	824,691	1,158,933	656,252	759,668	985,555	1,153,222	1,197,620
Tanzania	3,626,771	4,540,698	6,372,648	4,114,080	6,704,070	5,386,300	5,719,296	6,313,178	7,651,930	5,807,305	8,636,698	7,779,297
Uganda	2,112,000	2,309,000	2,368,000	2,508,000	2,274,000	2,459,000	2,557,000	2,631,000	2,722,857	3,795,734	3,905,390	4,228,000
Zambia	1,208,056	949,460	754,966	1,365,260	1,379,513	1,065,904	1,603,978	1,535,977	1,393,901	2,196,541	3,097,621	2,761,387
Sub-Saharan Africa excluding South Africa	72,754,849	78,268,906	77,772,408	85,543,282	85,557,288	95,191,257	102,548,843	99,425,809	107,885,007	104,268,105	116,466,984	109,283,345

Source: Africa Development Indicators, World Bank

TABLE 14: AVERAGE SIZE OF AGRICULTURAL LAND (HA) PER HOUSEHOLD

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Burkina Faso	3.6	3.3	3.4	3.3	3.3		3.3	3.5		5			
Ghana	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Kenya						0.7							
Malawi	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7
Mali	5	3	2	4	4	3	4	4	4	6	4	5	
Mozambique	1.4		1.6	1.6		1.8	1.6	1.7	1.6		1.5		1.0
Niger						3.1	2.7	2.9	2.8	3.0	2.9	2.8	
Rwanda									0.5				
Tanzania				2	2				2			2.4	
Uganda	1.6					0.9			1.1				

Source: AGRA Baseline Studies

TABLE 15: NUMBER OF AGRICULTURAL PLOTS PER HOUSEHOLD

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Burkina Faso	8.5	8.0	7.8	7.7	7.8		7.8	7.9		12			
Ghana	2	2.0	2.0	2.0	2	2.0	2.0	2.0	2	2.0	2.0	2.0	2
Malawi	2.3	2.2	2.2	2.1	2.1	2.0	2.0	1.9	1.9	1.8	1.8	1.7	1.7
Mali	3.6	3.4	3.1	3.4	3.3	2.9	4.4	3.2	3.2	4.5	3.8	3.5	
Niger						3.3	3.0	2.6	2.8	2.1	2.6	2.4	
Uganda	4.0					7.0							

Source: Ministries of Agriculture

TABLE 16: ARABLE LAND (HECTARES PER PERSON)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Africa	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.22
Burkina Faso	0.30	0.36	0.36	0.38	0.33	0.35	0.32	0.33	0.39	0.36	0.36	0.34
Ghana	0.21	0.21	0.21	0.20	0.19	0.18	0.19	0.19	0.19	0.20	0.19	0.19
Kenya	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.13
Liberia	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11
Malawi	0.24	0.25	0.24	0.25	0.24	0.25	0.25	0.22	0.24	0.24	0.24	0.23
Mali	0.41	0.40	0.41	0.48	0.39	0.43	0.42	0.41	0.40	0.42	0.41	0.43
Mozambique	0.21	0.21	0.23	0.23	0.23	0.22	0.23	0.22	0.21	0.23	0.22	0.22
Niger	1.28	1.24	1.19	1.16	1.13	1.09	1.05	1.07	1.03	1.00	0.96	0.93
Nigeria	0.24	0.24	0.25	0.24	0.24	0.25	0.26	0.26	0.25	0.22	0.23	0.22
Rwanda	0.11	0.12	0.13	0.12	0.12	0.12	0.12	0.11	0.12	0.12	0.11	0.11
Sierra Leone	0.12	0.16	0.20	0.20	0.23	0.25	0.28	0.18	0.19	0.19	0.19	0.18
Tanzania	0.25	0.24	0.24	0.23	0.25	0.25	0.24	0.24	0.27	0.26	0.26	0.25
Uganda	0.22	0.22	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.20	0.20	0.20
Zambia	0.28	0.26	0.24	0.26	0.26	0.24	0.26	0.24	0.25	0.26	0.29	0.25
Sub-Saharan Africa excluding South Africa	0.26	0.26	0.25	0.26	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.24

Source: Africa Development Indicators, World Bank

TABLE 17: ARABLE LAND (% OF LAND AREA)

Country	2000	2001	2002	2003	2004	2005
Africa	6.7	6.8	6.9	7.1	7.1	7.3
Burkina Faso	13.5	16.8	17.2	18.6	16.8	17.9
Ethiopia	10.0	10.7	9.6	10.9	10.9	12.4
Ghana	17.4	17.8	18.4	18.4	17.6	17.6
Kenya	8.6	9.0	8.9	9.0	9.2	9.2
Liberia	3.9	3.9	3.9	3.9	3.9	3.9
Malawi	29.2	30.2	30.2	31.8	31.8	33.9
Mali	3.8	3.8	4.0	4.9	4.1	4.6
Mozambique	5.0	5.1	5.7	5.7	5.8	5.7
Niger	11.0	11.0	11.0	11.1	11.2	11.2
Nigeria	32.9	32.9	35.1	35.1	36.2	38.4
Rwanda	36.5	40.5	45.2	44.3	45.4	45.2
Sierra Leone	6.8	9.4	12.4	13.1	15.7	18.1
South Sudan						
Tanzania	9.7	9.6	9.7	9.6	10.7	11.0
Uganda	26.5	27.0	28.0	29.3	29.8	29.8
Zambia	3.8	3.7	3.5	3.9	3.8	3.7

TABLE 17: ARABLE LAND (% OF LAND AREA) CONTINUED

Country	2006	2007	2008	2009	2010	2011
Africa	7.4	7.5	7.7	7.6	7.7	7.8
Burkina Faso	17.2	17.9	22.3	20.8	21.9	20.8
Ethiopia	12.9	13.4	14.0	13.6	13.9	14.6
Ghana	18.5	18.9	19.8	20.4	20.7	21.1
Kenya	9.3	9.3	9.3	9.7	9.7	9.7
Liberia	4.0	4.0	4.2	4.5	4.7	4.7
Malawi	35.0	31.8	36.1	37.1	38.2	38.2
Mali	4.7	4.8	4.7	5.1	5.1	5.6
Mozambique	6.1	6.1	6.1	6.6	6.6	6.6
Niger	11.2	11.8	11.8	11.8	11.8	11.8
Nigeria	40.6	41.2	40.6	37.3	39.5	39.5
Rwanda	45.7	44.6	48.7	49.0	49.5	49.5
Sierra Leone	20.8	14.1	15.1	15.2	15.4	15.4
South Sudan						
Tanzania	11.0	11.3	12.8	13.0	13.1	13.1
Uganda	30.5	31.3	32.3	33.0	33.8	33.8
Zambia	4.1	4.0	4.1	4.5	5.0	4.6

TABLE 18: ARABLE LAND (HECTARES)

Country	2000	2001	2002	2003	2004	2005
Africa	197,221,000	199,503,000	202,198,000	208,152,700	208,487,000	214,196,000
Burkina Faso	3,700,000	4,600,000	4,700,000	5,100,000	4,600,000	4,900,000
Ethiopia	10,000,000	10,712,000	9,600,000	10,928,000	10,928,000	12,364,000
Ghana	3,950,000	4,060,000	4,181,000	4,185,000	4,000,000	4,000,000
Kenya	4,891,000	5,128,000	5,091,000	5,146,000	5,258,000	5,264,000
Liberia	380,000	380,000	380,000	380,000	380,000	380,000
Malawi	2,750,000	2,850,000	2,850,000	3,000,000	3,000,000	3,200,000
Mali	4,589,000	4,615,000	4,900,000	5,942,000	5,002,000	5,603,000
Mozambique	3,900,000	4,000,000	4,450,000	4,500,000	4,600,000	4,500,000
Niger	13,980,000	13,975,000	13,970,000	14,070,000	14,125,000	14,148,000
Nigeria	30,000,000	30,000,000	32,000,000	32,000,000	33,000,000	35,000,000
Rwanda	900,000	1,000,000	1,116,000	1,094,000	1,119,000	1,116,000
Sierra Leone	490,000	672,000	886,000	940,000	1,128,000	1,295,000
Tanzania	8,600,000	8,530,000	8,600,000	8,540,000	9,500,000	9,700,000
Uganda	5,300,000	5,400,000	5,600,000	5,850,000	5,950,000	5,950,000
Zambia	2,816,000	2,722,000	2,582,000	2,874,000	2,862,000	2,727,000

TABLE 18: ARABLE LAND (HECTARES) CONTINUED

Country	2006	2007	2008	2009	2010	2011
Africa	216,794,300	219,134,800	224,912,700	223,425,400	227,409,100	228,205,500
Burkina Faso	4,700,000	4,900,000	6,100,000	5,700,000	6,000,000	5,700,000
Ethiopia	12,923,000	13,396,000	14,038,000	13,606,000	13,948,000	14,565,000
Ghana	4,200,000	4,300,000	4,500,000	4,650,000	4,700,000	4,800,000
Kenya	5,310,000	5,300,000	5,300,000	5,500,000	5,500,000	5,500,000
Liberia	385,000	385,000	400,000	430,000	450,000	450,000
Malawi	3,300,000	3,000,000	3,400,000	3,500,000	3,600,000	3,600,000
Mali	5,677,000	5,808,000	5,761,000	6,261,000	6,261,000	6,861,000
Mozambique	4,800,000	4,800,000	4,800,000	5,200,000	5,200,000	5,200,000
Niger	14,167,000	14,958,000	14,955,000	14,940,000	14,940,000	14,940,000
Nigeria	37,000,000	37,500,000	37,000,000	34,000,000	36,000,000	36,000,000
Rwanda	1,128,000	1,100,000	1,201,000	1,210,000	1,220,000	1,220,000
Sierra Leone	1,487,000	1,011,000	1,084,000	1,090,000	1,100,000	1,100,000
Tanzania	9,700,000	10,000,000	11,325,700	11,500,000	11,600,000	11,600,000
Uganda	6,100,000	6,250,000	6,450,000	6,600,000	6,750,000	6,750,000
Zambia	3,013,00	2,949,000	3,052,000	3,350,000	3,700,000	3,400, 000

TABLE 19: CEREAL CROPLAND (% OF LAND AREA)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Africa	3.0	3.1	3.1	3.4	3.3	3.6	3.5	3.5	3.6	3.6	3.7	3.8
Burkina Faso	9.7	11.7	12.1	13.1	11.3	11.8	11.2	12.1	15.3	13.2	15.7	13.5
Ghana	5.7	6.0	7.0	6.4	5.9	6.0	6.3	5.6	6.3	6.9	7.0	7.2
Kenya	3.3	3.6	3.6	3.7	3.1	3.8	4.2	3.6	3.6	4.1	4.5	4.7
Liberia	1.5	1.3	1.2	1.2	1.2	1.2	1.3	1.7	2.0	2.6	2.6	2.6
Malawi	16.7	16.8	17.4	18.8	17.9	17.8	20.5	14.8	18.9	19.0	20.1	19.9
Mali	1.9	2.1	2.6	2.8	2.7	2.6	2.7	2.9	2.8	3.3	3.3	4.8
Mozambique	2.3	2.2	2.1	2.4	2.2	2.0	2.8	2.4	3.1	3.2	3.2	3.3
Niger	5.8	6.2	6.2	6.4	6.2	6.6	7.1	7.2	7.8	7.2	8.4	7.9
Nigeria	20.0	17.9	18.7	19.1	19.5	20.1	21.0	21.3	20.8	15.2	17.7	18.2
Rwanda	11.5	12.7	12.2	12.8	13.5	14.2	13.3	14.2	14.8	14.4	15.7	17.8
Sierra Leone	2.9	4.7	6.5	6.8	8.5	10.3	12.0	7.1	7.9	8.3	9.1	10.0
Tanzania	2.8	2.5	3.8	5.4	5.5	5.5	4.8	4.9	6.5	5.9	5.9	6.5
Uganda	6.9	7.0	7.2	7.5	7.8	8.0	8.4	8.6	8.9	9.2	9.8	10.1
Zambia	1.0	0.9	0.7	1.1	1.0	0.8	1.2	0.9	0.9	1.4	1.6	1.6
Sub-Saharan Africa excluding South Africa	3.2	3.3	3.4	3.7	3.5	4.0	3.9	3.9	4.1	3.9	4.1	4.3

Source: Africa Development Indicators, World Bank

TABLE 20: FERTILIZER CONSUMPTION BY NUTRIENT

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010
Africa	**4,101,547**	**4,477,018**	**4,721,745**	**4,586,313**	**4,429,217**	**4,442,932**	**4,823,747**	**4,188,453**	**4,547,679**
Nitrogen Fertilizers (N total nutrients)	2,628,073	2,991,871	3,116,957	3,106,110	2,813,116	2,788,844	3,243,707	2,738,988	3,010,738
Phosphate Fertilizers (P205 total nutrients)	1,010,056	989,554	1,090,777	1,004,667	1,032,742	1,097,256	1,018,536	1,091,176	1,153,050
Potash Fertilizers (K20 total nutrients)	463,418	495,593	514,011	475,536	583,359	556,832	561,504	358,289	383,891
Burkina Faso	**2,010**	**52,996**	**57,687**	**74,694**	**63,000**	**49,495**	**57,207**	**53,876**	**56,571**
Nitrogen Fertilizers (N total nutrients)	2,010	26,620	29,081	35,435	30,000	23,580	30,584	28,392	41,122
Phosphate Fertilizers (P205 total nutrients)	-	13,417	14,494	22,147	18,000	13,354	13,460	12,742	7,726
Potash Fertilizers (K20 total nutrients)	-	12,959	14,112	17,112	15,000	12,561	13,163	12,742	7,723
Ethiopia	**167,624**	**62,315**	**127,464**	**139,803**	**149,111**	**225,168**	**234,026**	**246,354**	**318,203**
Nitrogen Fertilizers (N total nutrients)	97,647	34,075	81,860	80,503	84,628	106,019	111,773	118,364	156,141
Phosphate Fertilizers (P205 total nutrients)	69,977	28,240	45,604	59,300	64,483	119,149	122,253	127,990	162,062
Potash Fertilizers (K20 total nutrients)	-	-	-	-	-	-	-	-	-
Ghana	**15,660**	**28,621**	**52,802**	**23,995**	**84,251**	**76,368**	**65,473**	**89,183**	**45,774**
Nitrogen Fertilizers (N total nutrients)	4,330	8,559	5,702	11,105	30,171	25,924	18,374	24,844	12,433
Phosphate Fertilizers (P205 total nutrients)	120	2,834	3,584	6,306	15,196	13,340	9,933	42,938	28,558
Potash Fertilizers (K20 total nutrients)	11,210	17,228	43,516	6,584	38,884	37,104	37,166	21,401	4,783
Kenya	**139,051**	**170,316**	**145,546**	**180,695**	**176,052**	**192,895**	**176,424**	**175,214**	**166,909**
Nitrogen Fertilizers (N total nutrients)	62,724	68,061	64,724	72,514	77,667	79,441	73,071	67,372	70,788
Phosphate Fertilizers (P205 total nutrients)	75,461	90,378	70,165	93,143	85,245	99,143	97,673	93,168	75,853
Potash Fertilizers (K20 total nutrients)	866	11,877	10,657	15,038	13,140	14,311	5,680	14,674	20,268
Malawi	**84,684**	**93,232**	**103,218**	**97,574**	**121,521**	**125,156**	**111,376**	**102,630**	**118,790**
Nitrogen Fertilizers (N total nutrients)	60,083	60,989	71,630	66,172	82,959	84,330	89,264	70,671	86,098
Phosphate Fertilizers (P205 total nutrients)	18,022	20,662	23,747	19,676	24,016	25,369	12,489	16,654	16,802
Potash Fertilizers (K20 total nutrients)	6,579	11,581	7,841	11,726	14,546	15,457	9,623	15,305	15,890
Mali	**-**	**-**	**260,312**	**87,925**	**99,355**	**180,340**	**70,468**	**48,148**	**173,487**
Nitrogen Fertilizers (N total nutrients)	-	-	152,803	59,289	66,469	87,331	55,817	30,377	89,259
Phosphate Fertilizers (P205 total nutrients)	-	-	95,632	16,133	18,523	84,837	8,657	12,410	57,029
Potash Fertilizers (K20 total nutrients)	-	-	11,877	12,503	14,363	8,172	5,994	5,361	27,199

Source: FAOSTAT

TABLE 20: FERTILIZER CONSUMPTION BY NUTRIENT CONTINUED

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mozambique	**26,600**	**3,313**	**10,395**	**7,137**	**22,751**	**13,836**	**61,653**	**22,184**	**46,327**
Nitrogen Fertilizers (N total nutrients)	17,700	1,836	3,414	6,400	17,168	11,464	41,860	15,133	43,385
Phosphate Fertilizers (P205 total nutrients)	2,000	1,360	3,473	439	2,835	1,079	10,363	4,678	2,587
Potash Fertilizers (K20 total nutrients)	6,900	117	3,508	298	2,748	1,293	9,430	2,373	355
Niger	**8,541**	**4,126**	**3,385**	**5,475**	**7,459**	**5,297**	**2,289**	**5,893**	**7,490**
Nitrogen Fertilizers (N total nutrients)	6,525	2,519	2,117	2,786	4,049	2,508	1,558	3,304	4,829
Phosphate Fertilizers (P205 total nutrients)	1,821	1,276	653	1,628	2,117	2,200	383	1,608	1,969
Potash Fertilizers (K20 total nutrients)	195	331	615	1,061	1,293	589	348	981	692
Nigeria	**153,982**	**214,935**	**159,079**	**259,104**	**369,431**	**155,587**	**283,303**	**72,177**	**100,698**
Nitrogen Fertilizers (N total nutrients)	125,131	167,778	116,343	213,221	216,854	70,115	140,846	44,847	80,140
Phosphate Fertilizers (P205 total nutrients)	13,734	21,480	18,663	20,698	80,687	39,922	63,840	11,211	10,802
Potash Fertilizers (K20 total nutrients)	15,117	25,677	24,073	25,185	71,890	45,550	78,617	16,119	9,756
Rwanda	**-**	**2,449**	**2,035**	**3,400**	**3,886**	**8,824**	**10,753**	**1,444**	**94**
Nitrogen Fertilizers (N total nutrients)	-	877	709	1,214	589	2,573	2,799	535	94
Phosphate Fertilizers (P205 total nutrients)	-	793	622	1,087	1,528	4,247	4,317	455	-
Potash Fertilizers (K20 total nutrients)	-	779	704	1,099	1,769	2,004	3,637	454	-
Uganda	**7,463**	**9,331**	**8,758**	**5,756**	**7,652**	**7,497**	**18,976**	**13,746**	**11,606**
Nitrogen Fertilizers (N total nutrients)	3,651	4,328	3,951	2,578	4,389	3,968	10,644	7,046	6,366
Phosphate Fertilizers (P205 total nutrients)	2,126	2,976	3,298	2,018	2,172	2,171	5,493	4,152	2,811
Potash Fertilizers (K20 total nutrients)	1,686	2,027	1,509	1,160	1,091	1,358	2,839	2,548	2,429
United Republic of Tanzania	**31,818**	**38,050**	**50,247**	**55,818**	**52,357**	**50,716**	**52,966**	**86,533**	**76,255**
Nitrogen Fertilizers (N total nutrients)	22,192	26,590	34,469	33,530	39,222	41,448	43,426	66,942	58,341
Phosphate Fertilizers (P205 total nutrients)	5,281	6,390	9,725	16,825	11,552	8,992	9,264	14,951	8,055
Potash Fertilizers (K20 total nutrients)	4,345	5,070	6,053	5,463	1,583	276	276	4,640	9,859
Zambia	**67,325**	**75,221**	**85,587**	**76,312**	**77,365**	**95,354**	**117,980**	**91,511**	**99,190**
Nitrogen Fertilizers (N total nutrients)	40,335	42,816	60,177	51,637	49,225	55,754	53,215	64,145	77,617
Phosphate Fertilizers (P205 total nutrients)	13,470	14,559	11,414	4,790	8,553	11,587	8,889	6,226	8,425
Potash Fertilizers (K20 total nutrients)	13,520	17,846	13,996	19,885	19,587	28,013	55,876	21,140	13,148

Source: FAOSTAT

TABLE 21: IMPORT OF QUANTITY (MT) IN NUTRIENTS (N,P205, K20)

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010
Africa	2,069,275	2,292,192	2,566,435	2,633,717	2,729,241	2,461,356	2,664,697	2,370,438	2,664,676
Burkina Faso	2,032	52,996	57,669	74,694	63,000	48,702	56,910	53,876	56,571
Ethiopia	167,624	62,315	202,019	219,179	168,050	249,381	278,790	421,728	460,891
Ghana	15,660	28,621	52,802	23,995	84,251	76,368	65,473	89,183	45,774
Kenya	143,246	183,060	239,307	205,185	205,598	139,049	148,165	203,726	182,221
Malawi	49,024	52,707	37,866	96,438	54,857	100,964	111,194	102,450	118,790
Mali	-	-	170,316	62,717	73,522	47,439	43,851	20,925	138,268
Mozambique	26,600	3,313	10,395	7,137	22,751	13,836	61,653	22,184	46,327
Niger	9,076	3,365	3,300	6,269	9,280	5,297	2,289	5,893	7,490
Nigeria	153,982	214,935	159,079	259,104	369,431	155,587	283,303	72,177	100,698
Rwanda	-	2,449	2,035	3,400	3,886	8,824	10,752	1,444	94
Uganda	7,463	9,408	8,873	5,758	7,690	7,534	19,086	13,763	11,634
United Republic of Tanzania	30,440	46,265	60,557	96,138	70,862	70,066	82,552	116,060	112,817
Zambia	67,754	75,971	93,519	77,386	79,482	97,301	121,258	93,774	102,709

Source: FAOSTAT

TABLE 22: PROPORTION OF FARMERS USING INORGANIC FERTILIZER (%)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Ghana	46.0	54.0	48.0	53.0	54.0	55.0	53.0	51.0	56.0	55.0		
Kenya						52.1						
Malawi						42.0	65.0	53.3	75.0	61.0	61.0	
Mali						13.4	13.4	39.7	8.5	14.0	13.8	51.2
Mozambique	4.0		4.0	3.0		4.0	5.0	4.0	3.0			
Niger						7.0	10.0	9.0	12.0	12.0	11.0	16.0
Rwanda									16.0		26	31.0
Tanzania				8.0								13.0
Uganda	2.5					1.0			7.5			

Source: Ministries of Agriculture in the respective countries

TABLE 23: FERTILIZER CONSUMPTION (KILOGRAMS PER HECTARE OF ARABLE LAND)

Country	2002	2003	2004	2005	2006	2007	2008	2009
Burkina Faso	0.4	10.9	11.9	15.4	12.6	9.5	9.1	9.1
Ghana	3.7	6.8	13.2	6.0	20.1	17.4	14.9	20.3
Kenya	27.3	33.1	27.7	34.3	33.2	36.4	33.3	32.4
Malawi	29.7	32.7	34.4	32.5	40.5	41.7	31.8	28.5
Mali	0.0	0.0	52.0	15.7	17.5	31.1	12.2	7.6
Mozambique	6.0	0.7	2.3	1.6	4.7	2.9	12.8	4.4
Niger	0.6	0.3	0.2	0.4	0.5	0.4	0.2	0.4
Nigeria	4.8	6.7	4.8	7.4	10.0	4.1	7.7	2.1
Rwanda	0.0	2.1	1.8	3.0	3.4	7.4	8.3	1.1
Tanzania	3.5	4.0	5.3	5.9	5.5	5.3	5.5	8.7
Uganda	1.3	1.6	1.5	1.0	1.3	1.2	3.0	2.1
Zambia	26.1	26.2	29.9	28.0	25.7	32.3	38.7	27.3

Source: Africa Development Indicators (ADI), World Bank

TABLE 24: PROPORTION OF FARMERS USING IMPROVED SEED (%)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Burkina Faso							6.5	7.2					
Ghana	10	8	8	11	10	10	12	13	10	14	12	12	
Malawi		50	33	67	13	46	28	53	35	43			
Mali							10		12	19	17	23	21
Mozambique						6	9	10					
Niger						11	13	12	14	14	13	14	
Rwanda									14				
Sierra Leone												3	23
Tanzania				18				17	17			23	
Uganda	9					7			29				

Source: Ministries of Agriculture in the respective countries

TABLE 25: CEREAL EXPORTS QUANTITY (TONNES)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Africa	2,125,104	2,697,170	2,757,041	2,573,528	2,441,497	4,148,315	2,618,779	3,176,277	2,710,227	3,563,572	3,620,576
Burkina Faso	59,250	76,131	25,744	18,649	70,027	13,954	26,283	17,320	11,287	17,704	34,989
Ghana	2,381	1,935	42,245	2,733	2,102	476	2,604	12,271	267	400	8,823
Kenya	18,973	10,159	32,984	16,159	18,017	15,290	21,904	55,080	30,048	18,856	83,323
Liberia		2,000	50	2,050	4,926	3,426	3	58	58	58	58
Malawi	11,000	13,652	3,240	55,799	15,457	691	3,302	410,325	31,132	15,417	26,085
Mali	12,800	7,855	14,086	11,727	38,333	18,677	34,200	6,198	4,271	206	1,513
Mozambique			6,514	3,812	14,440	2,544	105,463	20,635	29,849	15,788	62,199
Niger	140	277	1,226	2,864	2,071	1,134	16,000	16,639	30,133	30,133	40,922
Nigeria	29,273	66,805	96,072	12,126	1,864	14,691	11,694	15,662	5,070	260	259
Rwanda				1,524	14	206	655	3,106	8,073	371	2,059
Tanzania	104,282	118,592	190,415	337,225	259,508	128,055	85,873	323,860	136,096	71,295	224,465
Uganda	7,610	25,064	44,126	37,051	79,755	75,680	109,581	103,872	72,966	105,060	210,554
Zambia	19,990	15,107	7,870	34,999	97,477	69,181	60,340	238,304	237,522	71,403	124,700
Sub-Saharan Africa excluding South Africa	583,448	586,314	771,715	766,080	872,117	561,744	741,798	1,561,612	955,534	828,129	1,748,422

Source: Africa Development Indicators, World Bank

TABLE 26: CEREAL IMPORTS QUANTITY (TONNES)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Africa	45,116,690	45,081,622	52,092,349	44,409,048	45,773,275	55,121,723	54,780,589	58,276,352	58,729,880	63,771,200	66,373,532
Burkina Faso	263,248	284,648	271,449	218,126	212,496	288,456	295,192	249,168	204,611	374,991	354,838
Ghana	450,771	576,677	541,066	985,130	1,109,585	926,658	852,184	835,961	824,950	804,523	685,409
Kenya	1,165,016	1,119,461	707,824	781,993	882,984	969,633	1,098,720	1,135,995	1,100,199	2,710,750	1,419,992
Liberia	216,515	176,187	202,716	206,602	228,586	272,410	346,925	256,564	261,971	357,109	339,289
Malawi	72,181	90,674	498,386	117,516	88,328	170,335	168,518	122,885	258,625	214,564	199,076
Mali	113,766	217,583	323,942	279,511	163,761	415,691	395,938	266,563	252,302	242,162	213,702
Mozambique	426,058	563,216	695,848	729,671	838,216	1,004,143	1,321,988	872,567	714,476	1,018,757	958,235
Niger	256,825	306,877	336,686	249,880	344,834	416,216	300,084	294,428	320,238	172,405	326,314
Nigeria	3,051,062	3,966,597	3,658,462	3,825,029	4,008,413	4,950,839	4,229,692	4,224,114	4,066,464	4,981,116	5,872,160
Rwanda	41,301	44,725	53,949	47,468	61,016	65,238	100,157	116,857	56,281	131,245	231,784
Sierra Leone	141,825	190,232	457,472	195,285	63,423	114,659	175,228	146,583	245,559	135,430	142,350
Tanzania	546,363	580,214	537,954	763,787	1,026,137	603,722	1,039,971	876,200	547,646	950,557	1,226,334
Uganda	172,333	62,793	205,588	280,742	472,925	558,428	583,495	500,448	439,472	513,748	463,743
Zambia	69,391	105,867	235,242	251,348	165,677	214,552	274,943	38,574	48,029	70,352	17,474
Sub-Saharan Africa excluding South Africa	15,750,025	17,446,064	19,151,471	20,163,713	20,665,595	23,501,854	24,064,405	22,240,082	23,095,601	29,062,794	27,689,498

Source: Africa Development Indicators, World Bank

TABLE 27: AGRICULTURAL R&D SPENDING PER RESEARCHER (MILLIONS 2005 PPPUS$)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008
Burkina Faso	0.11	0.07	0.16	0.11	0.11	0.09	0.08	0.08	0.08
Ethiopia	0.07	0.11	0.10	0.08	0.08	0.07	0.07	0.06	0.05
Ghana	0.09	0.09	0.09	0.12	0.12	0.11	0.13	0.15	0.18
Kenya	0.17	0.18	0.14	0.14	0.13	0.14	0.18	0.17	0.17
Malawi	0.09	0.13							
Mali	0.14	0.14	0.09	0.07	0.12	0.10	0.11	0.11	0.08
Mozambique					0.11	0.11	0.09	0.07	0.07
Niger	0.04	0.05	0.05	0.05	0.07	0.06	0.06	0.06	0.07
Nigeria	0.15	0.22	0.21	0.20	0.20	0.16	0.18	0.18	0.20
Rwanda						0.17	0.17	0.16	0.17
Sierra Leone		0.06	0.08	0.09	0.10	0.09	0.10	0.08	0.09
Uganda	0.16	0.16	0.22	0.30	0.31	0.30	0.25	0.27	0.29
Tanzania	0.08	0.05	0.06	0.09	0.08	0.04	0.07	0.10	0.11
Zambia	0.09	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04
Sub-Saharan Africa	0.12	0.12	0.14	0.14	0.14	0.14	0.14	0.13	0.13
Average 15 countries	0.11	0.11	0.11	0.12	0.12	0.11	0.12	0.12	0.12

Source: ASTI (Agriculture Science and Technology Indicators) IFPRI

TABLE 28: PUBLIC AGRICULTURAL RESEARCH STAFF PER MILLION POPULATION

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008
Burkina Faso	18.0	17.5	18.3	19.2	18.8	18.2	17.5	16.4	15.7
Ethiopia	11.5	12.6	14.1	15.1	15.1	15.4	15.7	16.4	16.3
Ghana	23.6	23.0	21.4	21.9	22.4	22.2	22.0	22.4	23.0
Kenya	27.7	27.7	28.1	26.9	26.8	26.6	26.2	25.7	26.1
Malawi	13.4	12.4							
Mali	22.1	23.5	28.7	28.0	26.2	23.6	19.2	20.0	24.6
Mozambique					8.2	9.5	10.4	10.8	11.8
Niger	10.0	9.4	8.7	8.0	7.7	7.5	6.8	6.6	6.4
Nigeria	10.5	10.5	10.4	10.5	10.8	11.3	11.5	11.7	13.6
Rwanda						10.8	10.7	10.9	48.9
Sierra Leone		11.2	11.0	10.9	9.0	9.1	10.2	10.8	12.0
Uganda	10.4	9.9	9.1	9.0	8.3	8.5	9.5	9.4	9.4
Tanzania	15.8	17.3	17.2	17.2	17.4	17.3	16.8	15.6	15.9
Zambia	16.3	13.8	13.7	13.4	12.1	12.3	12.2	14.3	16.5
Sub-Saharan Africa	22.5	23.3	23.2	22.4	22.3	21.6	21.9	22.0	23.4
Average 15 countries	16.3	15.7	16.4	16.4	15.2	14.8	14.5	14.7	18.5

Source: ASTI (Agriculture Science and Technology Indicators) IFPRI

TABLE 29: SHARE OF CROP RESEARCH IN TOTAL AGRICULTURE RESEARCH (%)

Country	2000	2001	2008	2009
Burkina Faso		25.4	29.3	
Ethiopia	51.7		55.1	
Ghana		61.7	63.7	
Kenya	33		37.6	
Malawi	68			
Mali		36	46.3	
Mozambique			31.1	
Niger		47.4	38.3	
Nigeria	47.5		37.7	
Rwanda				59.9
Sierra Leone			69	
Uganda	56.6		40.9	
Tanzania	43.8		51.9	
Zambia	49.2		59.5	
Sub-Saharan Africa	50.5	41.7	48.1	59.9
Average 16 countries	50.0	42.6	46.7	59.9

Source: ASTI (Agriculture Science and Technology Indicators) IFPRI

TABLE 30: RESEARCH STAFF (FTES) PUBLIC SECTOR

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008
Burkina Faso	210.5	211.2	228.0	247.2	250.2	250.1	249.2	241.3	239.9
Ethiopia	750.7	850.3	976.2	1068.1	1098.1	1148.5	1201.5	1291.0	1318.3
Ghana	460.9	460.7	437.5	458.3	479.9	486.2	492.3	512.7	537.1
Kenya	870.8	892.7	931.5	914.2	933.3	952.5	962.6	970.5	1011.5
Malawi	154.3	146.3							
Mali	232.8	252.3	315.9	316.0	302.4	279.3	232.0	248.5	312.6
Mozambique					165.6	197.8	223.0	237.1	263.3
Niger	110.2	107.0	102.2	97.6	97.6	97.9	92.3	92.8	93.4
Nigeria	1313.4	1338.0	1356.6	1411.8	1490.4	1596.5	1653.5	1733.2	2062.0
Rwanda						99.8	101.6	106.3	104.2
Sierra Leone		48.8	49.8	51.5	44.2	46.3	53.6	58.6	66.6
Uganda	254.3	248.9	235.6	241.2	229.5	243.4	281.1	288.6	298.6
Tanzania	539.3	606.6	616.8	636.6	659.9	675.4	671.9	644.4	673.5
Zambia	170.8	147.7	150.7	150.1	139.2	144.7	146.0	176.6	208.5
Sub-Saharan Africa	320.1	299.1	311.1	311.2	313.0	316.7	322.8	332.5	350.1
Average 16 countries	460.7	442.5	491.0	508.4	490.9	478.3	489.3	507.8	553.0

Source: ASTI (Agriculture Science and Technology Indicators) IFPRI

Notes

Notes

Notes

ALLIANCE FOR A GREEN REVOLUTION IN AFRICA (AGRA)

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