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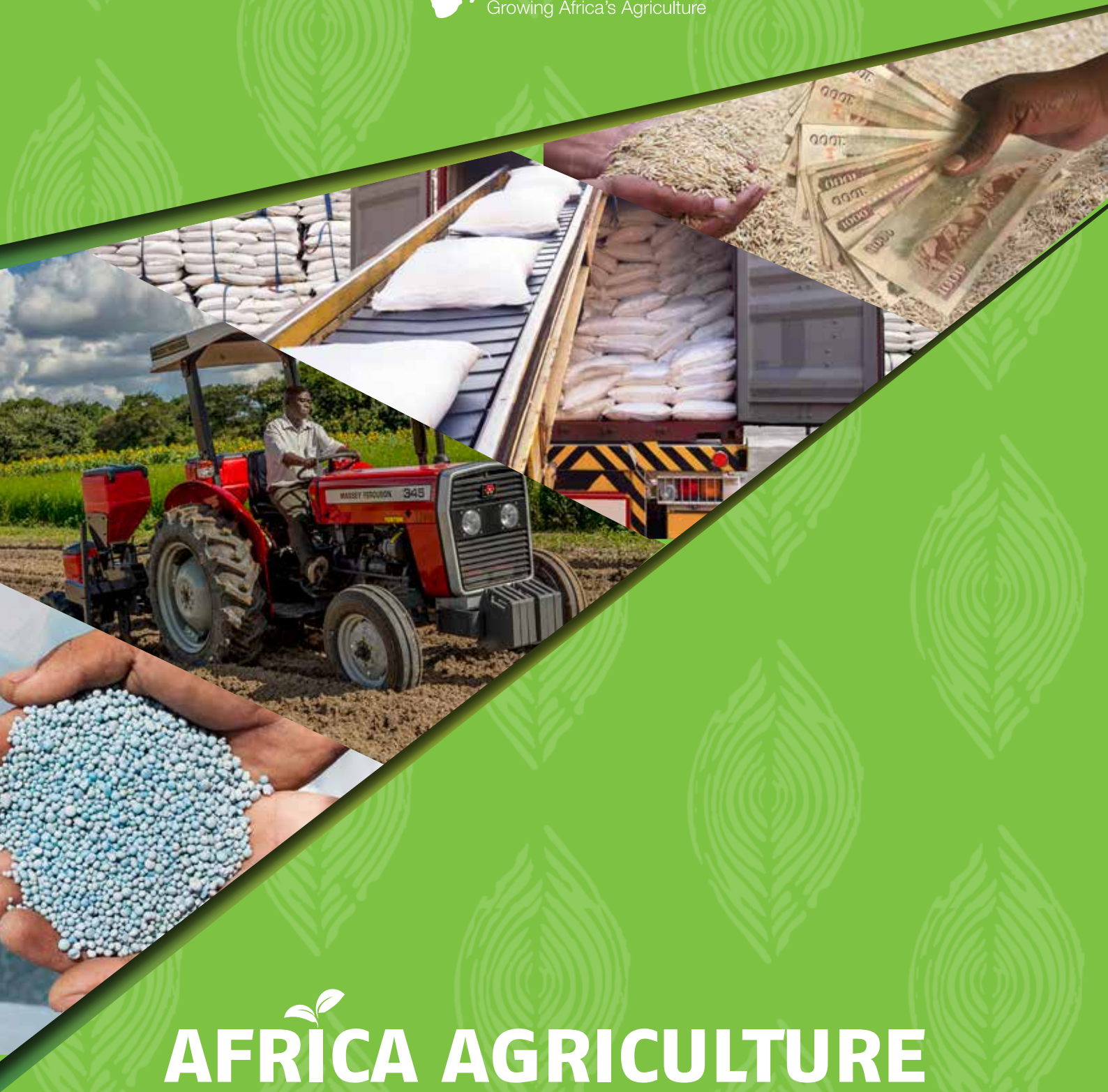

AFRICA AGRICULTURE STATUS REPORT 2017

The Business of Smallholder Agriculture in Sub-Saharan Africa

Africa Agriculture Status Report 2017

THE BUSINESS OF SMALLHOLDER AGRICULTURE IN SUB-SAHARAN AFRICA

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Foreword

This year's Africa Agriculture Status Report (AASR) is particularly close to my heart, as it speaks to an issue that I have passionately advocated for all my professional life. As I indicated in my recently released book, A Bucket of Water, when I insisted for many years that small-scale farms were as much businesses as large-scale operations, my views were considered at best romantic and at worst foolish. Never mind that 500 million smallholder farms around the world provide livelihoods for more than 2 billion people and produce about 80% of the food in sub-Saharan Africa and Asia. Few senior business or government leaders seriously believed that farmers working small plots of land could be considered part of the "business community". Today, the concept of smallholder farms as a business has become commonplace. That this Report is focusing on the "Business of Smallholder Agriculture" is a strong testimony that the concept has fully taken root in Africa. In fact, it is now becoming widely accepted that smallholder farmers in Africa, who make up to about 70% of the population, constitute the largest private sector group in African agriculture.

As we ponder the challenges that are likely to come with the rapidly growing population, projected to be well over 9 billion people by 2050, one would imagine that we need grand solutions. Perhaps the world requires larger and more heavily mechanized farms that can generate the much-needed food. The efficiency of modern tractors working large-scale farms may strike many as the obvious answer. Yet this is not the case. In Brazil, for example, smallholder farmers using mixed cropping on 8-hectare plots generate one job, while large- scale mechanized monocultures take 67 hectares to create one job. In other words, smallholder farms are eight times more effective at job creation, according to data from the Food and Agriculture Organization of the United Nations (FAO). In China, small farms produce one-fifth of all the world's food on 10% of the globe's land. Supporting smallholder agriculture, then, is not a romantic notion of doing good for the poor. It makes good business sense.

Turning smallholder farmers into profitable rural businesses that generate surpluses is not only the best way to achieve global food security; it also offers a path out of poverty and hunger. This is especially critical in Africa where an agricultural transformation is still urgently needed to safeguard the recent economic gains. However, the economic context for the transformation has changed, and it is no longer enough for Africa to pursue the exact same approach to agricultural transformation that was used by other regions of the world. Changes in diets and the urbanization of many food chains are creating even more opportunities for adding value and creating employment within the broader agri-food system. This sets the ground for an "inclusive" transformation of Africa's agri-food system, one that focuses on linking many more smallholders to high value markets, and adds value and employment along value chains through growth of small and medium enterprises (SMEs).

While larger enterprises are appropriate for richer countries with high labor costs, Africa is still at an earlier stage of its economic transformation, and a more balanced approach is desired. As I wrote in my preface to the IFAD Rural Development Report 2016 on "Fostering inclusive rural transformation", which is highly complementary to this AASR, "Economic transformation may be inevitable, as the world changes, but inclusiveness is a choice" and "countries need to take specific actions and make specific policy choices and investments—to enable rural people to seize the opportunities and deal with the threats".

This Report delves more deeply than most into some of the desired policy interventions for achieving an inclusive transformation. It highlights the need for a more holistic and multisectoral approach to the problem, and that builds on partnerships between the public and private sectors. And this is the new, holistic, and inclusive agricultural transformation that AGRA advocates for Africa. But it also poses a challenging agenda for many African governments, given weak public sector capabilities, and insufficient government commitment to smallholder-led agricultural development. One practical approach made is for countries to focus on first movers, such as priority value chains or spatial initiatives like agro-corridors and agro-based special economic zones. First movers can provide platforms that enable relevant public and private sector players to come together to better serve groups of smallholder farms, while enabling public and private investments in infrastructure, and supporting services to achieve critical levels. By leading to quick wins in terms of income and employment, the visibility of first movers can be good for developing political momentum and support for agriculture.

Dr. Kanayo F. Nwanze
2016 Africa Food Prize Laureate and Immediate former President
International Fund for Agricultural Development (IFAD)

Preface

Agriculture is a proven path to prosperity. No region of the world has developed a diverse, modern economy without first establishing a successful foundation in agriculture. This is going to be critically true for Africa where, today, close to 70% of the population is involved in agriculture as smallholder farmers working on parcels of land that are, on average, less than 2 hectares. As such, agriculture remains Africa's surest bet for growing inclusive economies and creating decent jobs mainly for the youth.

Most indications are that we are ready for take-off. The prospects for African agriculture looks favorable, despite the recent slowing in economic growth across much of the continent mainly due to the sharp drop in the global prices of oil and minerals. The African food market continues to grow with World Bank estimates showing that it will be worth US$1 trillion by 2030 up from the current US$300 billion. Demand for food is also projected to at least double by 2050. These trends, combined with the continent's food import bill, estimated at a staggering US$30–50 billion, indicate that an opportunity exists for smallholder farmers—Africa's largest entrepreneurs by numbers—who already produce 80% of the food we eat to finally transition their enterprises into thriving businesses.

The process by which an agri-food system transforms over time from being subsistence-oriented and farm-centered into one that is more commercialized, productive, and off-farm-centered is starting to take place in Africa. Food systems across the continent are responding to rapid urbanization, rising incomes and changing diets. Agricultural value chains are becoming more urbanized and consumer driven, with a premium on quality and food safety. These dynamics are creating many new growth opportunities within Africa's food system. Output and employment in agriculture continue to grow, and a great deal of value addition and employment is being created along value chains in the form of agricultural trade, farm servicing, agroprocessing, urban retailing and food services. Today, 40–70% of the food costs to urban Africans are incurred in the post-farm gate segments of the supply chain, creating a huge opportunity for youth employment.

However, much more remains to be done to sustain these gains and truly drive the agricultural transformation needed for Africa's development, and to ensure a better life for all of its people as laid out in the Malabo Declaration, in the Sustainable Development Goals (SDGs), and in Africa's Agenda 2063.

Additionally, and more crucially, these changes need to be beneficial to Africa's vast army of smallholder farmers and small and medium enterprises (SMEs) operating in the agri-food system. Given the myriad constraints they face, and the more stringent requirements of urbanized markets, there is a danger that many will be left out of this impending economic boom while larger commercial farms and large agribusinesses reap most of the benefits.

These trends and worries are not new, and have been highlighted in previous Africa Agriculture Status Reports. This fifth edition of the Report takes a business approach to the problem. Recognizing that Africa has experienced significant economic changes over the past decade, the Report calls for an agricultural transformation that is more focused on a market driven, business agenda that encompasses the entire food system, not just agricultural production. It argues for an inclusive transformation based on promoting small farms and SMEs on a commercial basis with the potential to create many more productive jobs, reduce poverty, improve nutrition outcomes, and make farming and value chains more resilient to shocks from climate change, and more attractive to young workers.

The Report acknowledges that not all of Africa's smallholders will succeed in farming on a commercial basis. Many are already diversifying into non-agricultural activities that are more lucrative than farming, while others are trapped in subsistence farming under conditions that make it difficult to compete in markets. The business agenda covered in the Report calls for segmenting smallholders into those with prospects and capabilities to transition to commercial farming who need business assistance, and those who need different types of support in transitioning out of farming if resources are not to be wasted.

It also acknowledges that the private sector can and should take the lead in transforming the food system. But an inclusive transformation requires that governments support and guide the transformation. In addition to providing the basics, such as a stable and enabling economic and policy environment, adequate rural infrastructure and agricultural research and development (R&D), governments must also work with the private sector and non-governmental organizations (NGOs) in undertaking targeted interventions to help commercialize many more smallholders, and assist the development of SMEs along value chains.

The Report has maintained the original objective of producing an annual series that provides an in-depth and comprehensive analysis of emerging issues and challenges being faced by Africa's smallholder farmers. It allows experts in African agriculture to share knowledge and offer practical and evidence-based recommendations that will steer Africa towards a path to prosperity through agriculture. The publication has also maintained its two section format: a detailed narrative that addresses various facets of the publication's theme, and a data section that presents country-level agriculture and economic growth data which reveal important trends in African agricultural development.

As the report outlines, the imperative to harness the economic potential of the smallholder farmers has never been greater. The steady progress recorded in the last decade or so shows that it can be done. We have built a significant asset-base of technologies, competencies, knowledge and partnerships across value chains that are now nearly matched with tested models that can take them to scale. Ultimately, I strongly believe that this is a war we can win in our lifetime. Those of us entrusted with the responsibility to drive this process cannot, in good conscience, do anything less than our best. We need to recommit ourselves to the Maputo decisions of 2003 when we adopted the Comprehensive Africa Agriculture Development Programme (CAADP) to guide the prioritization of Africa's agriculture transformation as our path to prosperity.

Dr. Agnes Matilda Kalibata
President
AGRA

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Peter Hazell (Independent Researcher) and Jane Njuguna (AGRA)

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The Africa Agriculture Status Report 2017 is an important accomplishment and I am grateful to all those who helped make it possible. I hope the Report serves as a useful contribution to the understanding of the role of commercialization of smallholder farmers in agricultural transformation in Africa.

Daudi Sumba
Head, Monitoring & Evaluation/Knowledge Management,
AGRA

Acronyms

AASR	Africa Agriculture Status Report
AfDB	African Development Bank
AGRA	Alliance for a Green Revolution in Africa
ATA	Agricultural Transformation Agency
AU	African Union
AUC	African Union Commission
BEAT Africa	Barefoot Education for Afrika Trust
CAADP	Comprehensive Africa Agriculture Development Programme
CEMAC	Economic and Monetary Community of Central Africa
CGAP	Consultative Group to Assist the Poor
CGS	Credit Guarantee Schemes
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
COMESA	Common Market for East and Southern Africa
DANIDA	Danish International Development Agency
DFID	Department for International Development
DFS	Digital Financial Services
DRC	Democratic Republic of Congo
EBA	Enabling the Business of Agriculture
ECOWAS	Economic Community of West African States
ESA	East and Southern Africa
FAO	Food and Agriculture Organization of the United Nations
FI	Financial Institution
GIIF	Global Index Insurance Facility
HGSF	Home Grown School Feeding
ICT	Information and Communication Technology
IFAD	International Fund of Agricultural Development
IFC	International Finance Corporation
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
IMF	International Monetary Fund
IPM	Integrated Pest Management
ISM	Integrated Soil Management
LAC	Latin America and Caribbean
MDC	Maputo Development Corridor
MDG	Sustainable Development Goal
MFI	Microfinance Institution
MSME	Micro, Small and Medium Enterprise
NEPAD	New Partnership for Africa's Development
NERICA	New Rice for Africa
NGO	Non-Governmental Organization
NRM	Natural Resource Management
OECD	Organisation for Economic Co-operation and Development
PFI	Partner Financial Institution
PSL	Priority Sector Lending
R&D	Research and Development
SACCO	Saving and Credit Cooperative
SADC	Southern African Development Community
SAGCOT	Southern Agricultural Growth Corridor of Tanzania
SAP	Structural Adjustment Program
SDG	Sustainable Development Goals
SEZ	Special Economic Zone
SG2000	Sasakawa Global 2000
SIAD	Spatial Initiatives for Agricultural Development
SME	Small and Medium Enterprise
SPFV	Special Purpose Funding Vehicle
SPO	Smallholder Producer Organization
SSA	Sub-Saharan Africa
UNCTAD	United Nations Conference on Trade and Development
UNDESA	United Nations Department of Economic and Social Affairs
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
WAEMU	West African Economic and Monetary Union
WEF	World Economic Forum
WFP	World Food Programme
WIA	Women in Agriculture
WRS	Warehouse Receipt System

CHAPTER 1

Why an Inclusive Agricultural Transformation is Africa's Way Forward

AUTHORS

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Peter B. R. Hazell
Independent Researcher

KEY MESSAGES

ONE

Africa's food systems are undergoing a period of dynamic change which is creating many new growth opportunities, but whose full exploitation requires an agricultural transformation.

TWO

The agricultural transformation that Africa needs today has to be much more focused on a market driven, business agenda that encompasses the entire food system, not just agricultural production.

THREE

From among the alternative pathways available for achieving this transformation, this Africa Agriculture Status Report promotes an "inclusive" transformation based on promoting the growth of small farms and small and medium enterprises (SMEs) in Africa's food systems.

FOUR

Agricultural assistance aimed at commercializing more small farms needs to be targeted to those farm households that have viable farm business prospects and capabilities. Alternative types of assistance should be given to other types of small farm households if resources are not to be wasted, or farm households misled into unsustainable livelihood strategies.

FIVE

Although the private sector can do many things on its own, achieving an inclusive transformation of the food system does require proactive public sector policies and investments.

Introduction

This chapter provides an overview to the 2017 Africa Agriculture Status Report (AASR). It begins by reviewing the case for prioritizing agriculture, arguing that Africa's recent pattern of growth based on "urbanization without industrialization" has increased rather than reduced the need for an agricultural transformation. It argues that many things are now coming together in ways that give Africa the need, the opportunity, the means, and the ambition to transform its agriculture sector. The question now is not whether Africa needs an agricultural transformation, but rather what kind of transformation it needs and how to achieve it.

African economies experienced unprecedented rates of economic growth over 2005–2015, as well as rapid urbanization. However, unlike Asia, this has not led to a shift of workers from agriculture to urban-based industries, especially export manufacturing. Nearly all the non-agricultural growth has been in the services sector, and while this has created many additional jobs, they are mostly low productivity jobs. This pattern of urbanization without industrialization offers limited scope for more rapid and sustained growth in national per capita incomes, highlighting the need for more proactive efforts by governments to promote growth in higher productivity segments of the economy, and shifting more workers into those activities. Renewed efforts to modernize the agriculture sector, or at least large parts within it, could make a valuable contribution to national economic growth in many countries, and to poverty reduction.

Along with more rapid economic growth, Africa's food systems have also changed. Demand for food is growing strongly, and national diets are shifting away from food staples like grains towards more horticultural and livestock products, and processed and pre-cooked foods. Food systems are becoming more urban based and consumer driven, with a premium on quality and food safety. Imports of many raw and processed foods that could be produced at home are also growing rapidly. Driving these changes are rapid urbanization, rising incomes, globalization, population growth, and a growing share of young people.

This dynamic is creating many new growth opportunities within Africa's food systems, which could help provide the boost to national economic growth and productive employment that most countries seek. Already a great deal of value addition and employment is being created by small and medium enterprises (SMEs) along value chains in the form of agricultural trade, farm servicing, agroprocessing, urban retailing and food services. Large agribusinesses like seed companies, agroprocessors, and supermarkets are also playing an increasing role in some agricultural value chains. Governments have the opportunity to leverage these dynamics to create even more growth in productive employment and income, and in ways that benefit young people and the poor.

However, the type of agricultural transformation relevant today is very different from the kind of green revolution transformation that Africa aspired to in earlier decades. The new agenda needs to be much more focused on a market driven, business agenda that encompasses the entire food system, not just agricultural production. But Africa is at a crossroads: should it go for a food system transformation led mainly by large commercial farms and large agribusinesses, as in many rich countries? Or should it go for an "inclusive" transformation based on commercial smallholder farms and SMEs along value chains. A large farm, large agribusiness approach would leave millions of small farms and businesses without adequate livelihoods, whereas an inclusive approach could engage more of them in productive employment, create more attractive jobs for young people, help reduce poverty, inequality and food insecurity, and contribute to better nutrition outcomes. But an inclusive approach would also require greater public sector involvement and investment, and hence government commitment to the transformation agenda.

This AASR argues for an inclusive approach to transforming Africa's agriculture sector and food systems more widely. Chapters in this report describe the ongoing changes in Africa's food systems, and the opportunities and challenges that an inclusive transformation approach would involve. They explore the rationale for the approach, and the kinds of policy, public investment, and governance issues that would be required.

Why Agriculture is still Critical for Africa's Economic Transformation

Economic growth accelerated across much of Africa during 2005–2015 (Figure 1.1). Although outpaced by Asia, the rates of growth achieved were nevertheless unprecedented for many African countries, and led to a period of euphoria among many experts in which African economies seemed finally to be taking off. As should be expected, this growth has been accompanied by structural changes in the composition of national economies (Figure 1.2). Agriculture has shrunk as a share of both national gross domestic product (GDP) and the total labor force. A surprise has been the rapid urbanization of Africa.

Figure 1.1 • Regional trends in GDP per capita (1990–2015)

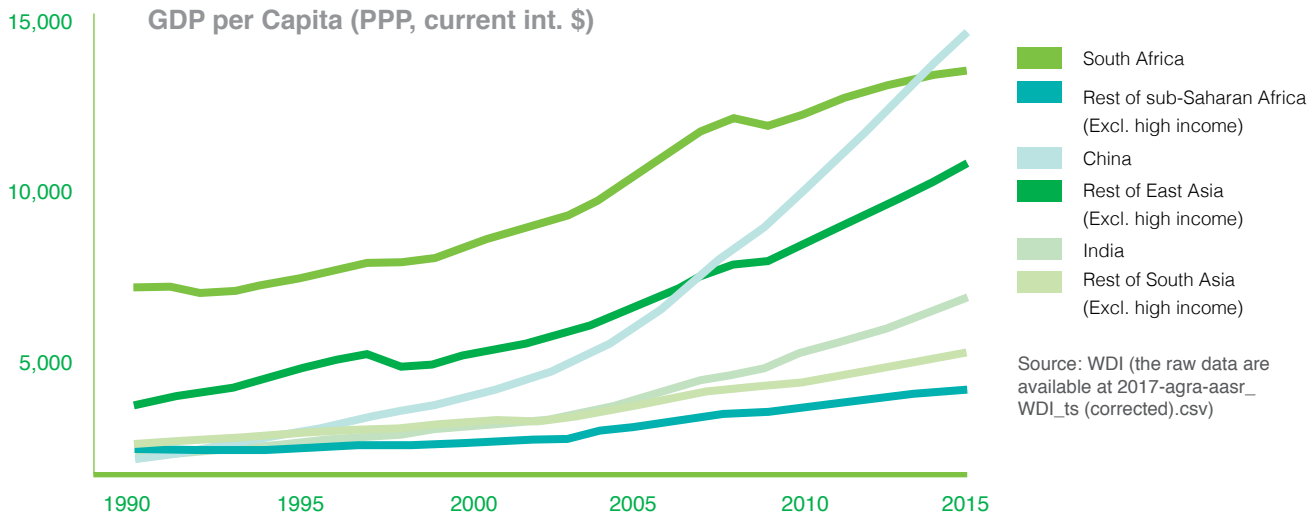
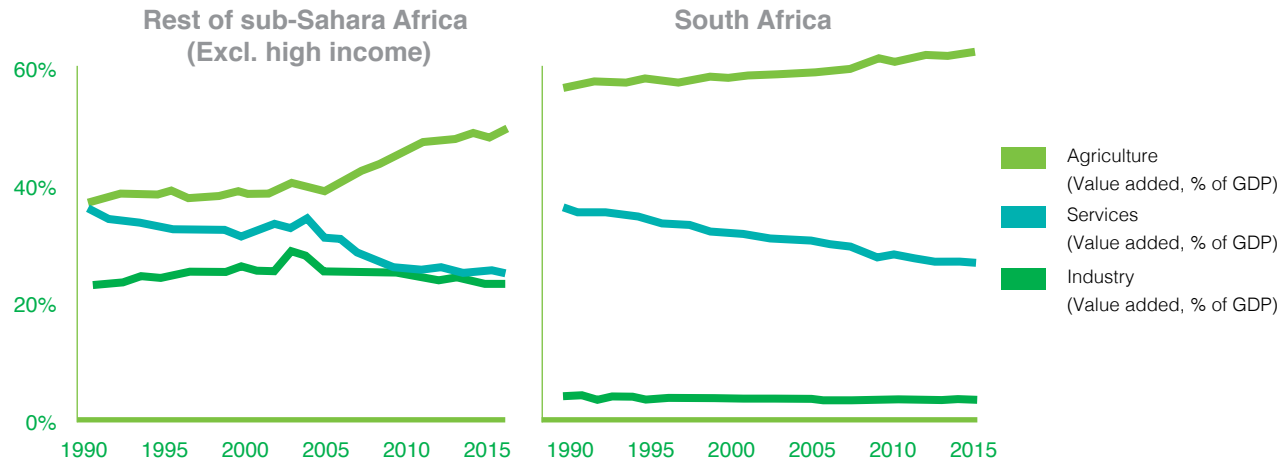


Figure 1.2 • Sector shares in total GDP, sub-Saharan Africa



Already, 37% of the population in is urbanized, and the UN projects that by 2050 the urban population share will reach 56% (UN, 2014). This urbanization is surprising because, unlike the economic transformations of China and some other fast growing Asian economies, workers have not moved into manufacturing. Rather, in much of Africa, industry at large, including manufacturing, has remained flat while workers have moved into a burgeoning and mostly urban-based services sector. The services sector is now the largest sector in Africa, and already accounts for over half of Africa's total GDP (Figure 1.2; Rodrik, 2016). This pattern of growth has been characterized as "urbanization without industrialization".

This pattern of economic transformation has some problems. For starters, it turned out that Africa's growth spurt was driven more by a commodity price boom than any real improvement in its economic fundamentals, and when prices turned so did economic growth rates. Also, the growing dependence on the services sector does not offer a sustainable pathway to rapid economic growth. This is because most services are informal, labor-intensive activities, whose labor productivity is little if any better than traditional agriculture. Unlike manufacturing, which faces an elastic demand for its outputs, either through exports or import substitution, the services that are produced are mainly for the domestic market (i.e., they are non-tradables), so their growth is constrained by growth in national demand.

Demand, in turn, depends on growth in national per capita incomes, population sizes, and changing patterns of consumption associated with the movement of people from rural to urban lifestyles. This pattern of transformation can only take Africa so far, and will at best lead to modest rates of national economic growth (Rodrik, 2016; McMillan, Rodrik, & Sepúlveda, 2016).

How can Africa accelerate and sustain its growth rate and become more of a hare than a tortoise? Growth in GDP per capita is highly correlated with growth in labor productivity, and there are two basic sources of potential growth in labor productivity. One is growth of labor productivity within sectors. The other is growth of high labor productivity sectors like manufacturing and the movement of workers to those sectors from lower productivity ones. So far growth in labor productivity in Africa has arisen mainly through increases in "within-sector" labor productivities (Badiane & Makombe, 2014; McMillan et al., 2016). While continued productivity growth within sectors is likely, it is generally quite modest, and faster economic growth needs to come from growing the more productive parts of the economy and facilitating the movement of workers to those activities.[1] What are the prospects for that?

Industry

There are reasons to be pessimistic about Africa's potential to become a major hub of export manufacturing, at least at a time when China and other Asian countries are flooding world markets with low cost manufactured goods. Manufacturing in Africa is also widely constrained by a poor business environment, high transport costs, inadequate and costly port facilities, unreliable power supplies, inadequate access to finance, difficulties in obtaining land, rising labor costs, shortage of skilled workers, etc. (Manufacturing in Africa, 2016). Rather than an exporter, Africa has become an important importer of manufactured goods. For example, China's exports of manufactured goods to Africa increased from US$4.4 billion in 2000 to US$86.7 billion in 2013; an average annual growth rate of 28% (Guillaumont Jeanneney & Hua, 2015).

Niche opportunities undoubtedly exist for some African countries to develop export manufacturing, and those opportunities should of course be pursued. But for most of Africa, more promising short to medium-term prospects lie at home and particularly in the growth of small and medium-sized manufacturing firms which can supply growing domestic and regional markets. One particular promising opportunity lies with food industries, which face a rapidly growing urban market for processed and pre-cooked foods. This sector is still dominated by many small and medium-sized firms, and has the potential to grow many more reasonably productive jobs. However, agroprocessing firms face many of the same constraints as manufacturing firms in general, as well as challenges in obtaining reliable supplies of raw materials of the right qualities from farmers (World Bank, 2013). Growth will depend on the successful modernization of many agricultural value chains.

Services

The rapid growth in the services sector has been led by growth in trade and personal services, both of which are dominated by small informal enterprises, and which have grown with per capita incomes and rapid urbanization. For example, trade services have grown with a greater need to move more agricultural commodities from rural to urban areas where more consumers now live. Not all the growth in services has arisen in the cities, and much has occurred in small and medium-sized towns where it has created new off-farm income earning opportunities for farm households in surrounding areas.

The difficulty with the informal services sector is that it has relatively low labor productivity, in some cases no better than traditional agriculture. Although opportunities may exist for developing pockets of modern services that have higher labor productivity, it is unlikely that they can achieve the scale needed to substitute for the development of modern manufacturing and agriculture if Africa is to grow faster.

Agriculture

This brings us to agriculture, which still has considerable potential for growth in Africa. Here are three good reasons to be optimistic about agriculture's potential:

- Africa still has the resource base that if more intensively farmed could easily produce another 100 million tons of grain equivalents each year, equivalent to adding another US corn belt to the global supply and turning Africa into a net agricultural exporter. This potential is evidenced by the low yields Africa currently achieves compared with those of similar agro-ecological zones (FAO & World Bank, 2009), experimental trials, and best farmer practices (Jirström, Andersson, & Djurfeldt, 2011). There is also considerable untapped irrigation potential[2] and remaining uncultivated land that could be brought into production.[3]

[1] While it is likely that the oil and mineral sectors will provide an important, if volatile, source of GDP growth in some African countries, these sectors are not likely to create much additional employment themselves.

[2] You et al. (2011) estimate that sub-Saharan Africa could profitably increase its irrigated crop area from surface and groundwater supplies from 7 to 21 million hectares by 2050.

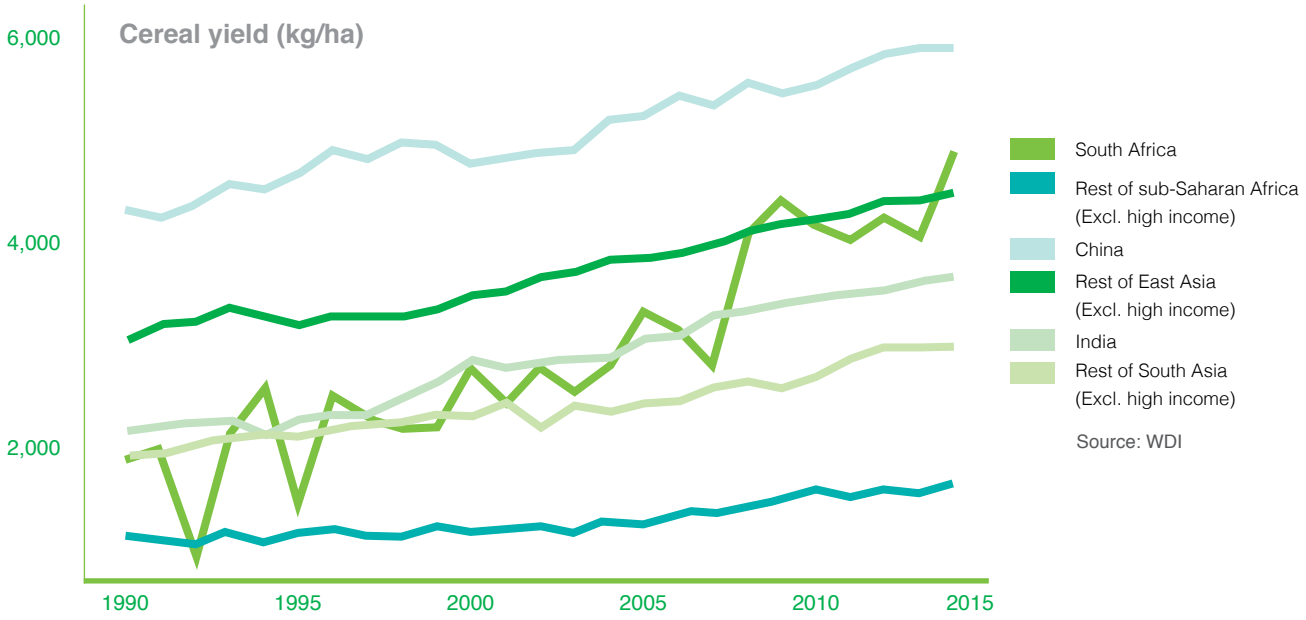
[3] Estimates vary widely. FAO (2009) estimates that Africa still has a further 800 million hectares of uncultivated land with potential for rainfed crop production, whereas Fischer, van Velthuizen, Shah and Nachtergaele (2002) estimate 240 million hectares. However, much of this land is used for grazing, is needed for environmental purposes, or is fallow land within extensive farming systems, so cannot easily be used for additional cropping (Conway, 2012, pp. 14–16).

- Demand for food is growing fast. Most African countries are still growing despite the slowdown induced by the decline in commodity prices in 2016, and the medium-term outlook is good for continued growth in international, regional and domestic markets. Africa's demand for food is projected to more than double by 2050 (Chapter 2), driven by population growth, rising incomes, rapid urbanization, changes in national diets towards greater consumption of higher value fresh and processed foods, and more open intra-regional trade policies, all of which are helping create new opportunities for Africa's farmers.
- Agriculture is also the best sector for addressing much of the remaining poverty in Africa. Since most farmers are smallholders, many of whom are poor, and increases in agricultural output help keep food prices low, small farm-led agricultural development typically has a big impact on poverty. Thirtle, Piesse and Lin (2003) estimate that a 1% increase in crop productivity reduces the number of poor people by 0.72 % in Africa and by 0.48% in Asia. Studies that compare growth–poverty elasticities across sectors typically find much higher elasticities for agriculture than for non-agriculture (Christiaensen & Demery, 2007; World Bank, 2007).

Yet despite the promise, Africa has not done well in modernizing its agriculture sector. Many attempts were made to bring the green revolution to Africa in the 1960s and 1970s, some of which were successful in raising productivity (e.g. the maize revolution in Eastern and Southern Africa (Smale & Jayne, 2010)). But they were typically based on top-down, heavily subsidized and state-led approaches that proved costly and financially unsustainable, and had to be pared back as part of the structural adjustment programs (SAPs) beginning in the 1980s.

Although Africa's agricultural growth rate improved after 2005, averaging about 7% per annum, this was driven more by a commodity price boom and expansion of the cropped area rather than by improvements in the underlying fundamentals.[4] Africa's cereal yields started to grow after 2000,[5] but still remain low compared to other countries, and the gaps are widening (Figure 1.3). Moreover, the gap in land and labor productivity between Africa and Asia also widened rather than closed over 2000–2014 (Figure 1.4). Within Africa, labor and land productivity improved the least in Southern Africa (excluding the Republic of South Africa), and improved the most in Eastern and Western Africa (Figure 1.5). Far from exploiting its potential of becoming a major breadbasket region, Africa continues to become more dependent on food imports. The aggregate annual food import bill is currently about US$35 billion, and is estimated to rise to US$110 billion by 2025 (Adesina, 2017).

Figure 1.3 • Trends in cereal yields in Africa and Asia



[4] Many estimates of past rates of agricultural growth seem too high, capturing the impact of real price increases and production increases. For example, Nin-Pratt, Johnson and Yu (2012) estimate that African agriculture grew by only 3.6% per year in constant prices during 2001–2010, but by 7.7% per year if the deflated increase in agricultural prices is included.

[5] Some experts attribute this growth to the spread of improved seeds, thanks in part to the growing role of small and medium-sized seed companies. Others look to a more complex set of factors, including prices, seeds, fertilizer use (and subsidies), mechanization, improved roads, etc.

Figure 1.4 • Regional trends in land and labor productivity, Asia and sub-Saharan Africa (2000–2014)

Source: Calculations by Ulrike Wood-Sichra using FAOSTAT, http://www.fao.org/faostat/en/#home, accessed June and July 2017 for area harvested, permanent pastures and value of production. Agricultural labor from AgRFPCountryincomegroups.xlsx downloaded from https://www.ers.usda.gov/data-products/international-agricultural-productivity/, maintained by Keith Fuglie (ERS/USDA)

Figure 1.5 • Regional trends in land and labor productivity, within sub-Saharan Africa (2000–2014)

So why has Africa not done better in modernizing its agriculture sector and raising the productivity of its agricultural workers? A green revolution was always going to be a bigger challenge in Africa than in Asia given the continent's diverse, rainfed farming systems, limited irrigation, and sparse rural infrastructure. Africa needed a "rainbow" revolution to address its diverse array of crops, farming systems and growing environments (InterAcademy Council, 2004). In contrast, Asia was able to enjoy a green revolution based on increasing the yields of just two crops—rice and wheat, grown on vast areas of irrigated land where the same technologies were widely applicable.

Added to these biophysical challenges has been a lack of government commitment to agriculture. Whereas Asian countries were determined to be largely self-sufficient in food staples at a time of world shortages, and spent on average about 15% of their total budgets on agriculture during 1970s and 1980s (Hazell, 2010), African governments never achieved anything like the levels of investment needed, rarely exceeding 5% of their total budgets (Fan, Bingxin, & Saurkar, 2008). Worse, most African governments and donors slashed their investments in agriculture and the institutions that support the sector during the SAP era, leaving a legacy of neglect that is still felt today.

Another problem was that before the SAPs, most African countries pursued macro and trade policies that discriminated against agriculture (Anderson & Masters, 2009). Within agriculture, many African countries also followed the initial Asian Green Revolution model of a top-down, state-led approach that included public provision of agricultural research, extension, and farm inputs, the shoring up farm credit systems, hefty subsidies for key inputs (especially fertilizer), and intervening in markets to ensure farmers received adequate and stable prices each year to make the new technologies profitable. These kinds of interventions can quickly become costly and inefficient, distort markets, and crowd out the private sector, and even where justified, need to be phased out once they have served their initial purposes.[6]

But all this is changing. Most macroeconomic, trade, and agriculture sector policy distortions were successfully pared back as part of the SAPs. Although these reforms were not perfect, they dramatically improved the economic environment for agriculture (Binswanger-Mkhize, & McCalla, 2010). African policy makers have also recognized the renewed importance of agriculture, and through the Comprehensive Africa Agriculture Development Programme (CAADP) process have committed themselves to increasing agricultural investment to 10% of their total budgets, and agricultural growth to 6% per annum. Public sector capabilities are still weak, but growing stronger. In many countries, the institutional environment has also improved and local governments, communities and the private sector have greater opportunities to participate in the agriculture sector. The business climate is also improving, albeit from a low level. And through the Grow Africa Investment Forum (African Union (AU), New Partnership for Africa's Development (NEPAD), and the World Economic Forum (WEF)), and the New Alliance for Food Security and Nutrition (G7 and AU), international agribusiness has committed to invest in Africa's food systems.

To conclude, many things are now coming together in ways that give Africa the need, the opportunity, the means, and the ambition to transform its agriculture sector. The question now is not whether Africa needs an agricultural transformation, but rather what kind of transformation it needs.

What kind of Agricultural Transformation does Africa Need

The situation in Africa today is very different from that in Asia at the time of its Green Revolution, and requires a different kind of agricultural transformation. Some key differences:

- Despite occasional shocks like the world food crisis of 2007, the global food balance is much more favorable today than in the immediate Green Revolution era, and international trade in agricultural commodities has soared. This means that African countries have more freedom to meet their food needs through a mix of own production and international trade, and can focus on producing those agricultural commodities which best match their resource endowments and export opportunities.

- African food systems have evolved rapidly in recent years in response to urbanization, rising incomes and changing diets. Although there is considerable country variation, overall there has been a huge increase in the volume of foods that pass through the food system, possibly by a factor of six- to eightfold since 1970 (Reardon et al., 2014). Moreover, some 40–

[6] Some research has shown that these kinds of interventions can be effective at the early stages of agrarian development when value chains are still poorly developed, and the demand for key inputs like improved seeds and fertilizers is still too low and spatially thin for private delivery systems to work adequately (Dorward, Kydd, Morrison, & Poulton, 2005; Dorward, Kydd, Poulton, & Bezemer, 2009). But as value chains develop, they become less relevant.

70% of food costs to urban Africans are now incurred in the post-farm gate segments of the supply chain (processing, wholesale/transport, retail, food stalls, restaurants, etc.) the World Bank estimates that the share of all agribusiness and food-related business in national GDP is typically around 20% in Africa (World Bank, 2013). These changes have been matched by a "quiet revolution" in supply chains, with large numbers of SMEs investing in trucking, wholesale, warehousing, cold storage, first and second stage processing, local fast food, and retail trade (Reardon et al., 2014). There has also been significant investment by larger African and foreign firms. Much of this investment has gone into the midstream of the value chains (World Bank, 2013). Private agrodealers have also expanded into the marketing of modern farm inputs, like seeds, fertilizers, veterinary medicines, and agricultural machines. Tschirley et al. (2015) provide data for six countries in Eastern and Southern Africa, showing that in 2010, the number of jobs in agribusiness was 10% as large as the number of jobs in agriculture, and half as large as all the jobs outside the food system. They also show that labor productivity in agribusiness is five to seven times higher than in agriculture, depending on the type of activity, and project that the agribusiness sector will continue to grow strongly until 2025 and beyond.

- Changing rural demographics are reaching tipping points that require attention. Rural populations continue to grow across much of Africa, and are projected to do so until at least 2050 (AGRA, 2016). With low levels of land productivity, this growth is putting huge pressure on the land base, especially in already densely populated countries. With continuing sub-divisions, many farms are getting too small to support a family, which in the absence of adequate opportunities to diversify into non-farm sources of income, contributes to the overuse of resources and land degradation (World Bank, 2007). An increasing scarcity of arable and grazing lands also contributes to more disputes and conflicts over land and water. Another trend is that the agricultural labor force is growing substantially younger. Yeboah and Jayne (2016) estimate that about 60% of the agricultural labor force is currently between 15–35 years of age, and the share is growing. Rural youths are looking for better and more productive livelihoods than traditional farming, and are migrating to urban areas even though there are inadequate jobs there. Creating productive and interesting jobs in agriculture and within the agri-food system for young workers needs to be a key plank in the transformation agenda.
- The development agenda has moved on. While food security was the primary goal during the Green Revolution, the agenda of the international community has evolved and development assistance today seeks to address a broad range of economic, environmental and social goals, as encapsulated in the sustainable development goals (SDGs). Improved nutrition and health have emerged as particularly important issues for agriculture and food systems.

Given these changes, it is no longer enough to focus only on transforming agricultural production systems. Today, we need to talk more broadly about the transformation of entire food systems.

In seeking to transform their food systems, African countries have to choose the type of transformation they would like. Just because there is a broad consensus today on the need for an agricultural transformation does not mean there is also a consensus on how that transformation should be achieved. Some scholars and policy makers, for example, argue for a food system transformation based on large-scale commercial farming, and with large agribusinesses like seed companies, agrochemical companies, and supermarkets encouraged to develop and integrate many value chains. This is the kind of food system found in most rich countries today, and even in South Africa. Such food systems can be highly productive, but they are capital intensive, create relatively little employment, and contribute to some unfortunate dietary consequences, like urban obesity. This is an important drawback for Africa given that most of the workforce is currently employed in small-scale farming and along agricultural value chains, and, as we have seen, there is little prospect that they can be quickly absorbed into more productive jobs in the industrial or service sectors.

A contrary view, and the one promoted in this AASR, recognizes the dominance of small farms and SMEs in Africa's food systems today, and recommends an "inclusive" transformation based on promoting their growth. This approach could create much productive employment and income, reduce poverty, inequality, and food insecurity, lead to better environmental and nutrition outcomes, and help make farming and value chains more resilient to shocks from climate change, and more attractive to the youth.

How plausible is such an inclusive transformation? We explore this question first from the perspective of small farm agriculture, and then examine more broadly the implications for a business strategy to achieve an inclusive transformation of the agri-food system.

Commercializing Small Farm Agriculture

Africa has about 51 million farms of which 80% (or 41 million) are smaller than 2 ha in size (Lowder, Skoet, & Raney, 2016), and their numbers are still increasing in most countries (Headey, 2016; Jirström et al., 2011). Africa wide, farms smaller than 2 ha produce about 30% of total agricultural output, while farms 4–20 ha produce another 50% (Herrero et al., 2017). The available evidence shows that many of these farms are efficient low cost producers which obtain higher yields, on average, than many larger sized farms, and are quite able to compete in markets given a fair opportunity (Larson, Otsuka, Matsumoto, & Kilic, 2014). As in Green Revolution Asia, many of these small farms have the potential to contribute to a successful agricultural revolution in Africa, one that is employment intensive and pro-poor.

Coping with the diversity of small farms

Africa's small farms are diverse and face varying livelihood prospects depending on their own assets and aspirations, as well as their regional and country contexts. There are few "one-size-fits-all" policies for assisting small farms, and hence this diversity cannot be ignored. However, not all small farms can hope to succeed as commercial farms in the future. Those that can need the right kinds of business support, while those who are unlikely to succeed as commercial farmers need different types of assistance. Targeting the right kinds of assistance requires a typology and a means of recognizing or targeting different types of small farms in programs and projects.

A variety of farm typologies have been offered in the literature to help manage this diversity. Key criteria proposed for segmenting farms include access to markets, household assets, agricultural potential, and non-farm income diversification. Drawing on this work, Hazell and Rahman (2014) proposed classifying smallholders into three groups to target small farm assistance:

- **Commercial smallholder farmers** are successfully linked to value chains and run their farms on a business basis. They may be full or part-time farmers.
- **Small farms in transition** have favorable non-farm opportunities and obtain much of their income from non-farm sources. In the absence of significant new opportunities in farming that can give a competitive return to their labor and capital as non-farm opportunities, many transition farmers are likely to leave farming altogether or, if they continue to live on their farms, farm largely for their own consumption.
- **Subsistence-oriented small farms** are marginalized for a variety of reasons that are hard to change, such as ethnic discrimination, sickness, age, or being located in remote areas with limited agricultural potential. Many of the same factors that prevent them from being more successful farmers also prevent them from accessing non-farm jobs and becoming transition farmers. Subsistence-oriented farms frequently sell small amounts of produce at harvest to obtain cash income, but are typically net buyers of staple food over the entire year.

Given the focus of this AASR on a business approach to smallholder agriculture, it is proposed to operationalize this typology along the lines portrayed in Figure 1.6. Here commercial farms are defined as farm households that sell high shares of their agricultural output. They can be further differentiated into specialized commercial farms that have low non-farm income shares, and diversified commercial farms that have high non-farm income shares. We also identify a group of pre-commercial small farms. These are specialized farms with low non-farm income shares that sell part of their agricultural production, but are less successfully linked to markets than specialized commercial farms, selling only medium shares of their farm output. Many pre-commercial farms might, with some appropriate assistance, aspire to become more successful commercial farmers and could make a particularly attractive target group for farm business assistance programs and policies. Subsistence farms are defined as those selling low shares of their farm output, and having low shares of non-farm income. Transition farms are those that have high non-farm income shares, and sell low to medium shares of their farm output.

Figure 1.6 • A typology of small farms

		Importance of farm sales (Agricultural sales/total agricultural income)		
		Low	Medium	High
Importance of non-farm income (Non-farm income/total household income)	Low	Subsistence farms	Pre-commercial farms	Specialized commercial farms
	High	Transitioning farms		Diversified commercial farms

How important are these small farm groups in Africa today? Very little research has been done to answer this question, even for other typologies. One relevant study estimates that only 35 million of the world's 500 million smallholder farmers (or 7%) participate in tight value chains, meaning that they are generally less poor, operate at least two hectares of land and take a more business-like approach to farming than other smallholders (Christen & Anderson, 2013). An analysis in Annex 1, using household survey data from Ghana, Ethiopia and Tanzania, provides a more encouraging result for Africa. Between 30% and 40% of small farms, smaller than 4 ha can be classified as commercial in Ghana and Tanzania, but only about 12% in Ethiopia (Table 1.1). Commercial farms are about equally split between specialized and diversified farms. Pre-commercial farms account for another 15% in Ghana and Tanzania, but 32% in Ethiopia. Transition farmers are the dominant group in all three countries, ranging from 39% to 50%. Subsistence farmers are a relatively small group, less than 10% in Tanzania and Ghana and 17% in Ethiopia.

The same data sources can be used to characterize the different types of households in each country (Annex 1). On average, farms that are diversified into non-farm sources of income obtain substantially higher total incomes than subsistence farms or specialized commercial farms. The diversified commercial farmers have the highest incomes, while the subsistence farmers receive the lowest. There is little difference in the household size amongst the five groups, or in the number of adult workers or the age of the head, and commercial farms are not noticeably bigger. However, commercial and transition farms have better educated heads than average, and in Ethiopia and Tanzania, are much more likely to be male headed (Annex 1).

How should assistance vary by type of farm household?

A primary purpose of segmenting small farms is to be able to develop appropriate assistance programs for each group. Assistance needs to be directed at the kinds of transitions that would be desirable for each of the small farm groups. Over time, shown as a move from period t to period t+1 in Table 1.2, it is desired that subsistence farms should become transition, pre-commercial or commercial farms, or exit farming altogether; that many transition farms should become commercial farms or successfully move to the non-farm economy; that commercial small farms should either prosper as such, or transform into larger farms; and that pre-commercial farmers should either succeed in becoming commercial farmers or diversify and become transition farmers. To be avoided are situations where many small farms revert to or remain trapped in subsistence farming, or where transition farms fail to find successful exits to the non-farm economy. In terms of a business approach to small farms, the green shaded column in Table 1.2 indicates the relevant transitions that are desired.

Table 1.1 · Composition of small farms ≤4 ha by type of livelihood strategy, Ghana, Ethiopia and Tanzania

Non-farm income as share total income	Share of crop production sold (%)		
	Low	Medium	High
GHANA			
Low	8.1	14.5	22.6
High	38.9		15.9
ETHIOPIA			
Low	17.2	32.0	6.8
High	39.4		4.6
TANZANIA			
Low	5.1	15.8	14.6
High	49.9		14.6

Source: Annex 1

Table 1.2 • Desired transitions for small farm groups

		Period t+1				
		Subsistence	Transition	Pre-Commercial	Commercial	Exit farming
Period t	Subsistence	O	X	X	X	X
	Transition	O	X	O	X	X
	Pre-commercial	O	X	O	X	
	Commercial	O	X	O	X	

Notes: X = desired transition; O = undesired transition; dark shaded green cells designate farm business oriented transitions.

Table 1.3 highlights the kinds of interventions that may be relevant for each of the five small farm groups. Commercial and pre-commercial farmers with viable market prospects need to be supported as a business proposition. They need access to improved technologies and natural resource management (NRM) practices, modern inputs, financial services, markets, and secure access to land and water. Much of this assistance will need to be geared towards high value production, and provided on a commercial and financially sustainable basis. If more subsistence and pre-commercial small farms are to become successful commercial farms, then special help may be needed in acquiring necessary knowledge and skills, and becoming organized to link to modern value chains. This may be especially important for many women and young farmers.

However, this may not be the appropriate strategy for other types of farm households. Transition farmers, for example, may gain more from assistance in developing their technical and entrepreneurial skills and assets to succeed in the non-farm economy, including developing their own non-farm businesses. Such help may be especially important for women and young people. Many transition farmers may simply not be that interested in expanding their commercial farming activities given higher income earning opportunities in the non-farm sector, so unless significant new opportunities exist in farming, assistance targeted at commercial farming may not be productive.

Subsistence farmers are predominantly poor and will often benefit more from some form of social assistance, such as productive safety programs, support for food gardens, and cash transfers and training that facilitates their exit from agriculture. Many subsistence-oriented farmers are too poor or too remote from markets to become successful commercial farmers without long-term subsidies, but assistance that helps them improve the productivity of their farms (e.g. better technologies and NRM practices) can make important contributions to their own food security and perhaps provide some cash income. But subsistence farmers have limited ability to pay for modern inputs or credit, so intermediate technologies that require few purchased inputs may be needed, or inputs will need to be heavily subsidized (e.g. basic amounts of seeds and fertilizer). Subsistence farmers are typically the most exposed and vulnerable to climate risks, and in addition to safety nets, they need help developing resilient farming systems.

Table 1.3 • Types of assistance relevant for different small farm groups

Type of small farm	Types of assistance
Commercial	• Farming as a business • Better technologies and NRM practices • Organizing farmers for marketing purposes • Incentivizing large agribusiness to link with small farms • Accessing seeds, fertilizer, finance and insurance on commercial terms • Securing land rights and development of efficient land markets • Encouraging entrepreneurship • Building resilient farming systems
Pre-commercial	• Stepping up into commercial farming • As for commercial farms, but with special attention to developing needed skills and accessing modern value chains. • Some subsidized support may be worthwhile to help launch their businesses.

Type of small farm	Types of assistance
Transition	• Stepping out of farming • Training and support for non-farm activity, including development of own small businesses • Encouraging entrepreneurship • Empowering women and other vulnerable groups • Securing land rights and development of efficient land markets • Better technologies and NRM practices • Safety nets
Subsistence	• Social protection • Safety nets and transfers • Better but low cost technologies and NRM practices • Perhaps some subsidized inputs for own food crops • Securing land rights • Building resilient farming systems • Empowering women and other vulnerable groups • Support for non-farm diversification

Targeting assistance

Different forms of assistance vary in how carefully they need to be targeted by type of small farm household. For example, public agricultural research on improved NRM practices or plant and animal disease control may benefit most farmers and needs little targeting, whereas the development of hybrid seeds that must be purchased and fertilized may be of value primarily to commercial farmers. Organizing farmers into groups for marketing purposes will be more worthwhile if most members have commercial capabilities. And agricultural credit needs to be targeted to farmers who have sufficient business activity to be able to repay. Subsidized inputs like fertilizer and seed need to be targeted to specific groups of poor farmers, otherwise substantial leakages can occur. How then can different types of small farms be identified for targeting purposes?

A helpful feature of the typology in Figure 1.6 is that it has an implicit spatial dimension. Production of high value but perishable commodities is more likely in areas with good access to roads and urban areas, and opportunities for non-farm income diversification are also more likely in such areas. Subsistence farmers might be expected to concentrate in less favored areas with poor agricultural potential and poor market access. Since agricultural potential and access to markets and urban centers can be mapped, it is possible to use spatially referenced data on these variables to identify areas on maps where different types of small farms are likely to be concentrated. Annex 1 draws on ongoing research to illustrate this approach for Tanzania. Such maps have already been developed for several African countries and could be a useful aid for targeting future development assistance to small farms.

Within spatial areas, further disaggregation of households is possible using household surveys and local knowledge. The private sector, for example, already uses local knowledge to identify farmers with whom it can do business (e.g., sell seeds or fertilizer), and many non-governmental organizations (NGOs) and social protection agencies are experienced at selecting poor and women farmers for inclusion in their development/protection projects. However, NGOs and the public sector are less experienced in identifying farmers who are best served by a farm business approach.

Business Strategies for an Inclusive Transformation of the Food System

If more small farms are to successfully transition to commercial farms and compete successfully in modern value chains, then, as noted in Table 1.3, they need access to improved technologies and NRM practices, knowledge, modern inputs (like seeds, fertilizers and machinery), financial services, and markets, and secure access to land and water. Many smallholders will also require help acquiring the necessary knowledge and skills to become successful farm business entrepreneurs, especially women and young farmers. Managing market and climate risk is also a growing challenge for many small farms and, in addition to insurance and access to safety nets, they need to develop resilient farming systems.

If SMEs are to prosper along value chains, then they too may need support. In addition to access to good roads and transport systems, they need an enabling business and regulatory environment, reliable supplies of energy and water, secure rights over land for building, access to

financial services, and often training in relevant technical and managerial skills.

As a list of needs, there is little that is new really here and which has not been part of the agricultural and SME development agenda for some years. But as part of a business agenda for an inclusive transformation of the food system, some things require new emphases and approaches:

- The business agenda is not just about improving cereal yields, valuable though that can be. Most small farms are too small to prosper by growing cereals on a commercial basis, even if they could double their yields. They need to diversify into high value crops and livestock activities that yield much higher returns to land. Fortunately, the market demand for these products is growing rapidly, and a key goal of the business agenda is to help more smallholders overcome the many constraints that prevent them from integrating into more lucrative value chains. This requires a much broader and more flexible agenda for the types of support offered to small farms than was the case with a green revolution agenda. For example, farmers need improved seeds for a whole range of high value crops, not just for major cereals, yet most research and development (R&D) systems are not set up for this task.

- Another new thing is the changed business environment prevalent in today's food systems, and the need for small farmers to build stronger business links with private sector enterprises. Here SMEs play primary roles since, apart from a relatively small share of small farms that are embedded in contract farming arrangements with large agribusinesses, most small farms depend primarily on SMEs to access modern inputs and financial services, and to market and process their output. An inclusive agricultural transformation therefore calls for assistance to SMEs as an integral part of the development agenda, something that cuts across sectors and hence government ministries and budgets.

- There is also new interest by large international agribusinesses in Africa's food chains, as exemplified by the Grow Africa Investment Forum and the New Alliance for Food Security and Nutrition. Although an inclusive approach to the transformation calls for an emphasis on SMEs, large agribusiness still has some important functions to perform. For example, SMEs have limited access to new technologies from outside their countries (like hybrid seeds), and they lack the scale and market power to develop and enforce quality standards along value chains, or to develop export markets. Nor can they marshal the kinds of financial services that small farms need. Big agribusinesses, including international corporations, can help fill these gaps. They can also help small farms more directly by: a) sourcing more produce from small farms through contract farming and out-grower schemes—scaling up may require working more with intermediaries like marketing cooperatives or farmer associations; b) developing and then helping small farms comply with quality and safety standards; c) developing supply chains for certified seeds, fertilizer, finance and insurance that serve small farms—this will typically require networking with SMEs along value chains; and d) investing in farm advisory services for small farms and developing market information systems for small farms using the latest information technology and communications technologies.

- Climate change is emerging as a real game changer that requires an adequate policy response. Average crop yields are falling with shorter growing seasons and higher temperatures, and more frequent and severe droughts and pest outbreaks are increasing the risk of seasonal production losses. More extreme weather not only has an impact on the productivity and welfare of farmers, but it also has repercussions along value chains that affect the supply and prices of foods, the viability of many SMEs, and ultimately the welfare of many poor people. Risk is hardly a new feature in African agriculture, but there is need to build more resilience into farm production systems and in the down and upstream segments of value chains.

- Another new thing is the growing recognition that many smallholder farmers are simply not going to succeed as commercial farms in today's food systems. Some smallholders have opportunities to diversify into more remunerative non-farm activities, and hence may be less interested in commercial farming, while others are constrained from being more successful as farmers by poor access to markets, or because they live in areas with low agricultural potential. Yet others are constrained by insufficient personal assets and capabilities to become successful entrepreneurs in either farming or non-farm activity. A key argument in this report is that agricultural assistance aimed at commercializing more small farms needs to be targeted to those farm household that have viable farm business prospects and capabilities. Alternative types of assistance are needed for the others if resources are not to be wasted, or farm households misled into unsustainable livelihood strategies. The ability to segment small farms and identify them on the ground for targeting purposes has become important and new lines of research using recently available farm household panel data sets, and spatially referenced data and GIS techniques can facilitate targeting in small farm assistance programs and projects.

Although the private sector can do many things on its own, achieving an inclusive transformation of the food system does require some proactive public sector policies. In particular, governments need to create an enabling business environment for agribusiness, build rural infrastructure, invest in agricultural R&D and extension for small farms, protect intellectual property rights, and help establish and enforce grading systems and health and safety standards for many farm products. There may also be need for innovative public sector interventions to help overcome initial market failure problems, such as promoting public–private partnerships to help deliver financial services and insurance to small farms, and organizing small farms into groups for marketing purposes. Some NGOs are very effective at assisting by playing intermediary roles. SMEs also need support as many have trouble accessing credit, and many lack business management skills and need training. These constraints can be overcome through setting up investment funds and training programs to support networks of SMEs. A good example is the type of support provided to small agrodealers by the Alliance for a Green Revolution in Africa (AGRA).

A real challenge is to find ways of convincing governments to actually commit to this agenda, and undertake what many of them have already promised to do (e.g. through CAADP). This is partly a challenge of political leadership, and of rallying and maintaining public support for the agenda, especially in more democratic countries. There is also a problem of institutional capability. Many public institutions are weak, especially those that serve the agriculture sector, and they have limited capability to design, implement, monitor and evaluate government programs and projects, or to work in partnerships with private sector and NGO players. Sometimes it is not just a lack of capabilities that prevents effective partnerships, but public sector skepticism about the roles of other non-government players. The seed sector is a classic example where public institutions have tried to crowd out private breeders and dealers for decades.

Given the practical realties of weak public institutions and sparse infrastructure in many countries, a first mover strategy that prioritizes specific segments of the agri-food system for early development can make a lot of sense. These might be priority commodities or regions, and the aim would be to drive these hard for early successes. Establishing quick success helps build momentum and political support for further agricultural investment, as well as opening up new growth opportunities elsewhere in the sector. Several first mover approaches are being tried in Africa, ranging from a carefully prioritized national agricultural transformation agenda in Ethiopia and Rwanda, to the targeted development of specific value chains, to spatial initiatives like agro-corridors, agro-clusters, agro-industrial parks, and agro-based special economic zones. First mover approaches provide platforms that enable relevant public and private sector players to come together to better serve groups of smallholder farms, while enabling public and private investments in infrastructure and supporting services to achieve critical levels.

Overview of the Report

The following chapters in this AASR delve more deeply into the opportunities and challenges facing Africa's smallholders as they confront the changing realities of the value chains in which they strive to function. Authors identify public policies and investments that can assist, and relevant roles that the public, private and NGO sectors can play.

Chapter 2 provides an overview of some important food related changes that have occurred in Africa in recent years. The chapter also provides model-based projections showing that for sub-Saharan Africa, the production of food staples should be about double by 2050, and the production of fruits, vegetables and meat should at least triple. Climate change could reduce these projected increases by as much as 5.1% in the case of cereals, and 1.7% for roots and tubers. Much of this increased production will need to come from farms smaller than 20 ha in size, as they currently supply about 75% of Africa's food. The chapter highlights the growing potential of agroprocessing to benefit small farms and SMEs, but developing these value chains calls for targeted policies and regulatory interventions to promote quality norms and standards and protect property. If smallholders are going to be integrated into modern value chains at scale, then the authors argue they need to be organized into producer organizations that have the technical, commercial and financial resources necessary to position their members as credible business partners. While cooperatives have attempted to play similar intermediary roles in the past, the authors argue that new types of producer organizations and business models will be required, and this will require more fostering by public and private sector players.

Chapter 3 highlights the remarkable changes that have taken place in Africa's food system in recent years, and the challenges that small farms now face if they want to succeed as commercial farming enterprises. The best opportunities for smallholders lie with high value, labor-intensive crops and livestock, as it will be hard for them to compete with large farms and imports in grain markets. To succeed, most smallholders will need to acquire game changing new skills

and investments. Governments can help by investing in infrastructure in secondary cities and towns, increasing the reliability of their energy and water supplies, and building more wholesale market spaces. Policy wise governments can help by promoting more open regional trade, and avoiding destabilizing market policies such as poor management of production shortfalls or publicly held stocks. New forms of business-oriented producer organizations are needed to link smallholders with value chains. Although the authors see the potential benefits of evidence-based, business assistance programs for SMEs, they are doubtful this will enhance their ability to work with smallholders in any organized way. Large agribusinesses may be a better channel for seeking organized linkages with smallholder organizations, and the Grow Africa program and the New Alliance for Food Security and Nutrition are both promoting this approach. Some progress has been made in partnering large agribusinesses with governments for organizing clusters of value chain actors for coordination purposes, and in funding NGOs to bear much of the initial cost of building relationships between private investors and small farms. Such public–private partnerships are now used in "development corridors". Another evolving approach is "impact investment", in which governments or donors invest in private sector projects on favorable terms as long as they lead to measurable gains in social or environmental goals alongside a financial return.

Chapter 4 addresses the challenge of strengthening financial systems for smallholders. The authors highlight the different types of financial needs of commercially-oriented verses subsistence or transition smallholders, and argue that while microfinance has helped meet the needs of subsistence farmers, there is a big gap in meeting the business needs of commercial farmers who earn little non-farm income. One reason for the gap is that financial institutions are reluctant to lend to small farms because of the high risk and service costs involved, a lack of usable collateral, and a history of political interventions in agricultural credit markets that work against lenders. Some good news is that contract farming arrangements are enabling some smallholders to gain access to credit, and recent developments in information and communication technology (ICT), the rapid penetration of mobile phones and payment services, value chain financing, and new forms of insurance, are opening up new opportunities for the spread of financial services to a wider range of commercial smallholders and SMEs along value chains. Governments can help by improving financial regulations, developing credit-reporting systems, supporting warehouse receipt systems, and by sharing part of the risk with lenders through credit guarantees and matching funds. Interest rate caps and mandatory lending targets have led to mixed results, and do not necessarily lead to increased lending to the smallholders rather than larger farms. Agricultural insurance has improved in recent years with advances in the design and administration of various types of index insurance, and this is opening up new possibilities for insuring farmers' loans and the financial institutions that lend to them.

Chapter 5 addresses appropriate responses to the challenges posed by climate change for Africa's food systems. Agriculture has always been a risky business in much of Africa, but climate change in worsening the problem. It threatens to reduce average crop and livestock yields, while also increasing the risks of major seasonal losses. These production shocks also have repercussions along value chains, affecting the supply and prices of foods, the viability of many SMEs, and the welfare of many poor people. Commercializing smallholder farms and linking them to modern value chains can help increase their incomes and assets, and hence strengthen their reserves for coping with seasonal losses. But it also exposes them to new financial, production, and marketing risks. There are many things farmers can do to add greater resilience to their livelihoods, such as crop and income diversification, making risk-reducing investments like irrigation, and by adopting climate smart farming practices. Policy makers can assist by investing in R&D on climate smart agriculture, promoting the development of weather-based agricultural insurance, facilitating the more widespread availability of rural credit and other financial services, and maintaining adequate rural safety nets. To build greater resilience into national food systems, governments should also consider policies that can help stabilize national food supplies and prices, such as maintaining an adequate national food reserve for emergencies, freeing up food markets to greater regional and international trade, and buying up surplus food in low price years for school feeding programs.

Chapter 6 reviews the policy agenda for achieving an inclusive transformation of Africa's food systems. In addition to providing the basics—a stable and enabling economic and legal environment, rural infrastructure, agricultural R&D, maintain safety nets and social protection programs for the chronically poor, etc.—governments also need to strengthen public institutions to better perform their roles, and undertake targeted interventions to help commercialize many more smallholders, and promote the development of local SMEs that play strategic roles along agricultural value chains. A key message is that an agricultural transformation of the kind articulated throughout this AASR will require significant government commitment, and a proactive policy agenda. Given the practical realties of weak public institutions and infrastructure, a first mover strategy that prioritizes specific value chains or specific regions for early development can make a lot of sense.

The final chapter pulls together the main findings and recommendations of the report.

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Annex 1

Operationalizing the Typology of Small Farm Households

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This Annex explains how the small farm typology described in this chapter can be operationalized to segment farms in practice. It uses household survey data to classify farms and quantify their relative importance and household characteristics, and spatial mapping techniques to identify geographic areas where the different types of households are likely to be concentrated.

The analysis uses recent household survey data from Ghana (Ghana Statistical Service, 2014), Ethiopia (Central Statistical Agency of Ethiopia, 2017) and Tanzania (National Bureau of Statistics, 2014) to demonstrate the approach[7]. Data on the share of crop production sold, and the share of non-farm income in total income, are used to segment the households into the five groups described in Figure 1.6 of the chapter. These household-level sales and income aggregates are derived from cross-country comparable measures extracted from FAO/RIGA database (FAO, 2016). When RIGA aggregates are not available the authors use the general approach (described in Carletto, Covarrubias, Davis, Krausova, & Winters, 2007). Small farms are defined as having 4 ha or less of agricultural land. Common boundary value choices between the different non-farm income share and crop sale share segments were determined iteratively through cross-country comparison, leading to the results in Table 1A.1.

Table 1A.1 · Composition of small farms ≤4 ha by type of livelihood strategy, Ghana, Ethiopia and Tanzania

Non-farm income as share total income	Share of crop production sold (%)		
	Low (≤5%)	Medium (5–50%)	High (>50%)
GHANA GLSS 2012–2013 (sample size 7,743)			
Low (≤33%)	8.1	14.5	22.6
High (>33%)	38.9		15.9
ETHIOPIA ESS 2013–2014 (sample size 3,000)			
Low (≤33%)	17.2	32.0	6.8
High (>33%)	39.4		4.6
TANZANIA NPS 2012–2013 (sample size 2,855)			
Low (≤33%)	5.1	15.8	14.6
High (>33%)	49.9		14.6

Source: Authors' calculations using nationally representative household survey data. Estimates are representative for the sub-population of farms smaller than 4 ha. Income and sales estimates are derived from FAO Rural Income Generating Activities (RIGA) database.

Commercial small farms are defined as selling 50% or more of their production. They are further sub-divided into specialized commercial farms if their non-farm income share is less than 33%, and diversified commercial farms otherwise. Taken together, about 30–40% of all small farms are commercial in Ghana and Tanzania, but only about 12% in Ethiopia (the sum of the and cells in Table 1A.1). There are about as many specialized ( ) as there are diversified ( ) commercial small farms in Ethiopia and Tanzania, but more specialized than diversified commercial farms in Ghana.

Pre-commercial small farms are defined as selling 5–50% of their production, and earning less than 33% of their income from non-farm sources. They account for about 15% of all small farms in Ghana and Tanzania and 32% in Ethiopia (in Table 1A.1).

Transition farms (in Table 1A.1) obtain 33% or more of their income from non-farm sources and sell up to 50% of their crop output. They are the largest group, accounting for 38.9% of all small farms in Ghana, 39.4% in Ethiopia, and 49.9% in Tanzania.

Subsistence-oriented small farms are defined as selling less than 5% of their agricultural output and obtaining less than 33% of their total income from non-farm sources (in Table 1A.1). They are a relatively small group, accounting for less than 10% of all small farms in Tanzania and Ghana, and 17% in Ethiopia.

[7] Ethiopia and Tanzania surveys are national instances of the World Bank-supported Living Standards Measurement Study—Integrated Survey on Agriculture (LSMS-ISA).

The same data sources were used to characterize the different types of households in each country (Table 1A.2). There is a clear bimodality in the distribution of non-farm income shares, with transition and diversified commercial farms receiving very high shares of non-farm income in all three countries, while the other groups receive hardly any. The households that are diversified into non-farm sources of income also have by far the highest total incomes. The pattern is the same in all three countries: diversified commercial farmers have the highest income of all, followed by transition households, specialized commercial farms rank a poor third, followed by pre-commercial farmers, and then subsistence farmers who are by far the poorest. Although not shown in Table 1A.2, there is little difference in the household size amongst the five groups, or in the number of adult workers, or the age of the head. However, there are differences in holding size, though there is little obvious relationship between non-farm income shares and farm size, and commercial farms are not noticeably bigger. Commercial and transition farms have better educated household heads than average, and in Ethiopia and Tanzania are more likely to be male headed. In Ethiopia, for example, 20.5% of the heads of subsistence farms are women, compared to 8.6% for diversified commercial farms, and 12.2% for specialized commercial farms.

Table 1A.2 · Summary statistics for different segments of farm households

	Farm household type					
	Subsistence	Pre-commercial	Commercial specialized	Transition	Commercial diversified	Average
% Non-farm income						
Ghana	2.2	3.3	4.0	92.5	82.3	42.9
Ethiopia	3.5	4.0	2.4	81.4	82.7	38.2
Tanzania	3.9	6.9	7.7	87.2	71.8	56.3
% Cash sales						
Ghana	0.3	29.6	76.6	7.7	78.6	43.6
Ethiopia	1.2	20.2	70.0	10.9	72.9	19.2
Tanzania	0.3	28.1	73.4	12.5	76.4	32.6
Mean income as ratio of subsistence household income						
Ghana	1.0	1.9	2.7	37.5	41.3	
Ethiopia	1.0	1.9	2.6	34.3	42.1	16.5
Tanzania	1.0	1.7	3.9	9.7	18.7	8.5
Farm size (ha)						
Ghana	0.80	1.10	1.30	1.00	1.10	1.10
Ethiopia	1.52	1.74	0.83	1.18	0.58	1.36
Tanzania	3.10	3.40	3.28	3.35	2.54	2.72
Education of household head (years)						
Ghana	3.10	3.60	4.10	5.60	5.80	4.50
Ethiopia	1.46	1.71	1.82	1.77	3.28	1.77
Tanzania	3.27	4.10	4.89	4.93	5.99	4.86
% Female-headed households						
Ghana	30.1	20.9	20.7	33.6	26.2	27.1
Ethiopia	20.5	17.4	12.2	22.2	8.6	19.1
Tanzania	32.1	22.8	17.0	31.7	16.9	26.0

Source: Authors' calculations using the nationally representative household survey data

A helpful feature of the typology in Table 1A.1 is that it has an implicit spatial dimension. Commercial farming is more likely to be found in areas with good agricultural potential. Quick access to urban markets may also be important, especially for the production of high value but perishable commodities. Non-farm income earning opportunities for diversifying household income are more likely in areas with good access to roads and urban centers. Subsistence farmers might be expected to concentrate in less favored areas with poor agricultural potential and poor market access. Since agricultural potential and access to markets and urban centers can be mapped, it is possible to use spatially-referenced data on these variables to identify geographic areas where different types of small farms are likely to be concentrated.

The approach is illustrated in Figure 1A.1 for Tanzania. Here the country has been segmented into spatial units by overlaying maps of agricultural potential (Van Velthuizen, 2007) with time of travel to a marketing center with at least 100,000 people (HarvestChoice, 2016b). Agricultural potential is assessed as suitability for rainfed farming using data on soils, temperature and rainfall. For simplicity, only two categories (low and high) are used for each segmenting variable, and this leads to four types of segments: lo-lo, lo-hi, hi-lo, and hi-hi, in terms of agricultural potential and market access respectively.

More refined analysis is of course possible, but even this coarse level of spatial segmentation shows some interesting relationships in terms of locating different types of small farms. Table 1A.3 cross-tabulates the percentage of each of the five small farm types against four spatial segments. We do not attempt to map the households to individual spatial units on the map because the sample sizes are too small. But, even at an aggregate level, some patterns can be observed. For example, pre-commercial farms are more concentrated in areas of low market access and low agricultural potential (lo-lo) and in hi-lo areas, suggesting that they are being held back from becoming more successful commercial farms by poor market access, and sometimes also by agricultural potential. Specialized commercial farms are more concentrated in hi-lo areas, suggesting that market access may be a constraint for them too. Surprisingly, few specialized commercial farmers are concentrated in the hi-hi spatial segment, seemingly because in those areas with good access to urban non-farm opportunities they either become diversified commercial farms or transition households. Subsistence farmers are more concentrated in lo-hi and hi-lo areas, but are also well represented in the other spatial segments too. It would seem that factors other than agricultural potential and urban access are helping to keep these households poor. Much richer results can be expected with more disaggregated levels of spatial definition, and by mapping households into spatial units at regional rather than national levels. This work is ongoing for Tanzania and several other African countries, and could be used to help target future development assistance to small farms.

Within specific geographic areas, further disaggregation of households is possible using survey data and local knowledge. The private sector, for example, already uses local knowledge to identify farmers with whom it can do business, and many NGO and social protection agencies are experienced at selecting poor and women farmers for inclusion in their development/protection projects. However, NGOs and the public sector are less experienced in identifying areas and farmers who are best served by a farm business approach.

Table 1A.3 · Distribution of household types by development domain, Tanzania

Development domain	Type household					
	Subsistence	Pre-commercial	Commercial specialized	Transition	Commercial diversified	Total
Lo-Lo	20.0	34.5	21.7	23.2	26.6	24.6
Lo-Hi	27.3	16.2	17.5	14.9	16.8	16.4
Hi-Lo	27.9	32.1	40.9	28.6	28.3	30.9
Hi-Hi	24.8	20.2	19.9	33.2	28.2	28.0
Total	100	100	100	100	100	100

Notes: Domains defined by agricultural potential and distance to market (4-hour threshold). Lo-Hi means low agricultural potential and high market access.

Source: Authors' calculations from NPS survey, WorldGrids crop mask (Hengl, 2017) and HarvestChoice agricultural potential and market access geospatial variables (HarvestChoice, 2016a)

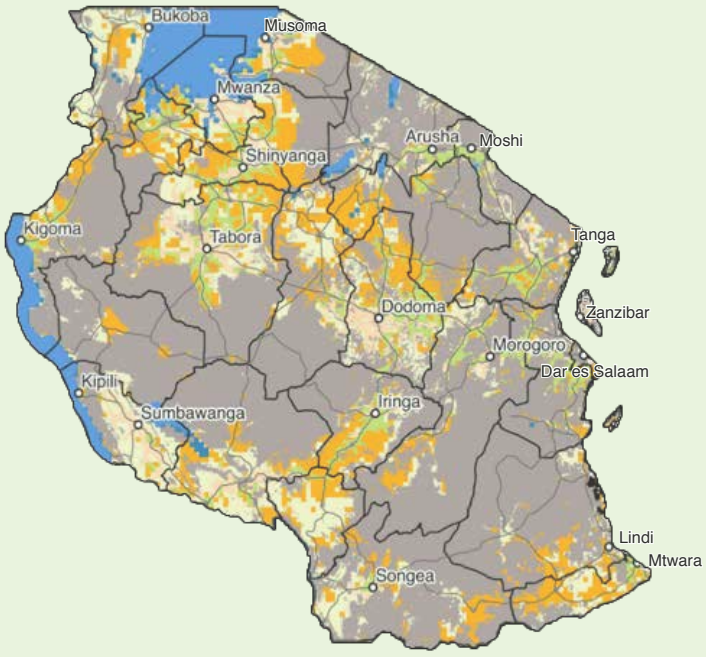
Figure 1A.1 · Map of agricultural development domains for Tanzania

Delineation of Sub-national Agricultural Development Segments

The map shows a spatial representation of sub-national areas in Tanzania that exhibit important differences in their suitability for rainfed agriculture and their distance from larger human settlements (i.e. major markets and service centers). The legend shows 4 [2 × 2] classes of the combination of hi-lo rainfed agriculture potential and hi-lo distance to markets (travel time to settlements of at least 100,000 people) indicating the agricultural potential first. This map also limits its depiction of the 2 × 2 areas to those locations known to lie within the major cropland areas of Tanzania, as assessed by analysis of satellite imagery coupled with ground validation (Hengl, 2017).

Within the geographic extent of each segment (see map) the nature of agricultural development constraints as well as the potential impact of specific types of intervention are likely to be more similar than between different segments. This type of mapping can thus be helpful in the geographic targeting of specific types of intervention.

Map of Tanzania



Legend

- Major settlements
- Major roads

Cropland mask

- Non-cropland
- Water

Ag. potential - Distance to market (4 hour treshold)

- Lo-lo
- lo.hi
- hi-lo
- hi-hi

CHAPTER 2

Business Pathways to the Future of Smallholder Farming in the Context of Transforming Value chains

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KEY MESSAGES

ONE

African smallholders have historically been able to compete locally and globally across a variety of value chains.

TWO

The rapidly transforming agricultural value chains, driven by urbanization and rising incomes, create significant market and income opportunities for smallholder farmers.

THREE

A key strategic priority is to foster the type of institutional innovations that would effectively integrate smallholder farmers as credible business partners into modern value chains.

FOUR

The most likely strategy to reach the largest number of dispersed smallholder farmers will be to modernize a critical mass of the large number of producer organizations with enhanced commercial and technical skills.

Introduction

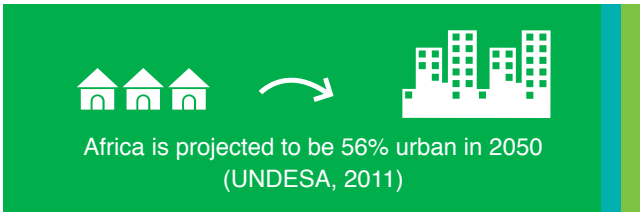
While analyzing business pathways to the future of smallholder farming in the context of transforming value chains, it is important to consider changes in strategies over time. In the mid-1960s India, Indonesia and the Philippines promoted smallholder-driven agricultural intensification through massive public investments that included price guarantees to raise smallholders' incomes (Birner & Resnick, 2010). In Africa, policies were dominated by structural adjustment policies of the 1980s and 1990s, with governments facing greater conditionality structures and smallholders facing lower and more volatile prices and less favorable terms of trade (Dorward, Kydd, Morrison, & Urey, 2004). These political constraints on state support to agriculture explain some of the challenges faced in Africa today, including institutional and governance deficit; lack of infrastructure to support production, processing and commercialization; weak integration of value chain components; and absence of opportunities for uptake of innovations (Dawson, Martin, & Sikor, 2016).

These challenges need to be overcome to allow smallholder farmers to benefit fully from rapidly expanding demand in domestic and global markets and to contribute to meeting the future food needs across the continent. In addition to dealing with the perennial constraints around technology and innovations, the future of smallholder farming will be determined by farmers' ability to successfully integrate into the rapidly transforming value chains across the continent. Given their large geographic dispersion and limited size of operations, it will be impossible to target them one farmer at a time. In fact, in all the cases where African smallholders have been able to compete locally and globally, there has been an institutional infrastructure that has bridged the wide divide separating them from the rest of the value chain actors.

A stylized picture of smallholder agriculture in Africa emerges from the literature. Even if not all its elements apply to all rural areas in the region—and Africa's diversity suggests that they cannot—most of them probably apply to most of the region. The stylized picture is of agriculture dominated by subsistence production of starchy staple crops. Production is primarily rainfed and non-seasonal and farms tend to be operated by a nuclear family with one or more non-nuclear residents. Land rights are vaguely defined, primarily based on traditional norms and customs, which tend to favor common over individual property. The many rural people and their relative marginalization under political systems in the region suggest an ongoing tendency for policy disincentives to smallholder agriculture. Africa has fragmented and underdeveloped infrastructure networks, and markets for agricultural inputs and outputs are often missing or unreliable (Delgado, 1999; World Bank, 2010).

The thorny problems of promoting the growth of incomes in smallholder agriculture in Africa have been exhaustively examined in literature inspired by a variety of concerns and ideological biases. For example, research points to urban bias where cities received disproportionate shares of public services and investments, and heavy net taxation on agriculture (Lipton, 1977; Krueger, Schiff, & Valdés, 1991). One strand of the literature emphasizes the need for smallholders in Africa to become increasingly involved in the production for sale of high value-to-weight commodities that also have high value-added, especially for export markets. Hausmann and Rodrik (2003) and Easterly and Reshef (2010) indicate that the rewards from identifying highly successful exports are always great. Promoting growth in smallholder agriculture in Africa through increased participation in growing world markets for high-value commodities is expected to require significant vertical integration of smallholders into the value chain (Delgado, 1999).

A key area of challenge related to efforts to deepen and broaden the integration of smallholder farmers trying to integrate into agribusiness value chains includes a rapidly changing and increasingly complex market environment. The increasing globalization of agricultural markets presents African smallholders with considerably more complex challenges than those faced by Asian producers during the Green Revolution era. African smallholders today need not only to produce more efficiently, but also to contend with far more logistically complex and competitive markets. Growing specialization in distribution channels and logistics; rapidly changing and differentiated consumer preferences; and increasingly complex norms, standards, and other technical specifications place increasing demands on the production and management skills of the average smallholder (Berg & Jiggins, 2007).



Over the last couple of decades, Africa has experienced a rapid transformation of traditional staples value chains fuelled by fast-paced urbanization and rising incomes. The urbanization level in Africa has reached that of other regions and has continued to grow at a comparatively faster rate of nearly 4% (UNDESA, 2011). According to projections by the

UN Population Fund, Africa and Asia are urbanizing faster than the other regions and are projected to become 56% and 64% urban respectively by 2050 (UNDESA, 2014). While only 2 cities in Africa had more than a million inhabitants in 1950, their number jumped to 50 in 2010 and is expected to nearly double by 2025. As the number of cities increases, they are becoming less concentrated. Instead of large metropolitan areas growing larger, growth in urbanization is also being driven by the emergence of many small towns (Tschirley, Haggblade, & Reardon, 2013). In West Africa, for instance, large metropolitan areas account for only 40% of the urban population while the remaining 60% live in secondary and tertiary cities in rural areas and around or along highways to large cities (Hollinger & Staatz, 2015).

The growing urban population, bolstered by the fastest economic recovery in the history of the continent, is boosting urban food demand, which is driving an explosion of demand for traditional food staples. African food markets are projected to grow sixfold by 2025, most of the expansion driven by urban demand for processed staples (Haggblade, 2011). Urban centers already account for half to two-thirds of total food demand (Dolislager, Tschirley, & Reardon, 2015).

While the share of urban population is rising, so also are the share and number with higher incomes. For instance, the number of people earning between US$2 and US$20 rose from a little more than 100 million in the 1990s to around 300 million currently, most of whom, at the higher end income bracket, reside in the urban areas (Ncube, Lufumpa, & Kayizzi-Mugerwa, 2011). The rising incomes are driving rapid transformation in diets; this drives up the demand for protein and thus staples value chains, with a rapid increase in processed foods. The share of processed foods is projected to increase five- to tenfold between 2010 and 2040. By that time, processed foods will account for between one-third and 40% of staples food demand. Africa's total urban food market is estimated to reach US$150 billion by 2030 and smallholder farmers could capture as much as US$30 billion of that (AUC/NEPAD, 2008).

Worldwide, more than 500 million farmers are responsible for the global food supply, with small farms contributing most of the food production, especially in low-income and middle-income countries (Herrero et al., 2017). The International Fund for Agricultural Development (IFAD) and the United Nations Environment Programme (UNEP) report that smallholders supply about 70% of Africa's total food requirements and provide around 80% of the food consumed in both Asia and sub-Saharan Africa (SSA) (IFAD, 2013).

Demand is also expected to surge in global food markets in the coming decades. The planet will need to produce more food in the next 50 years than has been produced in the past 400 years (Keating, Herrero, Carberry, Gardner, & Cole, 2014). Such performance cannot be achieved unless farmers increase the amount of agricultural land to grow crops or enhance productivity on existing agricultural lands through fertilizer and irrigation, and adopting new methods like precision farming (Elferink & Schierhorn, 2016).

Yet the contribution of smallholder farming goes beyond mere food production.

20%

of the world's cocoa is produced by smallholder farmers in Ghana

For instance, smallholder farmers in Ghana produce an estimated 20% of the world's cocoa, making the country the second largest producer in the world, with cocoa exports accounting for about 40% of its foreign exchange earnings, and for 8–12% of its gross domestic product (GDP) (UNCTAD, 2015). African smallholders are part of the whole production system tasked to meet consumer needs to achieve the sustainable development goals (SDGs). Smallholders are key actors in the quest for a more inclusive and socially and environmentally sustainable agricultural development model (UNCTAD, 2015).

This chapter analyzes the most relevant of these pathways in the African context while highlighting the specific role of smallholders. For decades, Africa's smallholder farming was characterized by biased policy regimes that eroded the performance and competitiveness the sector. Since the turn of the century, the sector has enjoyed a relatively long period of recovery. Rapid urbanization, rising per capita incomes, and modernizing distribution networks are fueling demand in domestic staples markets and creating new incentives for smallholder farmers. Nevertheless, African smallholders still face several challenges, including low access to both inputs and output markets, land insecurity, no access to financing, and limited knowledge and information.

Smallholder farmers can be characterized in many ways, including in terms of the land area of the farm, the number of workers, the value of output, or the value of asset holdings (Gollin, 2014). In this chapter we use land area, as most crop farms are smaller than five hectares (Eastwood, Lipton, & Newell, 2010, p. 3394).

Food Production by 2050 and the Role of Smallholder Farming

Sustaining recent growth in African agriculture is essential for the continent's ability to achieve food security and maintain broader economic growth in the future. Fast-rising food demand from growing and urbanizing populations presents an opportunity for African farmers, if they can ensure the required productivity and production increases. However, the effects of climate change threaten farmers' ability to maintain and accelerate agricultural growth. Sulser et al. (2014) use the International Food Policy Research Institute (IFPRI) International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT[1]) to project future trends in food production in Africa, and the likely impacts of climate change on production.

Analysis of trends in GDP per capita under the IMPACT baseline scenario shows that incomes in SSA are expected to almost double between 2010 and 2030, and more than double between 2030 and 2050. This will allow nearly all African countries to reach middle- or even high-income status by 2050. However, this scenario does not account for the effects of climate change, which is already affecting African agriculture and will continue to do so in ways that are uncertain, but likely to be profound. Climate change is expected to negatively affect the yields of most of Africa's major crops, with cereals showing the most consistent decline in each of the continent's regions. Yields of pulses could be positively affected by climate change in East Africa, but expected effects in other regions are negative.

Analysis of production trends for SSA under the baseline scenario (see Table 2.1), before the effects of climate change are considered, show that production of cereals, oilseeds, roots and tubers, and pulses is expected to double or more than double between 2010 and 2050, while production of fruits and vegetables will nearly triple; production of meat will more than triple. The largest percentage increases in cereal production will be in Western and Central Africa, with Western Africa accounting for the largest share of Africa's production. Western and Central Africa are also expected to see the largest increases in oilseeds production, and Western and Southern Africa will increase production of pulses the most, with Western Africa accounting for more than half the total production of both crops in SSA. Every region except Southern Africa is expected to triple meat production by 2050, with Eastern Africa producing the largest share. Eastern Africa is expected to show the largest increase in fruit and vegetable production by 2050, with Central Africa showing the largest increase in root and tuber production. However, Western Africa will still account for the largest share of production in both foods among SSA regions. Northern Africa is also projected to show significant increases in production of most crops, and its fruit and vegetable production is expected to surpass that of Western Africa.

However, the baseline climate change scenario shows that climate change will have a negative impact on production, although effects vary by crop. Climate change may have a modest positive effect on oilseed production in SSA, little effect on production of pulses, and small negative effects on production of meat and fruit and vegetables. Negative effects of climate change are likely to be larger for roots and tubers and particularly for cereals, expected to see reductions in production of 2.9% in 2030 and 5.1% in 2050 as compared to the baseline scenario. Central and Southern Africa show the largest negative effects on cereal production, with declines of over 11% relative to the baseline. Although oilseed production in SSA may see a slight benefit from the effects of climate change, oilseed production in Northern Africa will suffer, declining by 14% relative to the baseline.

Table 2.1 • Production, million metric tons

	Baseline (no climate change)				Climate change	
	2010	2030	2050	2010–2050 % change	2030	2050
Cereals	114.2	178.4	237.1	108%	–2.9%	–5.1%
Fruits and vegetables	101.4	187.4	293.7	190%	–0.3%	–0.1%
Oilseeds	52.9	90	113.9	115%	0.3%	1.0%
Pulses	11.6	18.2	27.5	137%	0.0%	0.0%
Roots and tubers	224	346.6	483.2	116%	–1.0%	–1.7%
Meat	10.8	20.4	34.4	219%	–0.1%	–0.1%

Source: Authors' calculations from data presented in Sulser et al. (2015)

[1] IMPACT is a partial equilibrium agriculture sector model used to assess scenarios for future food supply, demand, prices, and trade at the global level, as well as food security outcomes. For detailed documentation of the IMPACT model see Robinson et al. (2015) and the IMPACT website, https://www.ifpri.org/program/impact-model.

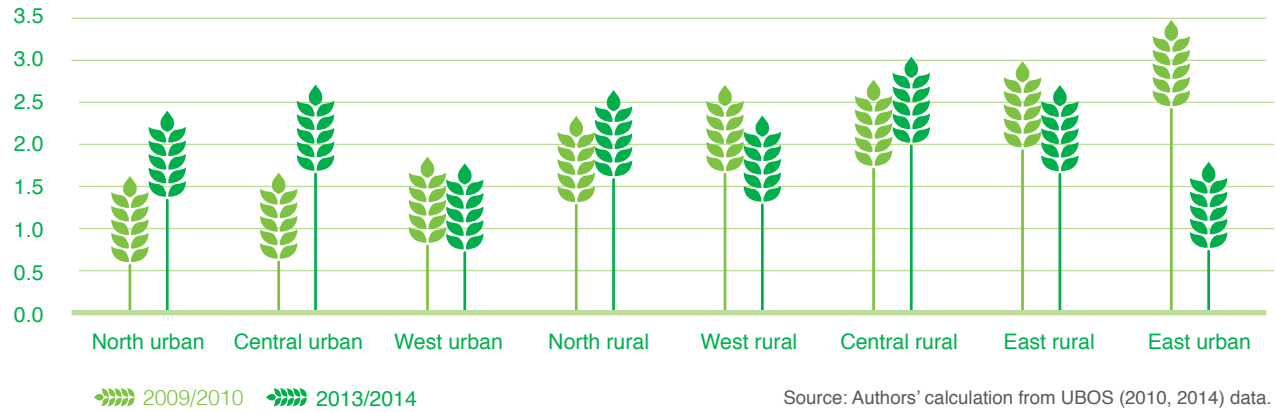
Using unique farm-size distribution data, Herrero et al. (2017) find that globally, small and medium farms (≤50 ha) produce 51–77% of nearly all commodities and nutrients considered in their study. Their study shows much heterogeneity across regions and land size. While large farms (>50 ha) dominate production in North America, South America, Australia and New Zealand where they contribute between 75% and 100% of all cereal, livestock, fruit production, and most other commodities, small farms (≤20 ha) produce more than 75% of most food commodities in SSA, Southeast Asia, South Asia, and China. Moreover, very small farms (≤2 ha) are important and have local significance in SSA, Southeast Asia, and South Asia, where they contribute around 30% of most food commodities and are managed by millions of smallholder farmers. The Herrero et al. (2017) findings also suggest that farms with less than 20 ha produce most of the essential nutrients (>80%) in SSA while farms smaller than 2 ha produce more than 25% of the nutrients.

When assessing the challenge of meeting the increased food demand by 2050, researchers often either overlook or ignore the role of smallholder farmers, despite their importance. Gollin (2014) points out that smallholder agriculture has long served as the dominant economic activity for SSA, and it will remain important for the foreseeable future. Uganda offers a good illustration of the role and importance of smallholder farmers.

Indeed, the 2009–2010 and 2013–2014 survey data in Uganda show an average farm size of 2.4 ha (see Figure 2.1). Farmers with less than 2 ha of land accounted for 33% and 20% of total farming income respectively in 2009–2010 and 2013–2014. Their share rises to at least 40% and 30% of livestock and milk income respectively (Table 2.2). Moreover, more than 40% of farmers are involved in farms smaller than 2 ha.

One study rightfully argues that "one of the agricultural pathways towards sustainable food and nutrition security is through local production of nutritious food, an activity in which smallholder farmers play a crucial role" (Dioula, Deret, Morel, du Vachat, & Kiaya, 2013, p. 2). Indeed, Africa will meet the 2050 food production challenge if and only if it finds a way to involve the millions of smallholder farmers across the continent in productivity-enhancing strategies. Plenty of evidence now exists to settle the debate over the relevance of smallholder farming's contribution to the food production goal by 2050 (Herrero et al., 2017). However, how to build an efficient and business-oriented smallholder farming system in Africa is still open to debate. What are the pathways to successful African smallholder farming?

Figure 2.1 • Farm size in Uganda by regions (ha)



Source: Authors' calculation from UBOS (2010, 2014) data.

Table 2.2 • Income and labor distribution in Uganda by farm size (%)

	2009/2010				2013/2014			
	Income			Labor	Income			Labor
	Crop	Livestock	Milk		Crop	Livestock	Milk	
<0.5 ha	6.0	10.3	6.2	8.5	1.4	38.9	4.8	3.2
≥0.5 ha to <2 ha	27.2	40.4	23.2	40.9	19.0	5.2	38.8	37.4
≥2 ha	66.7	49.3	70.6	50.5	79.7	55.9	56.4	59.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors' calculation from UBOS (2010, 2014) data

Modernizing Smallholders' Agribusiness Value Chains

Fanzo (2017) points out that the findings from the Herrero et al. (2017) study suggest that a one size-fits-all approach does not work for global food production; both small and large farms play important roles in ensuring enough diverse and nutrient-rich food is available. In addition, even though modern farms dominate global food systems, smallholder farms play a substantial role in maintaining the genetic diversity of the food supply, which reduces the risk of nutritional deficiencies, ecosystem degradation, and climate change (Fanzo, 2017).

In their estimation of the food gaps by 2050, Keating et al. (2014) derived the following 14 prospective pathways to meet world food demand by 2050:

Pathways to meet world food demand by 2050

Pathways that target reducing the food production demand curve

- Reducing food waste from farm to consumer
- Reducing over-consumption in human diets
- Rebalancing the livestock component of future diets
- Developing "smart" biofuel policies and/or technologies

Pathways that target filling the production gap

- Expanding the land resources used for agricultural production
- Expanding the water resources used for agricultural irrigation
- Expanding aquaculture (on land or in oceans)
- Closing yield gaps in existing crop and/or livestock production systems
- Developing new farming systems that intensify land and water use
- Crop and/or livestock improvement to lift the genetic potential

Pathways that involve avoiding losses in current or future production potential

- Maintaining pest and disease resistance and biosecurity
- Avoiding soil and water degradation
- Minimizing climate change through mitigation that maintains food security
- Adaptation to climate change that cannot be avoided

Source: Keating et al. (2014)

These pathways were submitted to 86 food security researchers who provided their views on the likely significance of each pathway. Overall, the surveyed experts ranked pathways that contribute to filling the production gap as the most important strategy; 46% of the required additional food demand is likely to be achieved through pathways that increase food production. Pathways to sustain productive capacity received 34%, compared with 20% for better food demand management. Keating et al. (2014) admit that food security pathways such as crop breeding and crop management are important, but are only part of the solution, and do not constitute silver bullets for solving the food security challenge. In Africa, all the above pathways require the effective integration of smallholder farmers in the rapidly transforming traditional staples value chains driven by increasing local demand. Non-governmental organizations (NGOs) lead efforts to empower smallholder farmers and small and medium enterprises (SMEs) and connect them to global corporate value chains (Clinton Global Initiative, 2016). In the next sections, we discuss more holistic pathways to enhance smallholders' contributions to meeting the 2050 food challenge in Africa. In general, smallholders who have produced traditional export crops that have involved even the smallest degree of local processing, such as cotton ginning or oilseeds milling, have fared better than their counterparts in terms of access to markets, technology and financial services (Peltzer & Röttger, 2013). They have also enjoyed higher income levels, asset ownership and wealth creation. The high value horticulture sector has also become important for SSA. One review reports that the industry developed first in Kenya (Tyler, 2008). From almost nothing in the late 1960s, exports of fresh flowers had reached 29,000 tonnes by 1995, fresh vegetables had reached 28,500 tonnes and the export of fresh fruit had reached 14,000 tonnes, worth over US$100 million. In Kenya, the horticulture sub-sector generates over US$300 million in foreign exchange earnings annually; the total domestic value in the sub-sector in 2012 amounted to US$2.5 billion, occupying an area of 662,835 ha with a total production quantity of 12.6 metric tons (International Society for Horticultural Science, 2015).

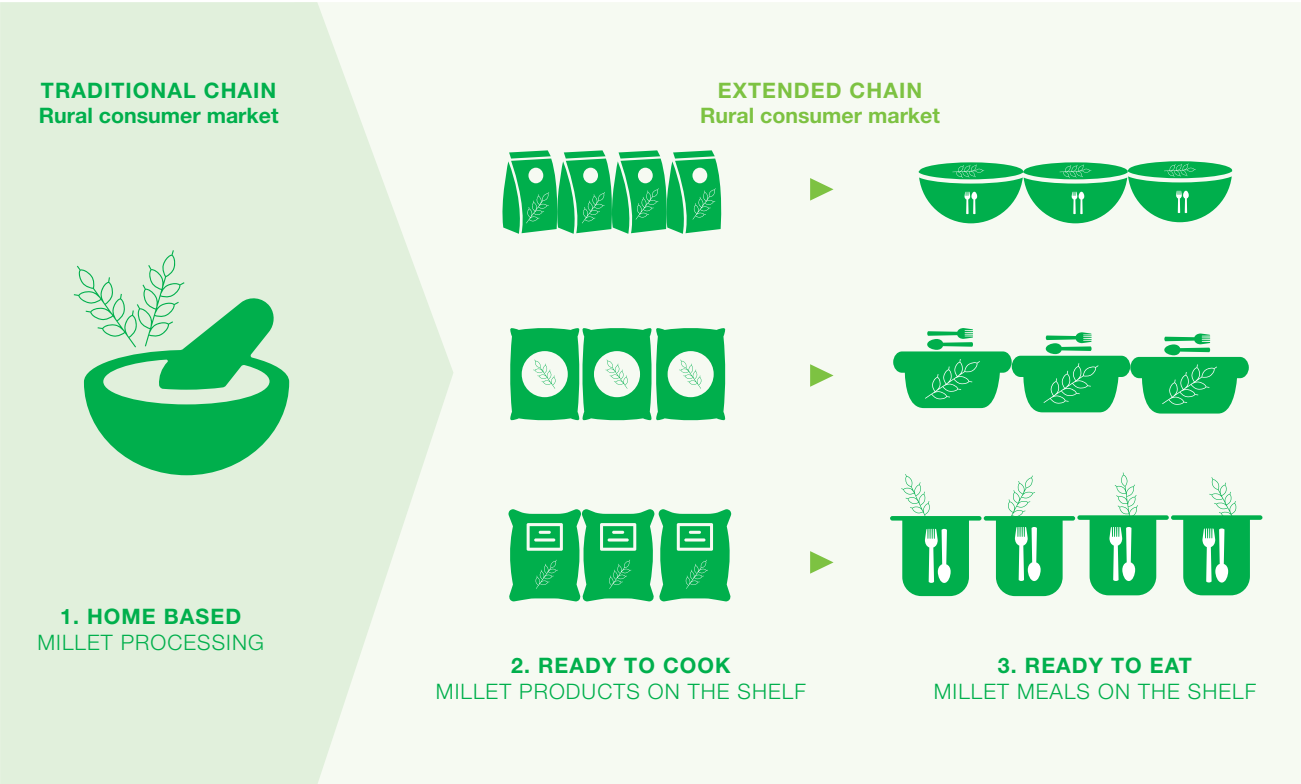
With respect to value chain participation, the distinction between cash and staple crops is irrelevant as the return to investment is the key factor. Indeed, smallholder farmers will engage in commercial agriculture if the returns to investment are superior to those available from alternative activities (Poulton et al., 2008). Hence, a vibrant staples processing sector tapping into the growing urban market

could create business opportunities for millions of smallholder households across Africa. Supermarkets, fast food chains and processing companies represent additional business opportunities for smallholders in rural Africa (Rao & Qaim, 2013). As a result, smallholders who already sell a share of their production to the market will increase their market participation and new groups of smallholders are likely to enter the market (Teklehaimanot, Ingenbleek, & van Trijp, 2017).

For African smallholders therefore the road to urban food markets leads through the nascent agricultural processing sector, especially staples food. With the transformations in food induced by rapid urbanization and a growing middle class, the domestic food market is becoming more attractive for farmers than traditional export cash crops (OECD-FAO, 2016). Urban food markets are set to quadruple and the food and beverage markets to reach US$1 trillion by 2030 (Schaffnit-Chatterjee, 2014). As pointed out earlier, processed foods will account for the bulk of future urban food demand. Smallholders will capture a significant share of this demand and realize the related potential income only through the existence of a vibrant and competitive domestic processing sector. Currently, the processing and distribution of staple foods, despite the presence of a few modern, medium-scale operators, is dominated by many informal, small-scale enterprises, most of which are owned and operated by women entrepreneurs.

Figure 2.2 shows the extent of the transformation of staples value chains, based on the example of the millet value chain in Senegal. Until recently, the chain hardly went beyond stage 1, where millet grown on the farm was milled in a neighborhood mill and the flour processed in the household into various products for home consumption or sales in the same neighborhood. The chain was so short that most of these products were hardly ever found outside of the main millet production areas, leading to a continuous decline in millet consumption not just in the capital city, Dakar, but also in other larger cities, including some near or inside the main production areas. Several projects and efforts at the National Institute of Food Technologies in the 1980s and 1990s developed and extended new processing and conservation technologies, laying the foundation for the emergence of a millet processing industry. The second stage of the chain, consisting of bringing branded flour and other ready to cook derivatives to urban markets, started in the early 2000s. The third stage, with a range of ready to eat meals, is currently in the middle of a rapid expansion.

Figure 2.2 • Lengthening of the modern millet value chain in Senegal



Source: Badiane (in press)

This transformation is not only responding to strong increases in urban demand in Dakar and other major cities, but also rapidly changing the eating habits of urbanites. Middle-class households now regularly consume millet-based meals on weekends. Lower-income households too are major consumers of these products, in particular the "ready-to-cook" brands. The "ready-to-eat" products are becoming popular meals on the go for travelers. A recent new trend in urban centers is to eat millet-based meals on the day after major Muslim religious holidays.

Beyond stimulating sales and income growth among smallholders, transforming staple and other agribusiness value chains such as dairy (see Box 2.1) has the potential to become a core segment of renewed industrialization strategies. A study in West Africa found that non-agricultural post-harvest activities of the food economy, such as processing, logistics and retail are developing quickly (Allen & Heinrigs, 2016); these account for 40% of the sector's value added and will continue to expand. From processing to packaging, transport, distribution, sales and advertising, and safety and certification services providers, agribusiness value chains have the potential to create many well-paying jobs while contributing to the diversification of the production structure of African economies. From cassava and maize to millet thousands of small- and medium-sized enterprises drive the transformation of the staples value chains. The enterprises are often women-led and employ a handful of workers. These enterprises tend to be concentrated in the main production areas or around the large urban centers. They follow the same trajectory and face many of the obstacles of endogenous industrial growth, going through the phases described in Table 2.3 (Otsuka & Sonobe, 2011). In the first, initiation, phase local enterprises produce the same type of products for the domestic markets using primarily adopted foreign technologies. In the case of the emerging agribusiness enterprise sector, it is more often the introduction of new processes, sometimes mechanized, of producing and distributing traditional foods outside of the household setting through specialized enterprises. Once a new product or business makes a successful appearance in local markets, a large and rapidly growing number of imitators and new entrants copy it, applying the same technology and producing the same goods for the same local markets.

Box 2.1 • Smallholder dairy value chain in Kenya

Commercial dairying was introduced into Kenya in the early 20th century, but indigenous Kenyans were not involved in it until the mid-1950s. After independence, most dairy cattle were transferred to the indigenous people, marking the beginning of smallholder domination of the dairy industry. The policy environment for dairy is divided into four phases:

◄1963

Pre-independence, export-oriented and large-scale

1967–1978

First administration after independence, growth of smallholders

1979–2002

Second administration after independence, period of disruption

2003 ►

Since 2003, period of new impetus

Milk production is mainly from cattle (3.5 million Friesian, Ayrshire, Jersey and Guernsey breeds and their crosses, and 9.3 million indigenous animals), camels (1 million) and goats (13.9 million). Dairy cattle produce about 70% of total national milk output (more than 3 billion liters). The bulk of dairy cattle feed is from natural forage, cultivated fodder and crop by-products. Commercial feeds include dairy meal, dairy cubes, calf pullets, maize germ, maize bran, molasses, cottonseed cake, wheat pollard and wheat bran. About 500,000 tons of commercial livestock feed was produced in 2007.

Estimated annual per capita milk consumption ranges from 19 kg in rural areas to 125 kg in urban ones. About 55% of the milk produced in Kenya, mainly from dairy cattle, enters the market. Most (more than 75%) is marketed through informal (unlicensed) channels, with about 30 processors and other formal milk marketers handling about 400 million liters a year, much of it in liquid form.

Owing to the large amount of milk that is marketed unprocessed and the weak monitoring of markets, there are concerns about public health risks from diseases and drug residues.

Box 2.1 · Smallholder dairy value chain in Kenya (Continued)

Milk product safety is controlled through the existing food safety standards and regulations contained in two main laws—the Dairy Industry Act (CAP 336) and the Public Health Act (CAP 242)—neither of which is very effective.

Possible negative environmental impacts of dairy production activities include loss of vegetation through overgrazing of natural pastures, and pollution from industrial processing.

At the farm level, dairy activities are estimated to generate, for every 1,000 liters of milk produced daily, about 23 full-time jobs for the self-employed, 50 permanent full-time jobs for employees, and three full-time casual labor jobs. This totals to 77 direct farm jobs per 1,000 liters of daily production, or about 841,000 full-time jobs in total (585,000 for full-time hired workers and 256,000 for self-employed/farm owners). In the processing sector, 13 jobs are generated for every 1,000 liters of milk handled, or a total of about 15,000 jobs. The informal sector accounts for about 70% of the jobs in dairy marketing and processing, generating 18 employment opportunities for every 1,000 liters of milk handled, or 40,000 jobs.

Licensed milk traders include producers, mini dairies, cottage industries and cooling plants, whose number has been increasing and is now over 1,500. Processors handle more than 80% of the total milk and dairy products marketed through the licensed (formal) market channel.

Source: Muriuki (2011)

Most if not all staple food processing value chains are currently in the initial phase or about to transit into the next, quantitative expansion phase. In the quantitative expansion phase, a rapid increase in the number of enterprises and supply of products takes place, leading to a progressive decline in profitability. In the absence of innovation in production technology and improved business practices, the number of enterprises continues to rise and profit to decline. This inevitably leads to a large concentration of low-productivity, persistently small enterprises, with no capacity to grow or create well-paying jobs.

If countries fail to escape from the trap of the quantity expansion phase and enter the quality improvement phase, the process of successful industrialization, in which some enterprises consistently succeed in improving product quality, raising profitability, and growing in size grinds to a halt. In this third and last phase, a critical mass of enterprises acquire, through adequate investment in capital and human resources, the required capabilities for multifaceted innovations, that is, innovation in product quality, production methods, internal management, sales, and marketing. During the transition to this phase, enterprises that are incapable of innovating will be forced to exit, leading to a reduction in the proliferation of firms, an increase in average firm size, and increased profitability. These are all conditions for sustained enterprise growth, employment generation, wealth creation, and poverty reduction.

Table 2.3 • Phases of cluster-based industrial development and policy priorities[2]

Phase	Innovation, imitation, and productivity growth	Institutions	Policy priorities and actions
Initiation	Imitation of foreign technology, production of low-quality products	Internal production of parts, components, and final products	1. Markets to lower transactions costs 2. Vocational training to improve management practices 3. Infrastructure: roads, communication, electricity to lower operating costs
Quantity expansion	Entry of a number of followers, imitation of imitated technologies, and stagnant productivity	Gradual development of market transactions, and formation of industrial cluster	
Quality improvement	Multifaceted innovations, exit of non-innovative enterprises, and increasing productivity and exports	Reputation and brand names, direct sales, subcontracts or vertical integration, and emergence of large enterprises	4. Knowledge transfer from abroad, industrial zones, access to credit, intellectual property

Source: Badiane and McMillan (2016), based on Sonobe and Otsuka (2006)

[2] By design, cluster-based industrial development brings together high-quality infrastructure, institutions, innovations, knowledge and human capital that create an enabling business environment for efficient agricultural production, processing and distribution for both large and smallholder farming.

African countries will soon face a strategic challenge in sustaining the transformation of staple foods and agribusiness value chains, and boost the modernization and growth of the smallholder farming sector. The strategic challenge is how to successfully transition from: (a) a situation where older and newly established businesses apply the same practices, produce the same narrow range of products, sell to the same local markets, suffer declining prices and profitability, and continue to operate at very small sizes to (b) a situation where some enterprises will eventually succeed in improving product quality, raising profitability, and growing in size through innovation in production technology and management practices.

The last column of Table 2.3 lists a series of indicative actions and interventions to deal with this challenge. Key short- and medium-term interventions to promote enterprise growth in the current context of the staple food processing value chain include policy and institutional innovations and related investments. These will: (i) help entrepreneurs acquire the required skills and tools to improve product marketing and capture a large share of the urban food demand; and (ii) create learning opportunities to improve technical and management practices, including in particular through ready access to vocational training. These interventions can help soften the downward pressures on sales, prices, and profits during the quantity expansion phase.

A successful transition into the quality improvement phase will require more targeted policy and regulatory interventions to promote and enforce quality norms and standards and protect property rights to encourage in-firm innovations. Countries will also have to invest in vocational training infrastructure to mainstream the upgrading and development of skills along the agribusiness value chains, including advanced training in quality control, marketing, accounting, labor management, and basic engineering theory and practice. Particularly important at the beginning of the quality improvement phase are efforts to facilitate learning from abroad as well as the importation and adaptation of foreign technologies from more advanced, in particular recently industrialized economies, through adaptive research and training. At this stage of the enterprise development process, access to credit to finance growth, property rights to stimulate innovation, and access to reliable and cost-effective power supplies will emerge as constraints that need to be addressed.

Failure to foster enterprise growth and maturation within the emerging staples processing sector would lead to a stalling of the transformation process. This would in turn limit the capacity of domestic sectors to compete for a share of the growing urban demand against foreign suppliers. That would take away from smallholders a major source of future income growth and severely limit options to modernize the farming sector.

Integrating Smallholder Farmers into Transforming Value Chains

Historically, geographic distance and diseconomies of scale have made the cost of doing business with smallholder farmers prohibitively high. Except for producers of major traditional and some high-value export commodities, most African smallholders are isolated from agricultural value chains for a variety of reasons, most of which center on their small scale, their geographic isolation, and their lack of capital. The few cases where these problems have been overcome are usually instances in which farmers have been linked to public or private sector firms or operators who have provided a bridge to other value chain actors. These firms provide some degree of credibility to smallholders as business partners to input dealers, technology providers, traders, financial services providers, processors, and exporters. As rightfully pointed out by Kelly et al. (2015, p 27), “smallholder-based business models operating in food staple value chains are made up of unorganized smallholders supplying the market”. With the dismantling of parastatals and a dearth of private companies operating in rural areas on a large scale, the capacity of farmers to tap into future urban demand is rather limited. This calls for workable alternative approaches to improve smallholder business credibility as reliable value chains. There are growing commitments by multinational corporations, NGOs, and social enterprises aimed at empowering smallholder farmers and SMEs and connecting them to global corporate value chains (Clinton Global Initiative, 2016):

- In 2015 the Hershey Company committed to train 7,500 smallholder farmers in Ghana on improved agronomic practices and empower them to supply commercial markets with groundnuts.
- In 2015 Unilever, Acumen, and the Clinton Giustra Enterprise Partnership committed to improve the livelihoods of over 300,000 smallholder farmers, by scaling social enterprises and linking them to inclusive global supply chains and distribution networks.
- In 2014 Sodexo committed US$1 billion in spending to bring more micro-, small-, and medium-sized enterprises (MSMEs), especially those owned and operated by women, into its global supply chain.
- In 2011 Heineken committed to locally source 60% of the raw materials used in its African beer brands by 2020.

The many smallholder producer organizations (SPOs) that have mushroomed across Africa are the best candidates to play the role of intermediation in the near future. Most of these organizations, however, lack the organizational, commercial, and technical capacities to operate effectively (Badiane, 2016). Overcoming these obstacles would take much time and cost a lot of money, which risks compromising the capacity of smallholders to capture meaningful shares of the urban food markets. Historically, smallholder cooperatives have acquired technical and commercial skills through services provided by public or private organizations. However, even in the first couple of decades after independence, when extension services had their widest coverage and strongest capacities, up-skilling smallholder cooperatives had limited reach in terms of sub-sectors involved, topics covered, or both. Hence, few cooperatives have been able to successfully integrate vertically and enable smallholders to participate in emerging value chains. Githunguri Dairy Farmers Co-operative Society in Kenya, KuapaKokoo Limited in Ghana, Oromia Coffee Farmers' Cooperative Union in Ethiopia and Rooibos Tea Cooperative in South Africa, are examples of successful SPOs, which function as demand-driven and market-oriented business organizations (Wanyama et al., 2014). In Kenya, dairy marketing includes farmer organizations such as cooperative societies and farmer groups which handle about 40% of marketed milk production and about 20% of total milk (Muriuki, 2003).

Successful transformation of African agriculture and the effective integration of smallholder farmers into modernizing value chains will require producer organizations that have the technical, commercial, and financial resources necessary to position their members as credible business partners. One practical option to cost-effectively integrate smallholders at scale and within a reasonable timeframe is to strategically deploy modern information and communications technologies (ICT) to build the commercial and technical capacities of SPOs to enable them to provide effective business credibility intermediation for their members. ICT can help overcome the physical, infrastructural, and institutional obstacles facing smallholders that prevent them from integrating into the globalizing and modernizing value chains. Reviewing the recent literature on the impact of ICT in the rural sector in developing countries, Deichmann, Goyal and Mishra (2016) conclude that digital technologies overcome information problems that hinder market access for many small-scale farmers, increase knowledge through new ways of providing extension services, and provide novel ways for improving agricultural supply chain management. For example, work on small-scale African farmers showed significant time and cost savings from using ICT for extension services (Aker, 2011).

Many projects and programs that target smallholder farmers are being deployed in many parts of Africa. A key weakness is that many of them target an isolated problem for a single segment of a given value chain, often in a specific geographical area. They offer solutions that are neither replicable nor scalable. Effectively linking farmers, in numbers large enough to make a difference, to modern value chains requires integrated solutions that deal with all major interfaces between smallholders and other value chain actors. The 21st century producer organization should be more than an advocate or marketing body. With modern ICTs at their fingertips, such organizations can upgrade their skills and their operations to offer a comprehensive set of services to their members. Through facilitation from SPOs, the potential of African smallholders can be harnessed to capture more of the rapidly expanding staples food markets to generate income, create wealth and transform traditional farming and rural areas.

Optimizing the Role of Producer Organizations in Promoting the Integration of Smallholders into Agricultural Value Chains

Increasing globalization presents African smallholders with considerably greater challenges than those faced by Asian producers during the Green Revolution era. African smallholders today not only need to produce more efficiently, but also to contend with far more complex and competitive markets. Growing specialization, rapidly changing consumer preferences and increasingly intricate technical specifications place significant demands on the average smallholder. Institutional and technical innovations around empowerment of and service provision to smallholder farmers therefore constitute key components of future agricultural transformation strategies. In Africa, as elsewhere, there is a plethora of different institutional arrangements governing agricultural production, comprising a variety of contractual and organizational arrangements (see, for example, Fafchamps, 2004). Over the past decade, developing country governments and donors have expressed a renewed interest in organizational forms based on collective action, such as agricultural cooperatives (Bernard, Taffesse, & Gabre-Madhin, 2008; Bernard, Spielman, Taffesse, & Gabre-Madhin, 2010; Francesconi & Heerink, 2010; Wanyama, Develtere, & Pollet, 2008; World Bank, 2007). Collective action is increasingly recognized as a way for rural smallholders to deal with a missing market situation or to generate countervailing power in the presence of monopolies or monopsonies. This widespread perception

induced the UN to declare 2012 as the International Year of Cooperatives (IYC). Cooperatives are expected to play a particularly important role in rural Africa, where agricultural production relies on a myriad of small and family farms (or farm households), facing considerable disadvantages vis-à-vis an increasingly globalized market.

To achieve adequate scale economies and market power while retaining independent ownership, smallholders could resort to the creation of collective governance forms represented by agricultural cooperatives (Valentinov & Tortia, 2012). Cooperative organizations thus appear to be an essential institution for inclusive agricultural development in rural Africa. This explains why cooperative organizations have been showing consistent growth throughout Africa over the past decade (Wanyama et al., 2008). In fact, empirical evidence (Bernard, Taffesse, & Gabre-Madhin, 2008; Bernard, Collion, DeJanvry, & Rondot, 2008; Bernard et al., 2010; Hill, Bernard, & Dewina, 2008) shows that agricultural cooperatives are found in every other village in selected West African countries and in one-third of villages in selected East African countries, involving up to 75% of farm households in a given village. Data from rural Ghana reveal that approximately 10,000 SPOs existed in 2010, comprising almost 400,000 farm households (Salifu, Francesconi, & Kolavalli, 2010).

However, numerous studies show that the role played by collective action organizations in emerging markets remains highly contested (Francesconi & Heerink, 2010; Bernard, Taffesse, & Gabre-Madhin, 2008; Bernard et al., 2010; World Bank, 2007). For every success story there seem to be many failures. Research suggests that collective action organizations are often dormant in developing countries, serving mainly to attract and re-distribute aid, subsidies and support from governments and donors (Hoff, Braverman, & Stiglitz, 1993; Meinzen-Dick, 2009). Cooperatives could obviously play a role in enhancing access to assets, access to services and access to remunerative markets for their members. However, a major challenge in using producer organizations as a locus of intervention to deepen the integration of smallholder farmers into agricultural value chains is the lack of sufficient customer service and business orientation among most organizations and associations, which hinders their ability to deal with the commercial and technical issues facing their members. In addition, in most cases such organizations and associations are not considered as credible partners by service and finance providers or other actors along the value chain. As a result, they fail to exploit the potential for public–private partnership and business-to-business alliances, which are critical to the development of smallholder agriculture in the post-structural adjustment era.

Improving Market Intermediation, Financial Services and Technology Innovation

The integration of smallholders into agricultural value chains therefore requires the transformation and operational diversification of producer organizations through acquisition of the necessary technical, commercial, and financial resources to enable them to efficiently and effectively fulfill all the major technology, market, and financial needs of their membership. In other words, they need to develop into business-oriented entities that can serve as credible business partners to other actors along the value chain. In general, smallholder cooperatives have acquired technical and commercial skills through advisory and training services provided by public or private organizations, including contracting parastatals or private firms.

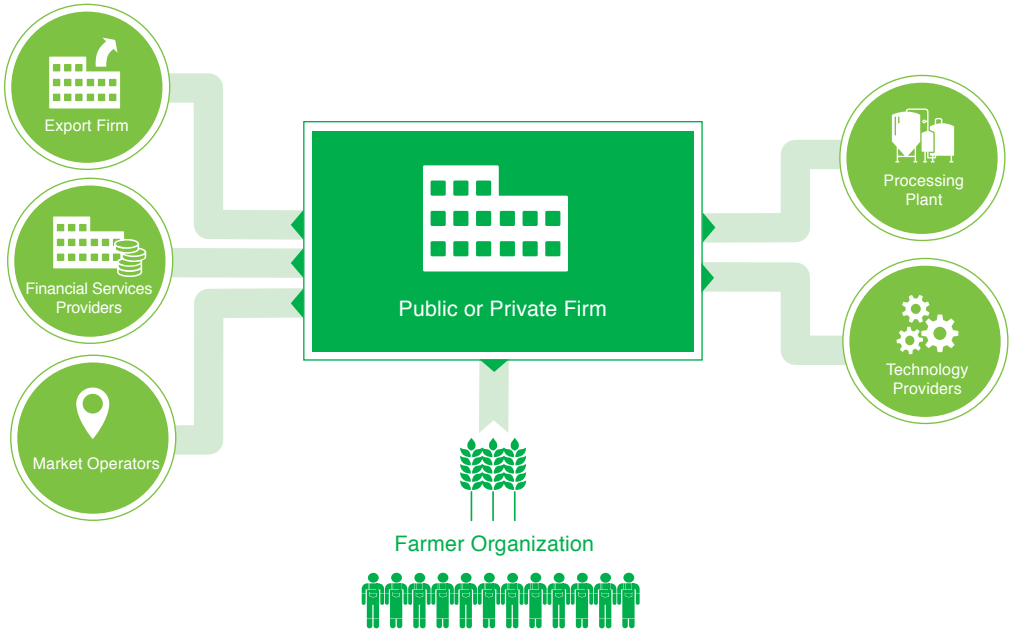
However, cases of successful integration of smallholders into value chains do exist. Examples include the groundnut and cotton chains in West Africa where smallholders have been able to produce and sell competitively to global export markets. Common to all these cases is the important role played by a third party, mostly public or private sector firms, in providing a host of services facilitating value chain access. For example, food retailers impose protocols relating to pesticide residues, field and pack house operations, and traceability (Narrod et al., 2009). Therefore, to enable smallholders to remain competitive, new institutional arrangements are required. In particular, public–private partnerships can play a key role in creating farm to fork linkages that can satisfy market demands for food safety, while retaining smallholders in the supply chain (Narrod et al., 2009).

Figure 2.3 illustrates the role of public and private firms in intermediating business relationships between smallholders and other actors and segments of agricultural value chains, including technology companies, financial services providers, processing plants, market operators, and exporting firms. The institutional setup usually includes an association or some sort of organization of farmers, which, representing and acting on behalf of smallholders, deals directly with the public or private sector entity. This type of institutional arrangement helps negotiate business contracts, facilitate payments, source technology, and access training and other advisory services. Through all the above, smallholders are positioned to find access to improved seeds, fertilizers, pesticides, herbicides, machinery, transport, storage facilities, packaging, and other quality management

equipment and infrastructure. In value chains where public or private sector firms have not been operational, such as millet and sorghum or to lesser extent cassava or maize, yield gaps and dispersion are larger and input use is lower, as are the volumes of sales.

Two observations can be made regarding this model of smallholder integration. First, the costs for all the services and support functions provided by the public or private entities are usually paid by the farmers themselves, either explicitly or implicitly. Second, the number of public sector companies providing these types of services has dwindled to near zero after costly parastatals were dismantled in the 1980s, while the private sector remains hesitant or constrained by limited capacities to substantially expand its presence. Essentially, the only viable future option to help smallholder organizations acquire the skills and capital needed to integrate into value chains is to work with them directly. It is imperative that countries tailor their national education systems to current skill upgrading needs of smallholder farmers. FAO (2015, p. 4) contends that, "this requires strategic inter-ministerial planning involving the ministries of agriculture, education and trade along with representatives of tertiary and secondary institutes, farmer organizations and agro-industry".

Figure 2.3 • Smallholder Business Credibility Intermediation through public or private firm



To encourage the development of producer organizations into effective "chain actors", primarily as "product specialists", which is often the first step in integrating smallholders who are predominantly outside of the value chains, these organizations need to engage in relationships with upstream and downstream firms in the agri-food chain. We know from the New Institutional Economics literature that institutions are transaction-cost-minimizing arrangements that may change and evolve with changes in the nature and sources of transaction costs. Coase (1960) pioneered this work when he argued that market exchange is not costless. He underlined the important role of transaction costs in the organization of firms and other contracts. Transaction costs include the costs of information, negotiation, monitoring, coordination, and enforcement of contracts. He explained that firms emerge to economize on the transaction costs of market exchange and that the "boundary" of a firm or the extent of vertical integration will depend on the magnitude of these transaction costs.

The starting point of transaction cost economics is the observation that the complexity of the real world makes it too costly to describe all relevant contingencies regarding the exchange ex ante in a contract. Contracts are therefore necessarily incomplete. Williamson (1985) argues that this causes problems when the parties involved in the exchange make specific, irreversible (or sunk) investments, that is, investments which have a significantly higher value within the relationship than in alternative uses. This puts the investor in a weak bargaining position regarding the division of ex post surplus, because the incompleteness of the contract prevents all eventualities from being covered ex ante. The investor anticipates that the other party may take advantage of the incompleteness, that is, behave opportunistically by

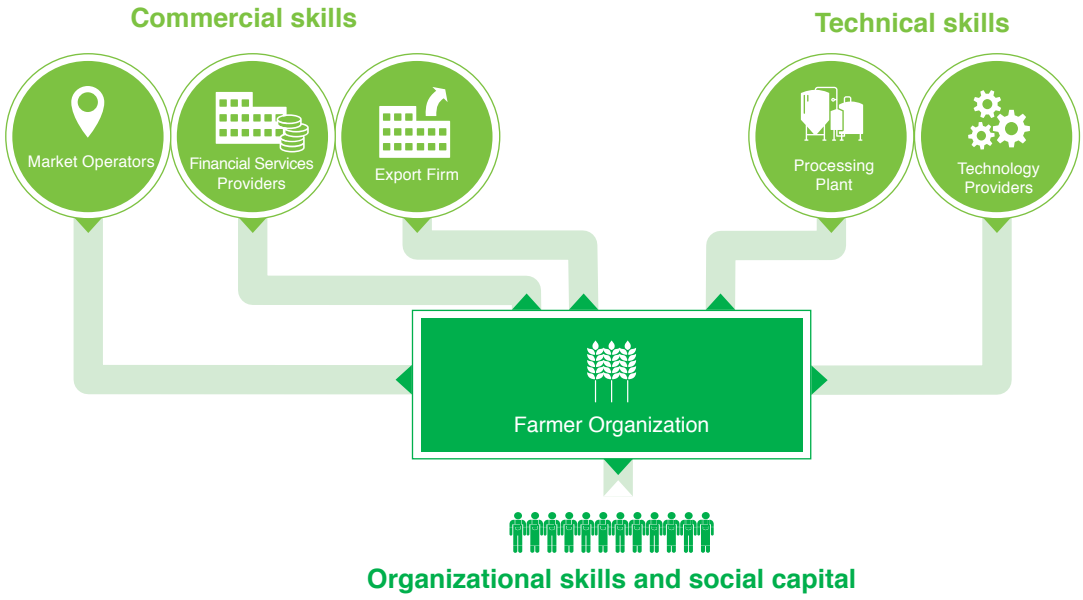
claiming a larger share of the ex post surplus than was initially agreed upon, and decides not to invest in the highest surplus generating project. This is the (inefficient) hold-up problem (Klein, Crawford, & Alchian, 1978). Hall, Scoones and Tsikata (2017) point out that contract farming has been promoted as an alternative to the "land grab" that large-scale acquisitions often entail, and also as an "inclusive business model" in which local smallholder farmers can participate and from which they can benefit. Cotula and Leonard (2010) find that smallholder contract farms and medium-scale commercial farms are more embedded in local economies, employing locally, and resulting in consumption and other linkages that benefit local businesses. However, transaction costs are rather de-incentivizing.

Transaction costs reflect costs and risks associated with doing business. They include coordination costs, which are incurred in coordinating with units actually or potentially producing an input or purchasing the output, operations risk or the risk that other parties in the transaction will willfully misrepresent or withhold information, or underperform—that is, "dodge"—their agreed-upon responsibilities ("dodging" is an aspect of a moral hazard problem). Operations risk stems from differences in objectives among the parties and is supported by information asymmetries between the parties or by difficulties in enforcing agreements. Information asymmetries are a common source of operations risk, but need not be present for these risks to exist: differences in bargaining power or incomplete or unenforceable contracts can also lead to operations risk. Opportunism risk, however, includes the risk associated with a lack of bargaining power or the loss of bargaining power directly resulting from the execution of a relationship, that is, a difference between ex ante and ex post bargaining power. However, buyers can pay suppliers an extra "efficiency premium" in high value chains, even with very unequal bargaining power in the contract relationship (Swinnen, Deconinck, Vandemoortele, & Vandeplas, 2015; Swinnen & Vandeplas, 2011).

A possible strategy to promote smallholder integration into value chains, either for domestic or global markets, would target the development of three categories of required skills for smallholder organizations (Figure 2.4):

1. The development of technical skills to enable them to: (i) source and apply improved technologies by engaging with technology providers; and (ii) claim a greater share of the added value through processing by meeting the technical requirements of third party processing firms or mastering the technical operations of their own plants.
2. The development of commercial skills for them to acquire the capacity to: (i) work with financial services providers to meet the capital and insurance needs of their members; (ii) strengthen their bargaining positions with traders and exporters; and, where possible, (iii) to competitively expand their participation in trading and exporting activities.
3. The development of organizational and institutional skills to: (i) avoid erosion of social capital; (ii) achieve the level of governance and coordination effectiveness required by greater participation in value chains; and (iii) improve the effectiveness and efficiency of service delivery to their members.

Figure 2.4 • Smallholder Business Credibility Intermediation through producer organization



Concluding Remarks

The rapid transformation of staple food value chains, driven by urbanization and rising incomes, represents considerable market opportunities for African smallholder farmers. At the center of this transformation are a large and growing number of small processing enterprises and an emerging modern packaging, distribution and marketing sector that is responding to the changing dietary trends among middle-income urbanites. Demand in urban food markets is not only much larger but also projected to grow considerably faster than demand for African agricultural exports to foreign markets. If they can respond to the needs of modern value chains, smallholders across Africa will capture a significant part of this future demand. The incremental income that this represents is estimated in the billions of dollars.

Whether the above scenario will become reality depends on continued progress on several fronts. Investments in institutional and firm-level innovation capabilities will be required to support enterprise creation and growth in the middle segments of the value chains. Smallholder farmers will need to become credible business partners with other value chain operators. No other options exist to realize this at scale without the intermediation of stronger farmer organizations with the required commercial and technical skills. Overcoming the infrastructural, institutional, and technological obstacles to business-oriented organizations with sufficient reach to support the millions of dispersed smallholder farmers using conventional approaches would take too much time and money to allow local farmers to capture a sizeable part of the surging urban demand. Countries will have to find innovative ways of harnessing modern technologies, in particular ICTs to reduce the cost and time of modernizing farmer organizations and connecting smallholder farmers to other value chain segments. This will require a successful transition from the myriad of isolated applications that focus on fragmented problems of specific value chain segments to products that offer integrated solutions to business operations across several value chain segments.

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CHAPTER 3

Engaging the Agribusiness Sector in Inclusive Value Chain Development: Opportunities and Challenges

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KEY MESSAGES

ONE

Smallholder farmers need to adapt to big changes in consumer demand and in buyer requirements (especially for safety, quality, and reliability). and must do so in the face of far more competition than in the past.

TWO

A small share, perhaps one-third, of smallholder farmers are in a position to compete effectively in this new and still rapidly changing environment.

THREE

Improved infrastructure and policy are the foundations of improved links of smallholder farmers to agribusiness. Projects and programs to actively create these links are important complements, but will have low payoff in the absence of better policy and infrastructure.

FOUR

Small and medium enterprises (SMEs) have by far the largest role in African agri-food systems and will have for many years. Smallholder farmers, and the traditional markets in which they sell, are the natural source of supply for SMEs. Therefore, strengthening the ability of SMEs to increase their scale of operation and compete in output markets is central to strengthening smallholder farmer links to agribusiness.

FIVE

Efforts to link smallholder farmers to large agribusiness will be important complements to the SME focus and will be increasingly effective as policy and infrastructure improve.

Introduction

African agri-food systems have transformed rapidly over the past two decades. This transformation has featured rapid urbanization, diet transformation, structural change from farm to retail, and impressive farm productivity growth in many countries (AGRA, 2016). This combination of changes has given rise to a huge increase (some 800%, Reardon et al., 2015) in the volumes and value of food marketed through rural-to-urban value chains. Rapid rises in food purchases by rural households has also developed a large food market in rural areas. All of this adds up to major opportunities for smallholder farmers.

To grasp these opportunities, smallholder farmers need to make investments and to shift away from traditional paths, and they must do so while competing with large farms in some locations, rising medium-sized farms throughout the continent (Jayne et al., 2016), and imports. Agribusinesses firms, non-governmental organizations (NGOs), and governments can help small farms address the challenges they face, while also leaving the field open for medium-sized farms and firms to flourish so that the overall food economy develops and modernizes as fast as possible to meet soaring needs in Africa.

This chapter tells the story of that transformation, the prospects and challenges it presents for smallholder farmers, and the ways in which agribusinesses, NGOs, and governments can and do help them in their path.

Transformation of the African Agri-food System in the past 25 years

The transformation of the African agri-food economy dates from about the end of the period of structural adjustment, when economies were liberalized and privatized and the role of the state fundamentally changed. While controversial at the time, these reforms made it possible for private investment to respond to price incentives, which is fundamental for economic efficiency and growth (AGRA, 2016). Since that time, the rapid urbanization that had been seen for many years began to reach levels where urban food demand became an increasingly weighty force. In addition, the policy environment, though still far from optimal, became much more conducive to private investment, both local and foreign (Jayne, Govereh, Mwanaumo, Nyoro, & Chapoto, 2002; Kherallah, Delgado, Gabre-Madhin, Minot, & Johnson, 2002). Though still with severe gaps, a wide range of physical infrastructure also dramatically improved and may be set for even more rapid advance in coming years (see http://www.au-pida.org/). Per capita income growth also rose rapidly across most of the continent and was among the highest in the world in some countries (Badiane & Makombe, 2015; McMillan & Harttgen, 2014). This set of changes has encouraged the transformation in the African agri-food system that we discuss in this chapter. However, these are changes "on average" as there has been much variation over countries and zones.

First, the urban food market as a share of national food markets is now substantial. Per the United Nations (https://esa.un.org/unpd/wup/), urban population growth rates in sub-Saharan Africa (SSA) from 2010 to 2015 were 4.0% per year, compared to 2.5% in Asia and 1.4% in Latin America and the Caribbean. With urban population growth rates exceeding those in Asia and Latin America and the Caribbean during every 5-year period since 1950, Africa has also caught up with the average level of urbanization in all developing countries. Regional urbanization levels in 2010 stood at 23% in East Africa, 44% in West Africa, and 59% in Southern Africa.

Urban population shares underestimate urban shares in total food consumption and purchases. This is because urban incomes exceed rural incomes by enough that it more than compensates for their lower shares of food in total expenditure, per Engel's Law. In East and Southern Africa (ESA), only 23% of the population is urban, but cities consume 48% of food produced and sold in the countries. Urban population shares in West Africa are higher, and urban shares of the food market reach 60% to 70% (Badiane & Makombe, 2015).

An African farm family now has to feed itself, one or two other urban families, and one other rural family for the following reasons:

- As noted above, the share of cities and towns in the overall food market is about half in ESA and two-thirds in West Africa.
- Diets remain basically local—imports are typically only 10–20% of total food consumption, based on our calculations from two sources: FAOSTAT food balance sheets and COMTRADE data on imports together with expenditure data from country level living standards measurement surveys (LSMS).
- The rural diet has gone from mainly home-produced to increasingly purchased foods. Even the rural poor are heavily engaged in the food market as buyers. In ESA,

for example, Dolislager (2016) show rural households bought 44% (in value terms) of the food they consume.[1]

Second, diets have diversified in both urban and rural areas. Gone are the days when African households consumed mainly grain with some vegetables and meat or fish in a sauce to give it flavor (Reardon et al. 2015; Tschirley, Dolislager, Reardon, & Snyder, 2015). LSMS data from ESA and West Africa show that non-staples such as fruits, vegetables, meat, fish, dairy, and oils form 60–65% of the diet (Reardon et al., 2015). The poor are not that different from the non-poor. For West Africa urban areas, Hollinger and Staatz (2015) show that, where the main staples are grains alone (Burkina Faso, Mali, and Senegal), they found that the share of grains increased slightly between the 1990s and 2000s, from 33% to 38% of urban food expenditure. Where grains plus roots/tubers are the staples (Côte d'Ivoire, Ghana, and Nigeria), they found that the share of grains dropped from 27% to 23% and that of tubers/roots rose from 14% to 17% over the same period. In the grains/tubers countries, staples went from 41% to 40% over this time. Slow growth in direct consumer demand for grains will be partially offset by growing demand for maize (and soybeans) for animal feed. Currently, poultry feed is the main driver of this source of demand.

Third, purchased-as-processed food has penetrated deeply across urban and rural areas. This penetration is driven by the quest for convenience as women enter the labor force outside the home, and by increases in income (although substantial purchase of these products was found also among the poor). In ESA (Reardon et al., 2015; Tschirley et al., 2015), urban households dedicated 56% of food expenditures to purchased-as-processed foods, and in rural households the share was 29%.

Fourth, intermediating between farms and African urban consumers are long supply chains and a series of actors—retailers, processors, and wholesalers. This set of players is growing, with micro-enterprises, SMEs, and big players. Processing SMEs and micro-firms, for example, are proliferating following liberalization and privatization of parastatals. An example is the rapid diffusion of such firms in milled, packaged, and branded maize in Tanzania (Snyder, Ijumba, Tschirley, & Reardon, 2015). The role of supermarkets has also increased, with a particular presence in processed foods, which is their usual starting point in developing countries (Weatherspoon & Reardon 2003) for Kenya; South Africa, Botswana, Zambia, and Zimbabwe (Nair & Dube, 2016); and Ghana (Meng, Florkowski, Sarpong, Chinnan, & Resurreccion, 2014). There has also been substantial emergence of midstream large firms—both processors such as Bakhresa in Tanzania and now Zimbabwe (Snyder et al., 2015), and wholesale firms such as in West Africa (see Weatherspoon & Reardon, 2003) and in Southern Africa (Jayne et al., 2016).

Fifth, some countries have an emerging middle-sized domestic farm sector (5–100 ha), often with urban investors starting these farms. Jayne et al. (2016) find that medium-scale farms control between about 20% and 50% of total farmland in Kenya, Ghana, Tanzania, and Zambia. The numbers of such farms are also growing rapidly, except in Kenya. The continued growth of this sector may pose major competition for smallholder farms, since larger farms can more easily ramp up production through intensified input use. These farms also present large-scale wholesalers and processing firms and supermarkets with much lower transaction costs in their procurement systems.

A related aspect of agri-food system transformation is how the rise of medium and large farms has influenced new investment by large grain and oilseed wholesalers. Recent studies found that areas experiencing a rising share of farmland in holdings over 5 hectares in Kenya, Tanzania and Zambia have attracted new investment by large-scale grain trading companies, resulting in a declining market share of small-scale traders (Jayne et al., 2016; Sitko, Burke, Jayne, & Muyanga, 2017).

The Agri-food System Transformation Presents Smallholder Farmers with Opportunities and Challenges to Meet the New Demand: What are their Chances of Succeeding?

To think about what opportunities and challenges these changes present for smallholder farmers, it is important to categorize them. Chapter 1 (see Figure 1.6), distinguished commercial small farms from those trapped in subsistence and those that may be transitioning out of farming. That chapter also noted the spatial dimensions to the classification, with commercial small farms likely to be located in areas with good agricultural potential and strong access to market outlets. This provides a framework for thinking about linking smallholder farmers to agribusiness.

[1] Note that these shares vary little across the income distribution. suggesting that the purchases are far more than just lean season purchases by food-deficit households.

The Opportunities and Challenges for Smallholder Farmers from the Transformation

Smallholder farmers have a huge opportunity in the half to two-thirds of marketed food that is not grain. Around the world smallholder farmers thrive in non-grains because many of these crops are not mechanized and do not show economies of scale, so one can earn much on small areas of land with intensive use of labor. Smallholder dairy has also been a success story in areas such as the Kenyan highlands. Non-grains are differentiated products where variations in quality can make a big difference in consumer acceptability and price. Small farms can compete on costs and quality if they invest in production and can market their crop quickly. Those that do not or cannot, will be unable to compete.

In contrast, everywhere that smallholder farmers have to compete with medium or large farms, and with imports, and especially in grains, they stand to lose out. That is because both production and processing of grains have economies of scale. Processing of grains also tends to be competitive, and processors look primarily for cheap grain, in contrast to consumers of non-grains who put more emphasis on quality in addition to price. Because smallholder farmers tend to be spread over broad areas, the cost of collecting grain from them is high. As a result, large-scale processors have a big incentive to get as much of their grain as possible from the other options—medium and large farms, or large traders or imports. They could also source grain from small farm cooperatives, but so far in Africa only a few of these can provide the volumes needed.

Without Outside Assistance, what Prospects do Smallholder Farmers have to Grasp Opportunities and Address Challenges?

Abstracting in this section from assistance that outside agents (firms, NGOs, and government) can give to small farms, what prospects do small farms have, on their own, to meet the transformed food system's demand?

Context

Several contextual points need emphasis. First, the most rapid growth in demand is for products that are "non-traditional" for a smallholder farmer. These farmers would have for a long time been treading the traditional path—a subsistence farmer mainly growing grains, while perhaps also producing a bit of meat and milk, and vegetables and pulses to complement the grains.[2] But the situation has now changed in at least two ways. For one, the service of commercialization itself is now in demand, meaning firms want efficient and predictable delivery of specified types and quantities of product. This service must be bundled with farm production if farmers want to enter in, and stay in, the new markets. In addition, the farm products in most growing demand now are the non-grains—fruit, vegetables, meat, milk, and fish.

The essence of the challenge today is for smallholder farmers to shift away from the traditional limited and mainly home consumed amounts of these products, and to add many new products and produce them in far greater volumes for the new demand. That is a major challenge, not a gradual shift.

Second, there is an additional way in which meeting the huge demand for non-grains will not be business-as-usual for small farms. In general, in the traditional setting cost competition and thresholds to meet were minimal. Farmers sold what surplus they had without having to compete with imports, with smallholder farmers from other zones or nearby countries, or with medium-sized farmers. They did not have to compete for procurement quotas—specified quantities of product delivered on an agreed schedule—sought by private processing firms. They did not have to meet basic quality requirements of urban wholesalers or emerging supermarkets. Now they increasingly face these "non-traditional" requirements, and they face them in a context of much greater competition than in the past. This, too, can be a big and sudden challenge, not a gradual shift.

Third, a shift by smallholder farmers to non-traditional activities, to a market orientation, to new marketing services such as sorting and grading, and to new products other than basic grains implies a substantial and "disruptive" level of investment by them. Economists call this a "threshold" investment. For example, a smallholder farmer, or an area with many smallholder farmers, or a smallholder farmer cooperative, may want to become a regular supplier of fresh vegetables to an urban wholesaler or a supermarket chain. To enter this market and remain in it, however, they typically need to have at least irrigation, and possibly a greenhouse. These are big investments for a small farm. They also need a "threshold" of knowledge of how to grow what is essentially a non-traditional product. Even if they have produced the vegetables in the past, they have not produced them in the quantities, and with the regularity and the reliable quality that this kind of market demands. The farmers may need a vehicle to get the produce to market. They very probably need an all-weather road, and maybe a bridge. They might need a packing shed to sort the product so they can get

[2] See Carr (2001) for a review of the substantial progress made by African smallholder farmers in agricultural productivity up to about the middle of the 20th century. This progress was based primarily on adoption of new crops—maize that replaced much lower-yielding sorghum and millet, and other "exotics" such as cotton, and new fruits such as mango, pawpaw, and avocado. Animal traction played a role in certain areas. From the 1960s, however, Carr (2001) notes "stagnation" in African agriculture.

better prices for the better quality portion. And even if they do all this, they might not be attractive to a wholesaler or supermarket if these buyers need to collect the produce from many smallholder farmers. So they might need to have some kind of aggregation facility or even a cooperative, which is uncommon, with the exception of groups organized around cash crops such as cotton.

Fourth, smallholder farmers (and their competitors, the rising medium-scale farmers, large-scale farmers in some countries, and importers), face a "product cycle". That is, in a given market, the product starts as a local niche, usually produced by smallholder farmers/gatherers. The second stage is the commoditization of the product from a niche to a bulk product, continuously available at cheap prices, and always achieving a basic level of quality. These are the characteristics we've described above, and they make it very difficult for smallholder farmers to compete. In a third stage, the product becomes differentiated, meaning that various qualities or certifications or other variations on the basic commodity theme emerge. It is sometimes in this third phase that again small farms may have a chance against larger producers. Yet this stage demands sophisticated production and marketing, meaning that knowledge thresholds become extremely important; entering these markets is very far from business-as-usual for small farms.

The reality in Africa is that as markets broaden and commoditize, smallholder farmers are exposed to new competition—we can say they are "de-protected"—from multiple directions. It is usually during the commoditization phase of the product cycle that smallholder farmers have the greatest challenge, just on the basis of production and transaction costs. They have a different set of challenges in the third stage with the quality requirements of product differentiation.

Empirical patterns

Several empirical patterns grow out of these contextual factors. First, wholesalers and processing firms and supermarket procurement units tend to choose sourcing areas based on quality, cost, and consistency of volumes. This, in general, means that the sourcing zones are not too far away or are connected by good roads, have low risk of breaks in supply of the product (so may feature irrigation), and have relatively low costs of aggregating and collecting the product. As the buyers have to make a profit to stay in business, they are driven by relative costs and risks. Barrett (2012) reviewed evidence from processing and supermarket operations in India, Madagascar, Mozambique, and Nicaragua. The author found that hinterland zones and resource poor zones tend to be avoided by procurement teams. That is a fundamental point for our purposes.

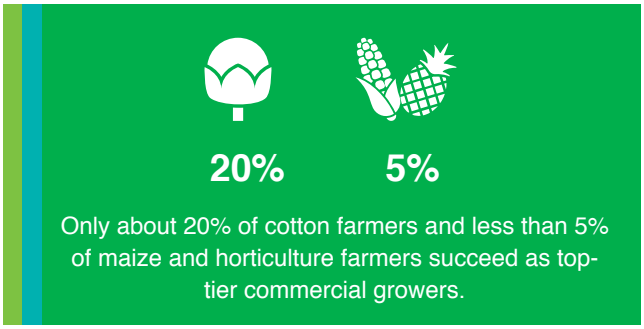
Second, even "commodity" non-grains (e.g. potato, onion, and other vegetables; cotton, and other cash crops) require substantial threshold investments by smallholder farmers. This is why many studies of supermarket and processor procurement find that it is the upper tier, even of the commercial smallholder farmers (Figure 1.6, Chapter 1), or the medium-size farmers, in favorable or intermediate zones, that tends to participate in these agribusiness sourcing systems (outside of subsidized programs by NGOs).

Third, however, much scope exists for smallholder farmers with some assets and located in advantageous zones to supply the wholesale markets of cities and towns in Africa with commodity products. These markets are less "actively coordinated" than the "modern" markets of large wholesale buyers, large processors, and supermarkets. They do not require producers to supply stipulated quantities of specific quality on a regular schedule. The investment requirements to provide these types of products to these types of markets may thus be within the possibilities of many smallholder farmers who are close enough to towns to deliver the product. For example, Liverpool-Tasie et al. (2016) found that many women in rural villages in northern Nigeria produce chickens and eggs for the market. Other examples among many include southern Nigeria with a particular orientation to the rapidly growing towns and cities; and areas of northern Mozambique where farmers responded rapidly to improved road connections by producing commodity vegetables and selling them in cities that had previously been too economically distant.

Fourth, contrary to the common perception of stagnant African small farms, external input use has grown rapidly over the past decade (Haggblade, Minten, Pray, Reardon, & Zilberman, 2017; Liverpool-Tasie, Omonona, Sanou, & Ogunleye, 2017; Minten, Reardon, & Chen, 2017; Sheahan & Barrett, 2017). This particularly has been the case for chemical fertilizer and herbicides. Interestingly, fertilizer has frequently been promoted by large-scale public subsidies (Jayne & Rashid, 2013), while herbicide use has been largely driven by private sector research, product development and marketing (Haggblade et al., 2017; Sheahan & Barrett, 2017).

Furthermore, contrary to the traditional image that credit (formal or informal) fuels farm input purchases, new evidence shows that credit is a minor source of cash for input purchases. Instead, Adjognon, Liverpool-Tasie and Reardon (2017) show that the cash mainly comes from rural non-farm employment (Haggblade, Hazell, & Reardon, 2007) and crop sales. As non-farm employment and crop sales are usually concentrated among the better-off households, these patterns mean that productivity increases and farm investments will be similarly concentrated.

Fifth, some smallholder farmers climb the "value ladder" beyond subsistence farming, into successful commercial farming (Figure 1.6, Chapter 1). An analysis of this is found in Chapoto et al. (2013). They studied the paths to becoming successful commercial smallholder farmers, producing maize, cotton and horticulture, three crops with strikingly different market institutions (strong government support for maize, private contract farming for cotton, and laissez faire for horticulture). They found that only a small minority of Zambian smallholder farmers succeed in transitioning to high-productivity, high-volume commercial agriculture.



By tracing the long-term trajectories of the successful farmers, they found two paths that farmers use to climb the value ladder. The "low road" is exemplified by cotton, and involves a two-generation transition via cropping that is low value but with well-structured markets—timely input supply on credit, and nearly guaranteed purchase of the crop. The more restrictive "high road", epitomized by horticulture, offers a steeper ascent, enabling prosperity within a single generation, but requires greater financing, management skills, and risk tolerance. A strong orientation towards investing profits into production, rather than consumption, was a key feature of those successful in horticulture. Many of them lived for many years in modest traditional housing, despite high earnings, until they could save enough to invest in (far) better housing and make other discretionary expenditures without risking their business.

Sixth, the above discussion focuses on the paths of and challenges to individual farmers. But the discussion at this point usually turns to what appears to be an "obvious" way out, which is for farmers to form cooperatives so that buyers see them as low-cost sources of supply and input sellers to see them as an attractive market. However, many studies find very few independently functioning farmer cooperatives in Africa. The few that exist are usually connected to donor or NGO initiatives or processing firm relations such as the cooperatives for milk collection centers in Zambia, or for cotton in West Africa (see Tschirley, Poulton, & Labaste, 2009).

A key reason for the paucity of functioning organizations to date, despite enormous support by governments and donors, is that unreliable markets make it not worth the time and effort that farmers have to put into organizations if they are to succeed. A reason now for some optimism is that the rise in demand for processed foods and quality-branded foods creates more "focused points of demand"—specific processing plants or large-scale buyers emphasizing quality—that need regular supplies of product. This may more often make it worth the farmers' time and effort to organize to satisfy these markets. Assistance in this regard from the food industry firms and/or NGOs may therefore have a higher payoff.

In sum, all the above spells "pretty small share" as a response to the question of how many smallholder farmers are in a good position to compete effectively in the medium term to supply the cities and the big players. From Chapter 1, this might be the 10% to 30% of "commercial farmer" households plus some portion of the pre-commercial ones, likely those located in more favorable zones as discussed above. The issue thus becomes what can be done to support that small base (say, perhaps the top third of smallholder farmers) and then spread it.

The Roles of SMEs and large Agribusiness Firms

We first focus on how private actors are relating to smallholder farmers in Africa, starting with the huge role of SMEs, then consider the role of large firms. The next section considers what governments, donors, and NGOs can do to broaden and strengthen the links between smallholder farmers and these firms.

SMEs have by far the Main Role in Helping Smallholder Farms be Included

SMEs in Africa's agri-food system include tens of thousands that supply most of the services of food processing, transport, wholesale, and retail. The emergence of these firms has been called the "Quiet Revolution" in agri-food systems (Reardon et al., 2015). These firms supply far more of the supply chain services in African than do large domestic companies and multinational corporations. We expect they will continue to do so for at least the next one or two decades. The performance of these SMEs is thus central to attempts to reduce transaction costs for inputs to and outputs from smallholder farmers.

SMEs have proliferated over the past two decades, encouraged by rising incomes, urbanization, privatization

of parastatals in the 1990s, and liberalization (Haggblade, Hazell, & Reardon, 2007). There is a rapid increase, for example, in small-scale maize processors in the wake of privatization of giant grain parastatals for example in Zimbabwe (Jayne & Rubey, 1993; Rubey, 1995) . Minten, Tamru, Engida and Kuma (2016) document the ultra-fast proliferation of SMEs in teff supply chains to Addis Ababa, with a spread of rural and urban teff wholesalers, truckers, and of cereal retail shops, mills, and cooperative retailers downstream. Snyder et al. (2015) document the diffusion of maize processor micro, small, and medium enterprises (MSMEs) in urban Tanzania, with differentiated quality, and packaged, labeled, and branded flour. Liverpool-Tasie et al. (2016) detail the fast spread of chicken feed mills and small- and medium-scale farmers, wholesalers and retailers moving chicken in northern and southern Nigeria to urban areas.

Our claims about the predominance of SMEs can be demonstrated with a few examples. First, at retail, supermarkets hold at most 20% of the overall food market even in countries like Kenya and Zambia, which have recorded the most progress most progress. In most other countries, and especially in West Africa, supermarket shares of overall food are likely in single digits. Thus, easily more than 80% of all the value of food sold to consumers is sold by SMEs and millions of micro-entrepreneurs in the informal sector.

Second, in the midstream, the maize milling market in Dar es Salaam, for example, has been left almost entirely to these micro-firms and to SMEs. This was occasioned by the departure from the business of Bakhresa, the largest grain miller in the country and a regional operator, which decided it could not compete with the influx of MSMEs selling branded maize meal; it remains a huge player in wheat milling, where imports allow large economies of scale. As a final example, Sitko et al. (2017) document the rise of the large-scale grain trade in Zambia, but even there the combined share of national and international large-scale traders was only 11% in 2015. In Kenya the gran market share of large traders rose from virtually nil in 2004 to 38% in 2010 (Sitko et al., 2017).

In other countries with little or no history of large farms, the share of such large traders is likely to be considerably smaller. The current dominance of SMEs and micro-firms will decline over time, but we expect this sector to remain overwhelmingly important for at least two decades.

The Role of Large Food Companies

Africa's agri-food economy has many things large companies do not like. This economy poses high risks under normal circumstances, along with possibilities of major disruptions (political or natural), and imposes very high costs of operation.[3] Unpredictable policy, including sudden placing or lifting of import and export tariffs or bans, and even restrictions in some countries (e.g. Malawi) on domestic trade, add to the costs and risks and inhibit investment by large companies. Large parts of the potential supplier base, the small farms, lack the assets and access to input markets to be reliable suppliers. Even agroclimatically- and commercially-favored areas and commercializing smallholder farmers face many of these challenges. That is why most processors and supermarkets still use traditional wholesale markets, and depend on the existing supply chains for products from the rural areas when they source locally; it is also why they often source as much as they can from imports or medium- and large-scale farms.

This is a level of basic challenge that will not be solved in a few years, or by just corporate social responsibility (CSR) by the largest firms, or even by the sum of NGOs weighing in to help. The basic challenge means that investment by large firms will be more gradual than in Asia and Latin America or South Africa. Governments in these places prioritized rural infrastructure, reducing transaction costs and risks for businesses wanting to invest. So we start with this challenge for African governments: regardless of what companies and NGOs and donors try to do, high risks and costs will continue to constrain the take-off of large companies sourcing from smallholder farmers until the physical infrastructure is dramatically improved, and trade (both domestic and regional/international) and other policies become more predictable. This challenge may also constrain the blossoming of the other beneficial phenomenon that we observe, the rise and diffusion of medium-size commercial farms serving urban markets.

Despite all these challenges, the sheer size and potential growth of the African market has attracted increasing numbers of large companies. These companies tend to follow two sourcing strategies for raw material (Reardon & Timmer, 2014). First, they tend not to produce their own, but source it instead from medium or large farms, imports, or smallholder

[3] The World Bank's Doing Business rankings show that 31 of the 50 lowest ranked countries are in SSA. The World Economic Forum's Competitiveness Ranking shows 31 of the bottom 40 countries being from SSA.

farmers. When doing so, the companies can work directly with the suppliers; this is illustrated in horticulture products sourcing in Kenya by local supermarkets (Neven, Odera, Reardon, & Wang, 2009). An example for grain is direct contracts by supermarket chains with the giant grain miller and importer, Bakhresa, in Tanzania.

When they do source from smallholder farmers, these firms do not typically themselves collect the product from them. Companies also prefer not to go directly to wholesale markets to buy large quantities of potatoes for a chips operation, grain for mills, tomatoes for puree factories, apples or mangoes for juice factories, meat for sausage, and so on. Doing so would mean high transaction costs and inconsistent volumes and quality.

Instead, if possible, they use dedicated wholesale agents who organize their sourcing from wholesale markets, from farmers large-scale and smallholder, and from import houses (Reardon, Timmer, Barrett, & Berdegue, 2003). An example is Freshmark Systems, part of the Shoprite Group based in South Africa, which handles all the food sourcing for Shoprite supermarkets (Weatherspoon & Reardon, 2003; http://www.fastmoving.co.za/retailers/shoprite-holdings-ltd-2/fresh-produce-197/freshmark-9). These agents are responsible not just for the logistics of the sourcing systems, but also for applying the retail company's minimum quality standards.

Second, whether the food company sources directly from smallholder farmers or through an agent, under certain circumstances it is in the interest of the firms to resolve "idiosyncratic market failures" facing smallholder farmers. In plain terms, this means that when a particular set of smallholder farmers cannot access needed factors like land, labor, or equipment, or variable inputs like seeds, fertilizer, etc., or credit to buy them, then sometimes it benefits large processors or retailers or even wholesalers to arrange a way for the smallholder farmers to get these inputs (Key & Runsten, 1999).

The most common way for firms to resolve farmers' constraints is through contract farming. Firms incorporate assistance into "resource-providing contracts" that address smallholder farmers' constraints to access to credit, farm inputs, extension, and output procurement. The provision of these resources alleviates idiosyncratic market failures for smallholder farmers and makes them competitive with large-scale farmers. Governments and NGOs may also provide the resources used in these contracts. Reardon, Barrett, Berdegué and Swinnen (2009) and Barrett (2012) review evidence of companies undertaking this kind of contracts in Africa; Tschirley et al. (2009) explore it in perhaps its most widespread application in Africa, the cotton sector. The model is also widely practiced for tobacco and some other cash crops.

An illustration of this model is the relationships that existed between large companies and small farms for fresh horticultural exports during the 1990s and 2000s. In several countries exporters began using resource-providing contracts with smallholder farmers. They did this where there were no large-scale farmers, or to broaden their supply base beyond the limited number of large farms. At the same time, the companies had to meet strict private standards for quality and safety imposed by supermarkets in developed countries. In the early 1990s in Zimbabwe, Hortico Agrisystems sourced vegetables for export only from large-scale farmers, but as policy change induced the farmers to shift to tobacco, Hortico began sourcing from thousands of smallholder farmers (Henson, Masakure, & Boselie, 2005). The company applied pesticide on the small farms to meet export standards. Hortico also provided technical assistance, inputs, credit, collection, training, and price risk management. The scheme is similar to that used by Lecofruit, a Belgian multinational sourcing vegetables from smallholder farmers in Madagascar for European supermarkets (Minten, Randrianarison, & Seinnen, 2009).

In some cases the company is vertically integrated (say a processor who also supplies inputs) or an alliance between a food company and an input company. provide the For example, Chi Farms, Amo Byng, and Zartech supply chicks and other inputs and buy chickens for processing in Nigeria (Liverpool-Tasie et al., 2016); Kenchic in Kenya applies a similar model. This allows coordination of the links to the output and input markets; contract farmers therefore have a profitable output market have affordable access to high quality seeds, fertilizer, other inputs, and extension specific to the quality requirements of these schemes.

Other examples include cases where the company engages in:

- the production of inputs (fertilizer and seeds), contract farming of rice, and production of processed foods including milled rice and other foods in Nigeria (Notori);
- the production of raw material input (milk, in contract farming), collection centers and chilling facilities, and production of dairy product in Zambia (Land O' Lakes);
- the provision of technical assistance, contract farming of greens by local smallholder farmers, and retailing of the greens by a supermarket chain in South Africa (Shoprite, Pick 'n Pay);
- a large pineapple export operation in Ghana, with provision of drip irrigation and seedlings, contract farming, and export (Blue Skies); or

- own production often in an estate, complemented by outgrower production (sugar in many locales, and also tea) In each case a large company serves as the link to the market and sources produce from smallholder farmers in remunerative contract farming arrangements. Smallholder farmers thus do not need their own independent link to the final market.

Note that if companies decide to set up resource-provision contracts, this means either that it is not economical to source from importers and medium/large suppliers (who would normally be the lowest-cost suppliers) or they are unable to get all the product they need from these sources. The companies therefore have to depend at least in part on smallholder farmers, or are already depending on these farmers and need to resolve their constraints to get the needed quality or volumes from them.

Many if not most of these arrangements are put in place by firms without any external (subsidized) assistance. Yet, as we have continuously emphasized, costs and risk are very high for the companies doing this. As a result, food companies in Africa and elsewhere also frequently seek third-party assistance, subsidized or free, from NGOs or governments to provide the needed resources, and even the linkage arrangements, with smallholder farmers. We discuss this in the next section.

What can Governments and Donors do to Enhance Smallholder Farmer Links to SMEs and Large Agribusinesses?

If SMEs are, now and for at least the next one to two decades, the foundation of Africa's agri-food system, then they must be at the center of any strategy to promote strong smallholder farmer links to growing agribusiness. At the same time, large companies are increasing their investment in Africa, and the continent will increasingly need them, with their world-class technology and expertise and links to global value chains, if it wishes to continue its growth momentum and raise the living standards of its people. Our argument is that promotion of such investment is simply an important complement to a primary focus on strengthening the SME sector.

For both SMEs and larger agribusinesses, it is crucial to recognize that the foundation for strengthening them and facilitating smallholder farmer links is policy and infrastructure (for this point with respect to SMEs, see Biggs, 2006). Investments in specialized training, building of relationships between firms and farmers, preferential credit access and other "project" activities can be important and must be pursued. But the return to investment in these focused activities will be vastly larger if the policy setting is conducive, and if infrastructure is in place to reduce costs and risks in the system. In the absence of such conducive policy and infrastructure, too much of the project spending will deliver little if any long-term benefit.

Foundations: Infrastructure and Policy

Infrastructure: Beyond the standard refrain of the need for investment in roads, energy, and water, we advance two key propositions about infrastructure investment in the service of inclusive smallholder farmer development. The first is that secondary cities and towns need to be a central focus, for three reasons. First, these urban centers hold about 60% of Africa's urban population and are growing faster than the larger cities (analysis from citypopulation.de). Second, they are economically and geographically closer to more farmers, generating more poverty reduction than large cities by being an easier "stepping stone" for rural residents moving into the non-farm economy (Christaensen & Todo, 2014); they also provide nearby markets for local production, and for obtaining inputs. Improving links from rural areas to these towns and from these towns to larger urban centers; increasing the reliability of energy and water supply in the secondary cities and towns; and providing the market infrastructure they need to efficiently receive rural production and redistribute it, will attract more food processing and trade and general value added, generate more employment, drive more economic growth and reduce poverty more. In all cases, smallholder farmers will be major beneficiaries. The third reason to focus on secondary cities and towns in infrastructure investment is that they currently have very little of it—especially marketing infrastructure—and thus provide an opportunity to "get it right" from the beginning and avoid the severe problems seen in this regard in larger cities.

Our second proposition deals with the degraded state of urban marketing infrastructure on the continent. Increasing the efficiency with which urban wholesale markets can receive and redistribute food, their ability to maintain product quality and safety, and the two-way flow of information between these markets and rural farmers, would have major positive effects for smallholder farmers since these farmers are the main users of these markets (Tschirley, Ayieko, Hichaambwa, Goeb, & Loescher, 2009). Currently, urban marketing infrastructure is too often deplorable, with very little new wholesale market construction over the past several decades, even as urban populations have

more than doubled and food volumes have increased two to three times.[4] The influence of entrenched groups and rent-seeking may be largely to blame for this. Linking vastly improved urban wholesale markets to improved rural assembly markets (as has been done with collaboration from Mviwata in Tanzania) would further tighten the link and benefit smallholder farmers.

Crucially, investment in hard infrastructure must be made only in the context of new ownership and management models that feature much more private sector engagement and far more active partnering between public and private sectors (Tschirley, Ayieko, et al., 2009).

A telling fact is that urban food systems are nearly entirely absent from the urban planning agenda in SSA. For example, Morgan (2009, 2013) trumpets "the rise of urban food planning" but finds little evidence for Africa, and Jaffee (2016) notes the absence of food from urban planning in the World Bank agenda. This needs to change.

Policy: The foundational policy element for large firms and SMEs alike is stability and predictability. The importance of these elements may be most obvious for large firms, who are risking potentially large amounts of capital; may have shareholders they have to satisfy; and may not even make an initial investment if instability appears too great. Yet there is no reason to think, for example, that SMEs are more able to deal with the price instability that comes from poor management of production shortfalls or of publicly held stocks, as happens so frequently in Southern Africa (Tschirley & Jayne, 2010). It may also be the case that instability strengthens the already strong hand of ethnic minorities and immigrant groups against indigenous entrepreneurs by increasing the importance of relation-based transactions to manage risk (Biggs & Shah, 2006; Gadzala, 2009). Rule-based approaches to regional and global trade, in which policy makers and political leaders agree to be subject to transparent decision-making procedures, and to eliminate unofficial controls and charges on traders and transporters in domestic and border trade, remains a pre-eminent need in the agricultural policy arena.

A stronger commitment to open regional trade is a key component in growing efficient local agribusiness capacity.

COMTRADE data for Nigeria, Uganda, Rwanda, Tanzania, Malawi, Mozambique, and Zambia show that regional trade in food (defined here as trade with any SSA country other than South Africa) rose between 2008–2011 and 2003–2015, but only from 7% to 10% of total food trade (averages for each period). Continued progress at this rate would be encouraging, but will require active promotion and commitment by policy makers and political leaders. By providing a larger market with consumers and firms that have similar demands in quality, timeliness, and types of products, regional trade is a key element in the incremental learning that agribusinesses have to undertake to expand their operations and compete over time on a broader stage (Haggblade, 2013). And as they do this, they will source more raw material from small local farmers.

Improved regional trade, with due consideration of phytosanitary and intellectual property-related issues, is also crucial in seeds. This is especially the case for vegetables and hybrid cereals, which very few local seed systems are able to produce in the diversity and volume needed to support such production.

Additional Steps to Strengthen SMEs and their Procurement from Smallholder Farmers

Smallholder farmers, and the traditional markets in which they sell most of their product, are the natural source of supply for SMEs. Most of these firms are too small to source from medium- and large-scale farmers, and likewise are not in a position to import raw material, other than through informal border trade. Promoting active coordination between SMEs and small farms is also likely to have limited success. The result is that strengthening links between smallholder farmers and SMEs essentially involves strengthening the capacity of SMEs to source product, access technology, and access remunerative output markets.

A big problem is that, despite the popularity of programs for direct provision of micro- and small-scale credit and of business development services to SMEs and sometimes to micro-firms—nearly every African country has an agency to promote small-scale industry, and donors have financed innumerable such programs—little is known about the effectiveness of these programs (Cravo & Piza, 2016). Danida (2009, p. 5) captures the situation well, stating that "recommendations are often based on speculation about what would work rather than on evidence of what works", and that the few evaluations that are done some years after the end of a project "seem to show very different [less positive] results" (brackets added).

[4] Based on average urban population growth of 4% per year per United Nations Population Division, and an assumed growth in per capita incomes of 2% and food expenditure elasticity of 0.75.

The risk of unproductive public investment here is thus very high. And while formal impact evaluation may help fill some of the gaps in information, its usefulness hampered by the fact that good program design is almost always highly context-specific, so generalization is difficult. The best that can be said is that programs need to be sensitive to local context and must pay close attention to cost control, as their cost per beneficiary can be high and benefits low (Haggblade et al., 2007).

When these services are provided, doing so to a cluster of similar firms is likely to be more effective and less costly than working with individual firms. Promoting such clusters as part of an overall strategic value chain intervention built around a known growing source of demand is likely to be more effective still. Potentially, clusters can also provide a critical mass of demand such that they become worthwhile destinations for smallholder farmer sales and eventually more active coordination of supply.

Beyond the policy fundamentals discussed in Section 5.1, a potentially important legislative focus is the creation of a "secured transactions system" based on a collateral registry. If effectively implemented, such legislation could enhance the availability of credit to currently credit-constrained SMEs and micro-firms through two mechanisms: by expanding the types of assets accepted as collateral to all tangible and intangible assets including, crucially, movable assets; and through more efficient enforcement mechanisms for lenders (de la Campa, 2017; see also http://www.mfw4a.org/financial-infrastructure/collateral-registries.html).

An emerging observation from research is that food processing is heavily concentrated in main cities, (Reardon & Timmer, 2012).[5] Products arriving into rural areas and small towns from even distant major cities are often much more price competitive than locally processed goods. The reasons for this are not yet fully understood, but access to reliable, low-cost energy may be one key constraining factor. Relieving this constraint may promote greater rural non-farm employment and broader rural growth. While so far off-grid systems limited to single households have predominated in the rapid expansion of renewable energy in Africa, these typically do not provide enough energy to run processing equipment. Micro-grids—power grids that work at a fraction of the scale of a traditional utility—linked to renewables are now seen as a potential solution (see, for example, Colthorpe, 2017; James, 2017), allowing leapfrogging in the energy sector much as cell phones did in communications. Governments and donors would need to play a major role in coordinating such investments and facilitating them through complementary infrastructure and conducive legislation (Mama, 2016). They may be an especially attractive focus for impact investors if proper policy frameworks can be created.[6]

A little discussed fact is that the most dynamic segment of SMEs in African countries often comprises immigrants (Biggs & Shah, 2006; Gadzala, 2009; Kohnert, 2010), whether Chinese (ethnic Chinese SMEs have increased dramatically in recent years) or other Africans (e.g. Nigerians and immigrants from the Lake Region (Rwanda and Burundi especially) to Southern Africa who have invested in the retail food trade). The attitudes and social networks associated with immigration typically give these groups a strong advantage over potential local entrepreneurs, and this advantage becomes more pronounced in the presence of political or economic instability. If political leaders wish to avoid this, predictable economic policy is the first requirement.

Promoting Large-Scale Agribusiness Investment in Africa

Large-scale agribusiness has operated in African agri-food systems for many years. These firms include local large firms, well-known multinationals, "regional multinationals" such as Export Trading Group and OLAM that started in trading and have been moving into processing, and specialty firms of all three types operating in cash crop sectors such cotton and tobacco. Section 4.2 discussed the investment and behavior patterns of these companies, emphasizing that most—apart from those in cotton and tobacco—do their best not to rely directly on smallholder farmers.

Organized efforts to promote new and broader multinational agribusiness investment in Africa began after the food crisis of 2007/08. In 2009 the World Economic Forum (WEF) held a symposium with international and African companies, governments, foundations, NGOs, and donors, focused on how to align actions of these actors to best provide assistance to emerging relationships of agri-food companies and smallholder farmers. This effort was a foundation for the "Grow Africa" program of WEF, launched in 2011, which promotes company "impact investments" in the region, and attracts NGO assistance for links between companies and smallholder farmers. The New Alliance for Food Security and Nutrition, with similar aims, was launched in 2012, eventually integrated into the CAADP (Comprehensive Africa Agriculture Development Programme) planning process, and appears to share a "leadership council" with Grow Africa to monitor private sector investments against commitments (https://new-alliance.org/about).

[5] Personal observation by author during rapid appraisals in central Tanzania, suggests the same pattern there.
[6] Impact investment refers to private investments "made into companies, organizations, and funds with the intention of generating a measurable, beneficial social or environmental impact alongside a financial return" (GIIN; https://thegiin.org/impact-investing/need-to-know/).

Symposium participants agreed that while the large-scale private sector wants to invest, actors in this sector often face high risks and transaction costs, for the reasons already discussed.

The approach proposed to deal with these problems was to forge several forms of "coordination, partnerships, synergies, and linkages" among combinations of: (1) private sector actors in off-farm segments (inputs, processing, and distribution); (2) farmers; (3) governments; and (4) donors/foundations and their associates (such as NGOs). The anticipated benefits to this coordination are the lowering of transaction costs and risk, the means to "take to scale" and achieve critical mass, and to achieve sustainability of value chain development initiatives that benefit rural communities.

A key approach supported by the participants was a combination of "clustering" of value chain actors for coordination over segments, with "public–private partnerships" (PPP) between the private sector and government. This combination would be further supported by donors/foundations and banks, who would fund NGOs to bear much of the initial cost of building relationships between investors and smallholder farmers. Box 3.1 illustrates two recent programs of this nature that have garnered some international attention.

Box 3.1 • Two examples of donor and NGO-facilitated linkages between large-scale agribusinesses and smallholder farmers in Africa

Project Nurture and the SAGCOT (Southern Agricultural Growth Corridor of Tanzania) Soya Value Chain Partnership are two examples of the kinds of partnerships being forged between large-scale agribusiness investors and smallholder farmers in Africa, as a result of efforts by Grow Africa and others.

Project Nurture is a project-based alliance launched in early 2010 by the Coca-Cola Company, The Bill and Melinda Gates Foundation and TechnoServe. This US$11.5 million partnership sought to double the fruit incomes of more than 50,000 smallholder farmers in Kenya and Uganda by 2014 by building inclusive mango and passion fruit value chains.
The Coca-Cola Company was responsible for product development, marketing, supplier relationships, and procurement systems that were used to satisfy its customers, creating a market for the smallholder farmers' produce. The locally sourced puree was used in the Minute Maid Mango juice that was launched in September 2010 in Kenya and May 2011 in Uganda. TechnoServe worked with experts and processors to improve market linkages, and with financial institutions to improve access to credit for smallholder farmers, with the costs of this work covered by the Gates Foundation.

Locally, in addition to smallholder farmers, the project involved banks, agricultural research institutes, fruit processors and exporters, and government ministries. The three founding partners focused on identifying and engaging local players with comparative advantages in the value chain, helping those players build the business focus and capacity needed to remain in business together after the project ended.

By the time of project completion in 2015, TechnoServe had recruited nearly 54,000 farmers across Kenya and Uganda, organized into 1,100 producer business groups, who had achieved sales of more than 132,000 tons of fruit. TechnoServe also trained about 70 community extension service providers and 48,500 farmers in agronomic practices.

Coca-Cola certified two processors who met the Company's quality standards and these processors became approved suppliers to the Company's value chain. In Kenya, Minute Maid Mango Nectar became the first Coca-Cola product in the country to use locally sourced puree from a processor certified to Coca-Cola standards. TechnoServe also facilitated sales from smallholder farmers to 16 local food processors. In 2016, the project won the Department of State's P3 award recognizing "best practices of public–private partnerships that are improving communities and the world". Coca-Cola continues to be active in these kinds of programs, for example through The Rockefeller Foundation's YieldWise initiative, where it hopes to help over 20,000 mango farmers learn innovative ways to reduce post-harvest loss.

Box 3.1 • Two examples of donor and NGO-facilitated linkages between large-scale agribusinesses and smallholder farmers in Africa (Continued)

SAGCOT is one of the key agricultural growth corridors in East and Southern Africa. Its Soya Value Chain Partnership seeks to expand the production of soya by smallholder farmers for animal feed and oil in Tanzania. To accomplish this, SAGCOT is working in the southern Highlands with a range of partners, led by the Clinton Development Initiative and its Anchor Farm project to build an interlinked value chain in maize, soya, and animal feed. The Anchor Farm is a commercial farm partnering with thousands of neighboring participating smallholder farmers, who gain access to improved soya seed, alongside training in agronomic techniques.

Critically, these farmers also have access to a domestic bulk buyer for their soya in Silverlands, an investment of Silverstreet Capital, which is an impact investing fund headquartered in UK and focused on Africa. Silverlands processes soya, produces broiler and layer chicken feed, and sells the feed and day-old chicks in at least seven locations within Tanzania.

To date, 1,000 ha of commercial farmland have been rehabilitated, and 3,600 smallholder farmers have been engaged in extension for and sourcing of soya. The program includes about 60 demonstration plots spread across more than 30 villages, to serve as a basis for continual training programs involving the participating smallholder farmers.

The initiative faces several challenges, including low supply of soya seed and reluctance of farmers to take-up the crop. One key reason for this reluctance is that the crop can be unprofitable in the first year, as farmers learn agronomic techniques. SAGCOT is addressing this issue by building a consortium of partners to actively promote soya farming in the region to actors across the value chain, including financial sector stakeholders.

The approach is now frequently applied in "development corridors" that typically run from a port and link to one or two inland countries and ideally a large investment such as the coal mine in Tete, Mozambique. Examples of such corridors with a strong agricultural focus include the Beira and Nacala corridors of Mozambique that link with Malawi; the Southern Agricultural Growth Corridor of Tanzania (SAGCOT) that runs from the port in Dar es Salaam into Malawi and Zambia; and the Northern Corridor that links the port in Mombasa, Kenya, into Uganda (see Haggblade, 2013 on the importance of corridors in breaking down artificial national boundaries).

This approach is closely related to the recent rise in development finance institutions (DFIs; see Savoy, Carter, & Lemma, 2016) and impact investment. DFIs are government-backed institutions that invest in private sector projects in developing countries. Examples include the UK Commonwealth Development Corporation (CDC), the World Bank International Finance Corporation (IFC), and the US Overseas Private Investment Corporation (OPIC). These have existed for many years, but others have emerged more recently. GIIN (2015) shows that, among tracked funds, investments by impact investor funds increased 15% in 2016 compared to 2015. About US$7.5 billion, 12% of the total that they were able to monitor, were invested in SSA in 2016, and nearly US$4 billion of this was invested in the food and agriculture sector (no data are available on what share of the African investments were in the food and agriculture sector). Perhaps the central issue in impact investing is the ability and willingness to measure social or environmental impact. Note these facts:

- Two-thirds of the 208 impact investors registered with the Global Impact Investment Network (GIIN) and responding to their survey are seeking risk-adjusted market rates of return (GIIN, 2015); in other words, they are unwilling to forego any financial return in pursuit of social or environmental benefits.
- Most firms measure their social and environmental performance using proprietary metrics, and 98% report that they have met or exceeded those metrics (GIIN 2015; Lemma, 2015). How does the outside world know that targets were met if the metrics are proprietary?
- Meanwhile, Brest and Born (2013, p. 24) indicate that "there have been few efforts to evaluate the actual outcomes of market-based social enterprises", and note that most investors (and their donors) report in a survey that they "are not willing to make any effort to gain information" about their social or environmental impact. This is a more acute version of the problem of the lack of any strong evidence on the plethora of SME improvement programs.
- The impact investment community itself vigorously debates the possibility of earning market rates of return

while also achieving social impact. Hattendorf (2012, p. 2) states "we find remarkably few for-profit ventures that both reach [the poor] and have the potential to become viable business enterprises" without ongoing assistance (brackets added).

With impact investing in its infancy, it is perhaps unsurprising to see these types of issues. And the fact that two-thirds of impact investors are seeking market rates of return means that one-third—still a substantial number—are accepting lower returns in the pursuit of social or environmental benefits. This is a major opportunity to inject needed capital into these agri-food systems. The work of organizations like GIIN to promote transparent reporting in the sector should be welcomed and encouraged. A central message of this chapter is simply that the success of these efforts will be heavily influenced by the extent to which governments make much more rapid investment in infrastructure and towards policies that reduce risks and uncertainties. Currently, and we argue over the next one to two decades at least, SME investments will dominate, and large company schemes facilitated in part by donor and NGO assistance will play a secondary, though growing, role.

Conclusions and Recommendations

This paper has made five fundamental points. First, smallholder farmers need to adapt to big changes in consumer demand and in buyer requirements for safety, quality, and reliability, and must do so in the face of far more competition than in the past. Second, a relatively small share, perhaps one-third on average, of smallholder farmers are in a position to compete effectively in this new and rapidly changing environment. Attempting to promote productivity growth among farmers who do not have the market linkages or assets needed to adopt the technologies and practices merely diverts resources from other smallholder farmers who could truly respond.

Third, improved infrastructure and policy are the foundations of improved links of smallholder farmers to agribusiness. Projects and programs to create these links are important complements but will have low payoff in the absence of better policy and infrastructure. Fourth, SMEs have by far the largest role in African agri-food systems and will for many years. We also note that smallholder farmers, and the traditional markets in which they sell, are the natural source of supply for SMEs. As a result, strengthening the ability of SMEs to increase their scale of operation and compete in output markets is central to strengthening smallholder farmer links to agribusiness. Finally, we contend that efforts to link smallholder farmers to large agribusiness need to be seen as important complements to a primary SME focus.

Recommendations follow clearly from these key observations. First, national, regional, and continental bodies interested in advancing the smallholder farmer agenda need first to advocate for stable and predictable policy that in particular favors a rules-based approach to more open regional trade. Second, these same bodies need to advocate for infrastructure investment that favors linkages between rural areas and secondary cities and towns, including improved urban wholesale markets linked by information flows to improved rural assembly markets.

Third, it is imperative that productivity investments be targeted to those farmers who have or can feasibly gain access to growing markets and who have or can access the assets needed to sustainably adopt productivity enhancing technology. Other strategies need to be developed for farmers transitioning out of farming (there are many) and those farmers who are stuck in poverty traps due to some combination of physical/commercial isolation, low agro-ecological potential, and low assets.

Fourth, the bodies that support conducive policy and adequate infrastructure in the service of smallholder farmers need also to support policies and programs that strengthen the SME sector and that improve the traditional markets (especially at wholesale and rural assembly) that they use. Finally, efforts should continue to promote large-scale impact investment in a context of development corridors and three-way partnerships between government and donors, private sector, and smallholder farmers. However, those promoting such investments realize that the return to them will be critically affected by the policy environment for investment and trade, and by the quality of market infrastructure.

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CHAPTER 4

Strengthening Financial Systems for Smallholders

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KEY MESSAGES

ONE

Financial needs and access to financial services vary widely depending on the nature of smallholder farming.

TWO

Value chain financing is widely used as a risk mitigation mechanism in providing short-term finance in tight value chains.

THREE

Diffusion and development of ICT has been changing the agricultural finance landscape in Africa quickly. Many smallholder farmers gained access to payment services through mobile telephones, which are also used in agricultural transactions.

FOUR

Among other risk mitigation tools, agricultural insurance products have been tested in many African countries to mitigate high-severity low-frequency agricultural risks.

FIVE

An enabling environment, with smart financial regulations, targeted and effective agricultural finance policies, and well-established financial infrastructure, is essential to ensure a well-functioning financial system that promotes the development of agricultural finance.

Introduction

The demand for financial services among smallholder farmers remains largely unmet in Africa, reflecting the many challenges that both farmers themselves and financial institutions face. Although binding constraints such as high transaction costs and frequent natural disasters and crop diseases still widely exist, important innovations are available, facilitating greater access to financial services. This is mainly due to diffusion of information technology. This chapter first provides an overview of the demand and supply of financial services for smallholders and the state of the enabling environment, including policies and regulatory frameworks in agriculture and financial sectors. This is followed by recent trends and some notable examples of financial services in credit, investment, savings and payments, and risk management. The delivery mechanism and role of technology are overarching themes which will be described in an independent section. The chapter ends with a set of key takeaways and broad policy framework for consideration.

Setting the Stage for an Agricultural Finance System

The two key critical components of an agricultural finance system are demand for and supply of financial services. One unique difficulty of the system stems from the heterogeneity of actors on both sides. This section therefore illustrates a wide range of players from the demand and supply angles, and highlights some unique challenges that prevent greater financial inclusion for smallholder farmers. The third important pillar is the enabling environment which shapes the incentive structures of all the actors in the agricultural finance system.

Demand for agricultural finance

Among 500 million small farms in the world standing on less than 2 hectares each, 41 million exist in Africa, accounting for 80% of all the farms in the continent (Lowder, Skoet, & Raney, 2016). These farms represent a diverse group of agricultural households and farmers which could be categorized differently, using various aspects such as size of landholdings, access to markets, and income levels. Although the size of these farms is small across the board, farmers' income levels may vary greatly depending on the crops they produce, their market opportunities, and their off-farm income opportunities. This heterogeneity makes the analysis of their demand for financial products difficult.

A Consultative Group to Assist the Poor (CGAP) publication in 2013 (Christen & Anderson, 2013) provided a systematic segmentation of farmers using their degree of commercialization and ties to value chains (loose versus tight). Since then, there have been various subsequent efforts to refine such segmentation. Among these other efforts, this publication uses the segmentation as discussed in the overview chapter (see Figure 1.6 in Chapter 1) which divides small farms into four categories: subsistence, transitioning, specialized commercial, and diversified commercial.

These four categories naturally demand different sets of financial services and products. The subsistence farms require financial products so they can save and borrow mainly to smooth their income and deal with emergencies. They also depend on social protection interventions such as cash transfer. Their demand is for financial products that meet broader household financial needs, and not specialized products for agricultural finance. The transitioning farms usually use their income generated from off-farm activities to finance agricultural production. Thus, general savings and credit and payment services would strengthen their livelihoods. Transitioning farms may also need credit to invest in non-farm activities. In addition to these basic financial products, commercial farms demand a wider variety of financial services to support their agricultural production and manage their household financial needs. Savings and lending products may be required to handle larger amounts and longer-term funding needs. Specialized commercial farms are likely to need specific products linked to crop cycles and also crop insurance. The diversified commercial farms may be less dependent on agricultural credit than specialized commercial farms as the diversified farms tend to have higher income and they even might self-finance their agricultural activities.

Although these categories offer a useful framework for financial service providers and policy makers to grasp financial requirements of smallholder farmers, the reality is usually much more complex and nuanced. Therefore, a thorough assessment on the demand side is critical for any access of finance analyses and interventions. In addition to national demand surveys, more specific demand surveys usually use questionnaires and farmer focus group discussions. The selection of representative samples often depends on the typology of farmers that is suitable within a country (or project) context and the types of value chains.

Supply of agricultural finance

Despite the diverse financial requirements in all the four categories of farmers, both informal and formal financial

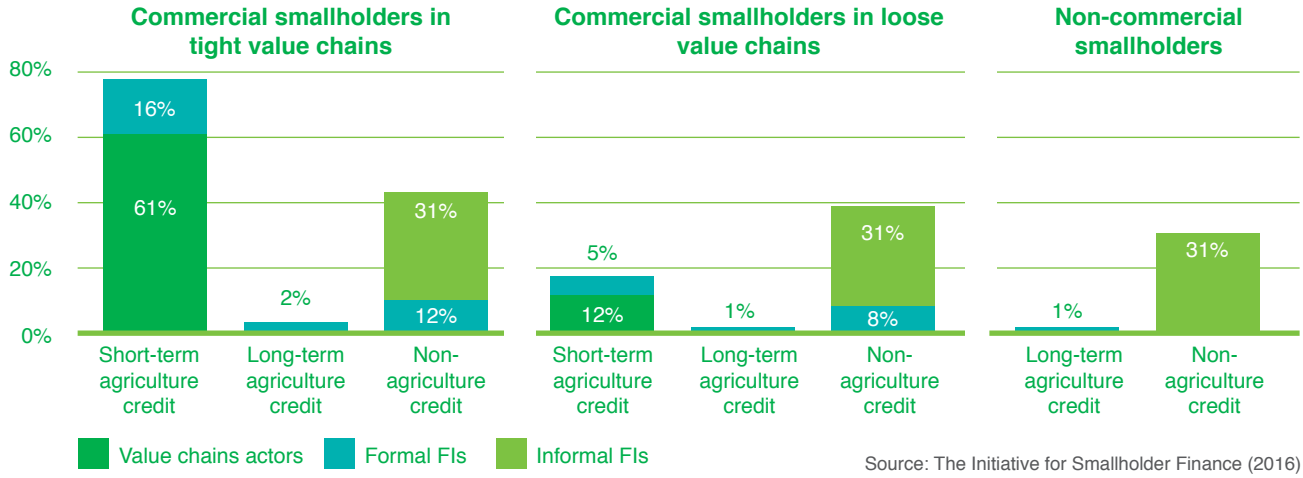
institutions (FIs) in Africa often fail to supply ample and suitable financial services, especially for agricultural production and agribusiness development. In Africa, more than 50% of the population is involved in agricultural activities while less than 1% of banking credit goes to this sector. The agriculture sector has traditionally been avoided by FIs even when ample liquidity exists in their balance sheets. Despite the presence of abundant business opportunities in agriculture, FIs lean towards lending to other sectors, non-agriculture household needs and/or invest in government securities. Among various segments in the sector, smallholder farmers are considered among the most difficult clientele to serve in a financially sustainable manner due to various risks and costs involved, including: (1) occasional natural disasters such as drought, flood, and epidemics of crop diseases; (2) high transaction costs due to dispersed rural population; (3) seasonal and lumpy financial requirements, yet limited physical assets for collateral; and (4) a long history of political interventions (both in the agricultural and financial markets) that sometimes create a prohibitive environment for financial services. Even if the financial services are available, they are often concentrated in cash export-oriented crops and high value chains and wealthier farmers. The costs of the services are generally high, but the variety and quality tend to be limited.

According to a recent estimate credit from FIs satisfies only a fraction of the agriculture-related financial needs of non-commercial smallholders and commercial smallholders in loose value chains (The Initiative for Smallholder Finance, 2016). Although FIs play a relatively larger role in providing short-term loans in tight value chains, the amount of their credit is about 25% of that from offtakers and input suppliers (see Figure 4.1). This implies that short-term agricultural credit in Africa is mainly provided through business transactions (value chain agribusiness firms), especially in closely managed value chains. Credit is a critical input to enable contracts between value chain actors and farmers/farmer organizations. Some commercial banks and microfinance institutions (MFIs) deploy specialized lending products for pre- and post-harvest finance, but these FIs are still exceptions in the financial market and rather limited to certain commodities.

Long-term credit requirements for capital investments seem to be largely unmet by FIs. Value chain actors usually do not facilitate any finance outside of their core business transactions such as procurement of agricultural products. So, other financial needs of households, such as savings, payment systems, non-agriculture loans, etc. are not met even though credit for crop production may be available through an agribusiness buyer. Alternative suppliers such as leasing companies and investment funds exist in some African countries. However, these are not widely available for many smallholder farmers and smallholder producer organizations.

Smallholder households require credit for their non-agricultural spending; informal FIs seem to be active in this space, regardless of the segments of smallholders. Savings groups such as Village Savings and Loan Associations (VSLAs) are promoted by numerous development projects and widely used as a financial tool to support the rural poor in Africa. Cooperative financial institutions also serve both urban and rural populations. Several MFIs also serve rural populations and agriculture. Their physical proximity and member-based organizational modality make the financial transactions more accessible and convenient for smallholder farmers. However, these informal FIs usually limit themselves to traditional short-term lending with frequent repayments, leaving demand for agricultural credit largely untouched. Some rural cooperatives serve agriculture clients with tailored products, but these are still exceptional cases.

Figure 4.1 • Credit supply from FIs and value chain actors (% of total credit requirements)

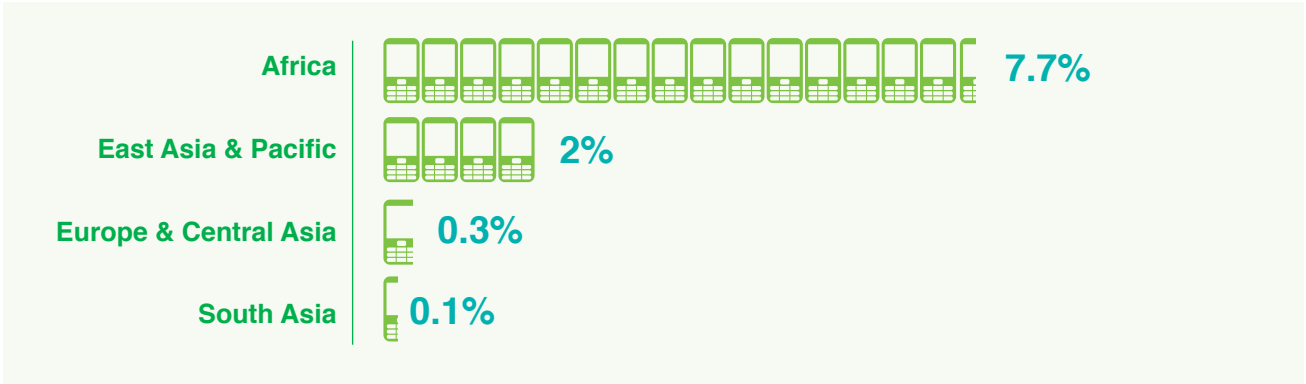


Source: The Initiative for Smallholder Finance (2016)

Penetration of FIs has also been limited in the provision of other financial services. For example, according to the Global Findex Database, close to 60% of the rural population in sub-Saharan Africa saved some money in the past year, but only 13% saved with formal FIs. The gap between the two represents rural savings requirements served through informal means, including savings groups. Most smallholder farmers do not have bank accounts and transactions are largely conducted by cash.

Recent development and diffusion of information and communication technology (ICT) has been quickly changing the agricultural finance landscape in Africa. Rapid penetration of mobile phones and payment services has dramatically increased access to financial services for millions of rural populations. Africa is by far the leading mobile finance market, especially among developing countries backed by high penetration of mobile phones and payment services. For example, traditional cash payments for agricultural products have partially been replaced by mobile payments which reduced the transaction costs and enhanced the security compared to cash transactions. While most transactions are still conducted in cash, mobile payment is used much more in Africa than in other regions (see Figure 4.2). In addition, some groups of financial service providers including mobile network operators offer mobile-based savings and lending services in some countries; users of these services are increasing rapidly.

Figure 4.2 • Rural population received payments for agricultural products through a mobile phone (2014)



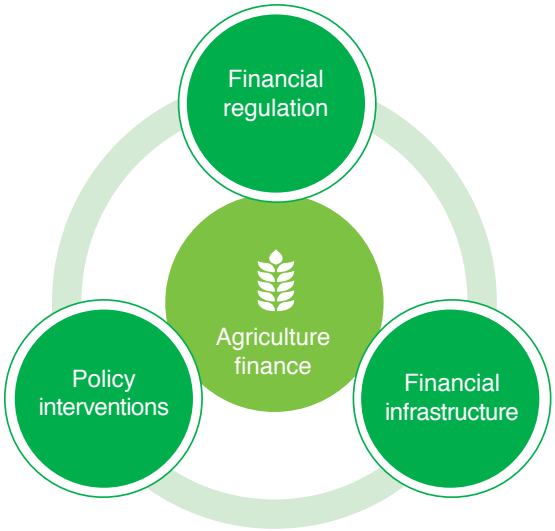
Source: The Global Findex Database 2014

Agricultural insurance products still do not reach many smallholder farmers. In several African countries, including Burkina Faso, Ethiopia, Kenya, Mali, Mozambique, Rwanda, Senegal, and Zambia innovative products (based on the concept of index-based insurance) have been pilot tested mainly through donor initiatives. Relatively few of them have reached a commercial scale. International players, including non-governmental organizations (NGOs) dominate the industry and interest and participation of local insurance companies have been still limited, albeit recently growing.

Enabling environment: Policies and regulatory framework for agricultural finance

There has been increasing recognition of the role of governments in alleviating the constraints and risks inherent in agricultural finance. An enabling environment, with smart financial regulations, targeted and effective agricultural finance policies, and well-established financial infrastructure, is essential to ensure a well-functioning financial system that promotes the development of agricultural finance (Figure 4.3).

Figure 4.3 • An enabling environment to promote agricultural finance



Financial regulations

Financial regulations are rarely established to serve a specific sector. Instead, a full-fledged financial regulatory environment would benefit all the real sectors, including agriculture. Financial regulations facilitate agricultural finance indirectly through various dimensions, including: 1) regulating financial institutions which are important providers of agricultural finance such as local financial institutions including (MFIs), savings and credit cooperatives (SACCOs) and financial cooperatives; 2) establishing standards and guidelines to regulate the current booming digital financial services; and 3) providing a regulatory framework relating to collateral and security interest to facilitate lending.

Financial regulation plays a key role in facilitating the entry of new market participants, lenders, and financial providers in rural markets. SACCOs, MFIs and financial cooperatives, which are more experienced in servicing underserved rural markets (Meyer, 2013) often have risky portfolios with high administrative costs due to managing small agricultural loans (Helms & Reille, 2004). Regulators seek to minimize the credit risk through prudential regulations such as capital adequacy requirements and provisioning rules (Fiebig, 2001). However, these requirements need to be set at appropriate levels to preclude micro-lenders from entering the market. Additionally, consumer protection regulations with requirements such as transparent interest rate disclosure, compulsory participation in deposit-insurance schemes, and data privacy standards, enhance trust among stakeholders in the financial system. Most of the countries in SSA have established legal frameworks for local financial institutions such as deposit-taking MFIs and financial cooperatives. The West African Economic and Monetary Union (WAEMU) adopted the Loi 23 -2009/AN du 14 mai 2009 portant réglementation des systèmes financiers décentralisés (SFDs) in which SFDs are defined as institutions that offer financial services to people who generally lack access to banking services. Other SSA countries have also established separate regulatory frameworks (see Box 4.1) for microfinance activities. For instance, the Law No. 40/2008 Establishing the Organization of Micro Finance Activities regulates microfinance activities in Rwanda. The capital adequacy ratio for MFIs is set at the same level as that of commercial banks, and provisioning rules are appropriately more stringent for MFIs than for banks. In most of countries in SSA, deposit-taking MFIs, financial cooperatives or SACCOs are not required to participate in deposit insurance schemes. However, the Micro Finance Deposit-Taking Institutions Act of 2003 in Uganda requires all microfinance deposit-taking institutions to be enrolled in a deposit insurance scheme.

Innovation has become one of the driving forces to promote more cost-efficient means of delivering financial services (Lumpkin, 2009). Mobile banking and other technology-enabled delivery of financial services are regarded as an entry point in facilitating access to formal financial services for poor and rural consumers. While regulation is not regarded as a necessary condition for encouraging innovation, it is a key enabler to accelerate the adoption and proliferation of new technologies, particularly concerning digital finance (Lumpkin, 2009). For instance, regulation on interoperability for e-money, that is, the ability to transfer money from one mobile banking platform to another is conducive to wide reach and easy adoption of the technology. However, rapid development of digital finance brings potential risks such as cyber security and abuse of funds collected by non-prudentially regulated institutions. Regulations therefore need to strike a balance between promoting innovation and managing potential risks to ensure financial stability. Consumer protection laws such as data privacy laws that restrict the unauthorized collection and distribution of consumers' personal data, protect customers and foster trust in the use of the new technologies (Dias & McKee, 2010). The SSA region has instituted continuous reforms in the arena of electronic money over the past few years. The Guidelines for e-money Issuers were adopted in Ghana in 2015, allowing both banks and non-bank institutions to issue electronic money. Instruction No.008-05-2015 governing the conditions and terms of e-money issuers' activities in WAEMU sets forth requirements on interoperability of e-money service platforms.

Lack of collateral has been one of the key obstacles to smallholder farmers accessing credit. This calls for regulations to establish recognition of immovable assets such as land ownership and support the use of other alternative movable collaterals. Alternative products and arrangements such as contract farming, collateral management arrangements (CMAs), and warehouse receipt systems (WRSs) have emerged in credit markets to enable producers and processors to use agricultural commodities to fulfill collateral requirements and gain access to credit. CMAs and contract farming generally rely on contractual laws to facilitate their use, and smooth functioning of WRS requires specific warehouse receipt regulation or secured transaction laws (Varangis & Saint-Geours, 2017). Regulations that establish licensing and performance requirements for warehouse operators are also vital to recognizing warehouse receipts issued by trustworthy warehouses, which then helps the use of WRSs as collateral (Höllinger, Rutten, & Kiriakov, 2009). Unlike in India and several LAC countries where warehouse receipts are widely accepted by financial institutions, SSA is still developing the system. Côte d'Ivoire, Ethiopia, Ghana, Malawi, Tanzania, Rwanda, Senegal, Uganda and

Zimbabwe are among the countries that have established comprehensive legal framework to regulate the use of warehouse receipts. However, a comprehensive regulatory framework is only the first step and other factors such as financial literacy of farmers, trust and acceptance of warehouse receipts by financial institutions, and the capacity of regulatory authority are also essential to ensure the smooth function of the system. In Uganda, although the Warehouse Receipt System Act, 2006 and the Warehouse Receipt System Regulations, 2007 provide detailed provisions on requirements related to performance guarantees for warehouse operators and requirements of a valid warehouse receipt, WRS is not meeting its potential because farmers lack knowledge on the cereal grades required within the system, and on the stringent collateral requirements of financial institutions.

Box 4.1 • Assessment of regulatory frameworks for agricultural finance—The EBA Finance Index

The World Bank Enabling the Business of Agriculture (EBA) project examines and monitors regulations that affect how markets function in the agriculture and agribusiness sectors. The EBA finance indicators measure the quality of laws and regulations that promote access to financial services for smallholder farmers and small and medium agricultural enterprises from three aspects.

Pillar 1

Non-bank lending institution indicators focus on prudential regulation and consumer protection standards of financial institutions that are important players in agricultural finance, namely deposit-taking MFIs and financial cooperatives.

Pillar 2

Branchless banking indicators measure regulatory frameworks for non-traditional delivery channels—namely agent banking and e-money—that reduce the time and transaction costs associated with accessing financial services for the unbanked and agribusinesses.

Pillar 3

Movable collateral indicators assess legal frameworks and financial infrastructure that facilitate the use of non-traditional collateral, from aspects of warehouse receipts, collateral registries, and credit information in secured lending.

The EBA Finance indicators were assessed in 62 economics across regions including sub-Saharan Africa (SSA), Latin America & the Caribbean (LAC), East Asia & the Pacific (EAP), Europe & Central Asia (ECA), high income OECD countries, South Asia (SA), and the Middle East & North Africa (MENA). The increasing prominence of digital finance in facilitating access to financial services is reflected in the research, as between 2015 and 2016 a total of 16 countries, mainly in SSA, reformed their e-money regulation to align with regulatory good practices as measured by the indicators. However, the low scores for deposit-taking MFIs were driven in part by weak standards on capital adequacy requirements and deposit insurance schemes. Countries with strong legal frameworks for deposit-taking MFIs were found to have a higher share of the population that borrow to start, operate or expand a farm business and receive payment for agricultural production relative to countries with weaker scores on MFI regulation. Finally, although countries in the high income OECD countries and LAC regions outperformed across all indicators, the ECA region earned the second highest score on the movable collateral indicator (Doing Business—Getting Credit indicators and warehouse receipts indicator), suggesting the prevalence of enabling financial infrastructure in ECA.

Policy Intervention for Agricultural Finance

Policy interventions, such as mandatory lending quotas (also referred to as priority sector lending (PSL), interest rate caps, and credit guarantee schemes (CGS), and matching grants, are increasingly used to facilitate lending to the agriculture sector. Trade policies relating to agricultural commodities and subsidy programs on inputs and agricultural equipment also have an indirect impact on agricultural finance. These policies depend on country contexts, and implementation arrangements play a key role in ensuring their effectiveness as policy tools. In Africa, interest rate caps are the more

commonly used policy instrument followed by the use of credit guarantees (CGS). Matching grants have also been used in many countries in Africa to promote credit to agriculture, particularly for the longer term, although in most matching grant schemes so far the link to financial markets has been weak.

CGSs share credit risk with their partner financial institutions (PFIs) in exchange for the guaranteed fees. PFIs are expected to lend to pre-defined target borrowers such as smallholder farmers and SME agribusinesses with the guarantees to cover a pre-determined percent of the loan value. A recent World Bank global survey of 60 public CGSs (Calice, 2016) includes 7 African CGSs. Other donor-driven CGSs exist, such as the USAID Development Credit Authority (DCA) guarantee programs and the Private Agricultural Sector Support in Tanzania and Mozambique backed by DANIDA. Many of these CGSs seem to cover the agriculture sector exclusively or together with other target groups. In Angola, for example, the Fundo de Garantia de Credito issues guarantees to SMEs in all sectors, but 40% of the guarantees issued are in agriculture. Agriculture CGSs tend to suffer from higher non-performing loans (NPLs) and claims than other CGSs. A study of CGSs in Tanzania (Financial Sector Deepening Trust, n.d.) found that the rate of default in CGSs for agriculture was almost always over 10% and as high as 30% whereas that of CGSs for SMEs remained between 5% and 10%. According to an analysis conducted by the Food and Agriculture Organization of the United Nations (FAO), the claim rate should be lower than 3% for CGSs to be sustainable and successful (FAO, 2013).[1] CGSs with high payouts are bound to become unsustainable and eventually fail.[2] If the margin of the CGS operation is limited, and CGSs cannot cover the cost of risk and administration costs, they could easily become money losing operations requiring frequent recapitalization to continue operating. The lower level of capital to guarantee loans diminishes the confidence among PFIs, leading to fewer guarantees and smaller fee revenues. Besides the challenges of financial viability and long-term sustainability, CGSs face other issues such as ensuring the guarantee delivery approach balances outreach, additionality[3], and financial sustainability, as well as impact evaluation. Good practices in design and implementation of CGSs are established to address those challenges. The World Bank and industry experts established a list of Principles for Public Credit Guarantees for SMEs (World Bank and FIRST Initiative, 2015). Many principles are applicable to other CGSs, including the schemes targeting the agriculture sector. The important principles include: 1) establish an independent public credit guarantee agency; 2) specify clear and transparent eligibility criteria and qualifications for targeted beneficiaries (firms, SMEs, farmers, etc.), lenders (participating financial institutions or PFIs) and credit instruments eligible for coverage; 3) guarantee coverage ratio shall be less than 100%; 4) adapt risk based pricing principles; 5) adopt efficient and transparent claims process management; and 6) specify financial reporting and disclosure requirements in order to evaluate performance, outreach, and additionality of CGSs. In addition, the agriculture CGSs should work with PFIs with a clear strategic interest in the sector and establish a policy to prevent a sudden capital loss in case of systemic incidents, including catastrophic climate events.

The performance of PSL or mandatory lending quotas in facilitating lending to the agriculture sector has been highly variable. Under the PSL, compulsory lending targets are given to lenders, typically banks, to facilitate a higher share of their lending portfolio in priority sectors such as small-scale industries (SMIs) and agriculture. A recent analysis by the World Bank concluded that while some PSL schemes are effective at channeling credit to specific sectors, most of these schemes face a variety of challenges associated with financial inclusion (lack of targeting to the poorest segments, increase in costs of access to credit), declining loan asset quality, and misallocation of limited financial resources. Among the various models, the indirect model, where lenders lacking the specialized experience in priority sectors are able to purchase certificates from financial institutions that have a comparative advantage in lending to targeted sectors, might help expand access to finance while limiting economic distortions. Policy interventions of PSL mandatory lending quota are not as widely utilized in Africa as in Asian countries such as India, the Philippines and Vietnam. So far, in Africa only Zimbabwe has tried to impose on banks to lend 20% of their portfolio to agriculture.

The financial crisis of 2008 reopened the debate on interest rate controls as a tool for consumer protection. A recent study has found that at least 76 countries around the world currently use some form of interest rate caps on loans (Maimbo, Gallegos, & Alejandra, 2014). The SSA region has the highest number of countries adopting interest rate cap, followed by the LAC region. WAEMU, the Economic and Monetary Community of Central Africa (CEMAC) and countries, including Eritrea, Ethiopia, Ghana, Mauritania, Namibia, Nigeria, South Africa, Sudan, and Zambia have adopted interest rate caps. The use of interest rate caps is often justified as a financial policy instrument intended to protect a poor and vulnerable population from predatory lending practices and address concerns over high interest rate spreads in priority sectors such as agriculture (Maimbo

[1] It also argues that very low claims may suggest excessive operational costs of CGSs and/or overcautious guarantee practices.
[2] This discussion may not be relevant to CGSs with a limited time horizon and/or a clear priority on development impact over financial sustainability.
[3] In this context, additionality indicates lending activities that would not have happened without CGSs.

et al., 2014). However, micro-lenders operating in rural markets often incur higher operating costs due to the high administrative expenses of managing small loans and high capital requirements of financing unsecured or un-collateralized loans. This leads to a higher interest rate spread relative to commercial banks. A CGAP study on the determinant of interest rate for micro-lenders revealed that the global median interest yield of MFIs is 27% and in Africa, the median rate is more than 30% (Rosenberg, Gaul, Ford, & Tomilova, 2013). In this context, interest caps oftentimes distort lending to the sector, driving lenders out of higher-cost rural and of microcredit markets, and undermining their innovate new ways of lowering administrative costs.

Other policy schemes such as matching grants have also been used for private sector development interventions in Africa. In fact, out of 106 matching grant schemes in a World Bank survey (World Bank, 2016a), more than 50% were in Africa (see Box 4.2). Another recent analysis showed that many World Bank matching grant projects lack strong economic justification for the use of matching grants (Sberro-Kessler, in press). Indeed, many projects identify the lack of rural finance as a reason for the adoption of matching grants, without fully identifying the market failure and whether other instruments might be more appropriate to unlock rural and agricultural finance. Four main design features have been used in matching grants projects to promote financial inclusion, and each of them is associated with specific advantages and challenges. These are: 1) financial institutions are deposit-takers as beneficiaries are required to save—a specific amount and/or at a specific frequency—from the proceeds of their activities; (2) financial institutions are required or incentivized to provide credit to finance part of the activities; (3) financial institutions are involved in the management of grants, including the appraisal and disbursements of grants; and (4) financial institutions advise beneficiaries in the preparation of their business plans. Some matching grants projects have been successful at improving agricultural income, generating spillovers and improving access to finance in a sustainable way.

Box 4.2 • Rwanda grant scheme

In Rwanda the Business Development Fund (BDF), a public entity jointly owned by the Government and the Development Bank of Rwanda, is responsible for managing the grant programs. The matching grants are provided to farmers, producer organizations and agribusiness SMEs to stimulate technology adoption, use of inputs, and agriculture commercialization in general. The matching grants are channeled through financial institutions to help leverage the credit to targeted farmers and SMEs. Upon the approval by the BDF, the grant is deposited at a partner financial institution (PFI) when a loan is disbursed to a borrower. Once the borrower repays a pre-determined portion of the loan (e.g. 50%), the grant is used to offset the balance of the loan. The level of the grant coverage differs by grant programs and target beneficiaries/commodities. If borrowers default, the grant needs to be returned from PFIs to the BDF. In 2015 the BDF provided RWF 2.8 billion and these grants leveraged RWF 11 billion in loans (US$1 = RWF 719.61709). The major sources of the funds include the International Fund for Agricultural Development (IFAD) and the United States Agency for International Development (USAID). The BDF also manages guarantee funds which mainly cover SMEs and the agriculture sector. The grant programs and the guarantee funds are managed independently from each other and it is possible that both are used for the same loan. The BDF proactively promotes its grant programs to potential beneficiaries and financial institutions.

Financial infrastructure

Finally, in the absence of enabling financial infrastructure, financial regulation and policies may have limited impact in facilitating access to finance for smallholder farmers and agribusinesses. Credit bureaus and collateral registries are cornerstones of a well-functioning and efficient secured transaction system. In countries that have introduced registries for movable collateral, firms experienced increased access to bank finance, and declines in interest rates and extensions in loan maturity (Love, Martinez Peria, & Singh, 2013). Credit bureaus are effective tools in lenders' credit assessment and help minimize the risk of adverse selection and moral hazard in future loan transactions (OECD, 2012). However, these enabling infrastructures are often non-existent in developing markets or are not suited to serve rural markets and agribusinesses.

For instance, credit-reporting systems remain under-developed and in many countries participation is limited to commercial banks. Of the 39 countries in SSA reported to have credit registries and bureaus, only Burundi, Mozambique, Rwanda, South Africa, Tanzania and Uganda enable MFIs to participate in the system (Beck & Maimbo,

2013). This significantly limits the potential for non-bank financial institutions such as MFIs and financial cooperatives that serve rural and low-income customers to participate in the system. Agricultural loans are often characterized by low loan amounts, and thus do not meet the specific thresholds to be reported in the system (OECD, 2012). Additionally, some bureaus and registries do not collect from alternative data sources such as retailers, utility providers (telecom, electricity, and gas and water companies) and value chain firms (which are, as mentioned, of special importance as lenders to agriculture) Collecting such information allows the unbanked borrowers to create "reputational collateral", that is, a credit history about their repayment behavior, which lenders can use to extend credit (World Bank, 2017). Large mobile operator call data records (CDRs) from rapid development of information, communication and technology have shown great potential in credit scoring, enabling financial institutions providing credit to the unbanked population (Chen & Faz, 2015).

Recent trends

This section discusses promising products and cost-effective delivery mechanisms. Both the opportunities and the challenges related to these products will be presented through some examples.

Short-term credit

Both pre- and post-harvest finance for African smallholder farmers seem to be heavily dependent on the linkages and coordination of the value chain actors. Farmers in tight value chains may have various structures to access credit for their working capital needs given the foreseeable marketing opportunities of the commodities and the payments to be received. For example, FIs provide pre-harvest loans for inputs through collaboration with various value chain actors such as offtakers. Reliable value chain actors and their partner farmers/producer organizations usually provide good entry points for FIs. In theory, such value chain financing arrangements can supplement lack of sufficient collateral (Miller & Jones, 2010) if FIs could assess the strength of the value chains, the relationships between the actors and transaction flows. However, FIs often miss these important insights and require physical assets as collateral, especially for new borrowers. Offtakers and input suppliers also provide finance directly to farmers based on the track records of business transactions, assuming that the crops will be sold according to the contracts. In Africa, offtakers are the major source of financing for farmers in higher value and tight value chains. A key risk in value chain finance is the potential of side-selling: the opportunity of farmers to sell to another offtaker to avoid repaying the loan. Tight value chains, where the offtaker monitors the crop and effectively controls the purchases, can reduce this risk considerably.[4] Financing requirements in the post-harvest phase are often satisfied by short-term working capital loans for other household requirements and aggregation in case of farmer organizations. If appropriate infrastructure exists, harvested commodities can be used as collateral.[5] WRS is the most relevant commodity-backed finance instruments for smallholder farmers.[6] There have been various donor-supported efforts to introduce WRS in some African countries such as Ethiopia, Ghana, Malawi, Rwanda, Tanzania and Uganda.

Under the WRS, warehouse operators issue receipts as evidence that commodities with specific quantity and quality are stored in a certain location by a specific depositor. The depositor, farmer and/or producer organization in this case, can use the receipts as collateral to borrow from FIs. The system requires many important prerequisites: (1) the price information of the commodities is widely available for the market participants; it is also critical that the price goes up after the harvest season towards the next planting period so that the potential gain for farmers exceeds transaction costs of storing the commodities; (2) proper enabling environment exists to support healthy development of the WRSs, for example, WRSs are usually supported by a dedicated warehouse receipts law and institutional arrangements for licensing and inspecting third-party warehouses that issue receipts; (3) FIs and farmers understand how WRS works and proactively participate in the market. Capacity development training and awareness raising efforts are required to increase the number of participants and achieve economies of scale; and (4) professionally-managed warehouses exist in the multiple locations of the country and FIs and agricultural producers trust that the value of the stored crops will be maintained.

In Ethiopia and Tanzania, where multiple cash crops are used as collateral under WRSs, the volumes of the stored

[4] Tight value chains are often associated with crops with some centralized marketing and processing system, including sugar, cotton, oilseeds, etc.
[5] Crops can be pledged as collateral for both pre- and post-harvest finance, however, commodity-backed finance is widely used for post-harvest finance in Africa due to its relative simplicity.
[6] Other instruments include collateral management agreements (CMA) and stock monitoring agreements (SMA) which are more applicable to more established players with solid track records with FIs.

crops in the system amount to hundreds of thousands of tons every year. The South African WRS achieved a much larger scale amounting to millions of tons. Cash crops such as coffee with structured value chains and a transparent market place tend to be more successful in WRS than staple crops such as maize due to the unsupportive political framework. For example, in the counties where maize is the important staple crop, governments tend to intervene in a rather unpredictable manner which sometimes creates uncertainty in the market and discourage private players to hold stocks and FIs to lend against the receipts (IFC, 2013). Farmers in other African countries also benefit from WRS. In Côte d'Ivoire, Kenya, and Malawi where World Bank projects support the development of WRS, a total of about US$45 million in loans have been facilitated and 50,000 farmers have been reached. Other institutions such as AGRA have also invested in WRS in Ghana (see Box 4.3), Kenya, Malawi, Tanzania. Although there are some success stories and the interest is growing in Africa, WRS is still not as widely used as in India and LAC.

Box 4.3 • Profiling the Ghana Grains Council

The Ghana Grains Council (GGC) has piloted the design of a warehouse "Goods Receipt Note" (GRN) to encourage participation of smallholder grain farmers in its warehouse receipt system (WRS). This initiative is an example of work funded by the Alliance for a Green Revolution in Africa (AGRA). Currently, WRS is used mainly by warehouse operators because most the certified warehouses are located closer to market centers, making aggregation much easier. Unfortunately, the main grain producing areas where a large percentage of smallholder farmers live are far away from the certified warehouses, and transporting the grain to these warehouses is expensive. Most of the smallholder grain producers therefore are unable to bear the cost of transport to deposit their grains at the certified warehouses.

Through AGRA support, GGC staff and members visited the Eastern Africa Grain Council (EAGC) in March 2014. The study group learned first-hand about the EAGC WRS, including the receipting of grains at the community warehouse level in Kenya.

Piloting GRN receipting of grains started in March 2016. A total of 10 warehouses in the 2 northern regions (Northern and Upper West) of Ghana participated. A total of 125,162 kg of grain has been receipted under the GRN.

GGC operates a private sector self-regulated WRS. To date, the Council has certified 11 warehouses with a grain storage capacity of 54,600 metric tons (MT) and 21 community-based warehouses with a grain storage capacity of 2,280 MT. A total of 46,942 MT of grains have been receipted and about US$2.5 million worth of credit leveraged using 12,555 MT graded grains receipted under the WRS as collateral.

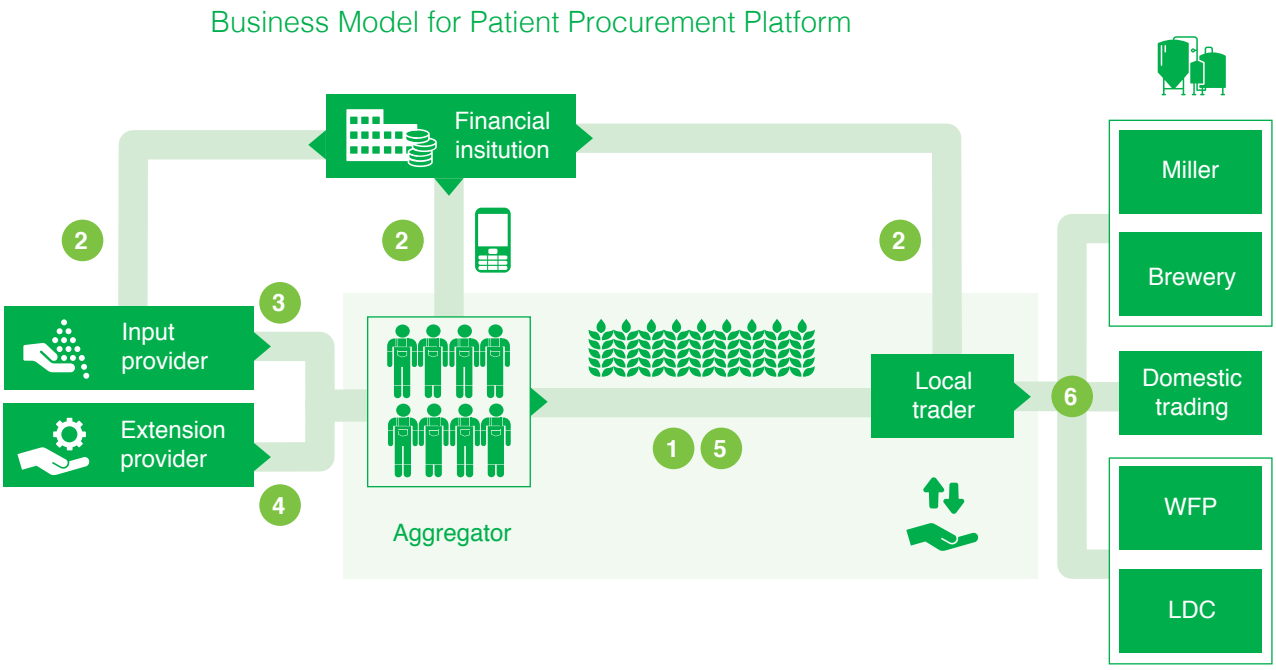
The GRN helps improve inclusiveness of smallholder grain farmers in the WRS ecosystem. It also expands on the development of the potential participation of the approved community warehouse operators in the WRS. As the system evolves, grading will be progressively introduced at the community-based grain storage facilities, that is, the 80–450 MT storage warehouses. Grain graders will be trained and licensed under a GGC/Ghana Standard Authority (GSA) collaboration over the next five years. Service fees for the grain graders will be determined by the critical volumes needed at the warehouses for grading.

The Council is in the process of expanding the number of approved community warehouses in its ecosystem from 21 to 60. It has identified additional community warehouses in the Brong Ahafo and Ashanti regions which will be brought into the GGC ecosystem. The average storage capacity of these warehouses is a minimum of 100 MT, giving an estimated total storage capacity target of over 6,000 MT. Most of these warehouses were built with USAID funding and implemented by Technoserve, the African Development Bank, and the World Bank in collaboration with the Government of Ghana.

To the contrary, smallholder farmers in loose value chains have fewer options in borrowing or no formal lenders are available. Due to the prevalent informal market opportunities, FIs usually cannot rely on other value chain actors to share the credit risks unless close coordination between the stakeholders exists. This is one of the primary reasons why FIs are reluctant to lend in loose value chains and the smallholder farmers in this category largely depend on loan products from MFIs, financial cooperatives, savings groups, local money lenders and other sources. Offtakers are also reluctant to lend since they are

uncertain as to whether these farmers will be delivering the crop to them to repay the loan. Some attempts have been made such as the interventions by the One Acre Fund to provide credit directly as part of a comprehensive support including inputs, technical assistance and market access. Despite the inherent challenges discussed, there are some notable attempts to provide finance for commercial farmers in loose value chains. For example, the World Food Programme (WFP) launched a multi-stakeholder initiative called Farm to Market Alliance (formerly known as the Patient Procurement Platform) in 2015 with partners including AGRA, International Finance Corporation (IFC), Grow Africa, Rabobank, Bayer, Syngenta, and Yara International. This Alliance started with 11 buyers who had committed to procure 85,000 tons of cow peas, maize, pigeon peas and soya beans from over 65,000 farmers in Rwanda, Tanzania and Zambia. The ultimate goal of the alliance was to reach 250,000 farmers covered by pre-planting contracts with buyers over 3 years.[7] Figure 4.4 demonstrates how the Farm to Market Alliance model works. In this partnership, the farmers would benefit from reliable marketing opportunities and access to high quality inputs and extension services. FIs were invited to provide finance backed by the pre-planting contracts under the assumption that the farmers would sell their crops to designated buyers and repayment would be subtracted from the proceeds.

Figure 4.4 • Farm to Market Alliance model



1. Farmer organizations enter into multi-season crop delivery contracts with offtakers
2. Financial Institutions provide finance to input suppliers, millers and farmers
3. Input suppliers provide seeds, fertilizer and training on credit
4. NGOs provide on-the-ground extension support and monitoring throughout the growing season, aided by mobile apps
5. Farmers deliver the crop while off-takers provide post-harvest support with regard to storage and aggregation
6. Agricultural commodities are consequently used for:
   - Domestic trading on trader's risk and profit
   - International trading or food aid, i.e. WFP or international commodity trader
   - Domestic processing (i.e. milling, brewing etc.) for food or feed purposes

The platform supports the supply chain with:

- Coalition building
- Contract templates
- Risk mitigation
- E&S standards
- Monitoring tools
- Marketing
- Advisory
- Project management

[7] Grow Africa website (https://www.growafrica.com/groups/farm-market-alliance) (accessed on May 29, 2017).

In Tanzania, several leading commercial banks in agricultural finance including CRDB Bank and NMB Bank provided loans to maize farmers under the Alliance. Farmers gained access to high value inputs though the coordination between banks and inputs providers where payments for seeds and fertilizers were made directly from the bank loans. In addition to the security through the contracts, Private Agricultural Sector Support (PASS), a local credit guarantee facility, partially covered the credit risk of the loans. Early experiences of the FIs seem to be positive. AGRA reported that the repayment record of a small group of farmers under the Alliance surpassed 85%, and non-repayment was mainly due to unpredictable weather and crop diseases,[8] which are still difficult to manage effectively under the current mechanism of AGRA. In response, a crop insurance product will be introduced in AGRA to further reduce the exposure to the systemic risks that farmers face. This example clearly illustrates the amount of effort required to facilitate value chain financing smallholder farmers in a loosely organized value chains such as maize. It also highlights the possibility that value chains could be tightened through contracts and/or differentiation in terms of quality, size and etc.

Long-term finance for Investment

Commercial smallholder farmers and producer organizations require longer-term finance for capital investments to grow their operations. Small tractors, processing facilities and warehouses, for example, could improve their productivity and allow them to produce higher-value products. Countries and regions with a single crop cycle could hugely benefit from irrigation facilities. Despite seemingly obvious opportunities, these investment projects often do not happen due to many reasons; one of the binding constraints is lack of long-term finance. In Africa, the demand for long-term finance in agriculture is largely unmet. Although formal FIs such as commercial banks provide investment loans to other sectors, they usually avoid agriculture due to limited physical assets for collateral and inherent risks in the sector. In some African countries alternative funding sources including investment funds and leasing companies exist, some of which serve smallholder farmers.

A group of investment funds is currently focusing on African agriculture and agribusiness. A recent FAO study identified 63 agricultural investment funds of which 24 (38% of total) exclusively focus on Africa (FAO, in press). Their investment strategies and target businesses are diverse, ranging from large-scale agro-processors, SMEs, and rural MFIs to producer organizations. Most such investment funds focus on large-scale investment opportunities mainly in lower segments of value chains such as processing and trading that are less exposed to risks in agricultural production. However, some investment funds, supported by public donors and impact investors, explore investment opportunities in agricultural production and/or agribusiness procuring raw materials from smallholder farmers. Investment funds for producer organizations such as Root Capital, Fairtrade Access Fund (Incofin) and Fair Agriculture Fund (responsAbility) mainly provide debt for trade financing and other working capital requirements. Long-term loans for capital investments are also available. For example, long-term debt accounts for 36% of the portfolio of the Fairtrade Access Fund[9] and while this is one important focus of the fund, it has been the most difficult to finance due to ready-to-finance demand and the risks. These investment funds for producer organizations deploy US$600 million per year globally and target smaller investments from US$50,000 to 2 million (The Initiative for Smallholder Finance, 2017). However, due to the high transaction costs, small investments are extremely difficult and as a result, less than 10% of their loans in 2013 were below US$300,000 (The Council on Smallholder Agricultural Finance, 2015). This means that they selectively invest in larger and more established producer organizations. In addition, investments are skewed towards tight value chains where business models are proven and reliable international buyers exist. In Africa, coffee, cocoa, cotton and cashew accounted for close to 60% of their investment portfolio in 2013 (The Initiative for Smallholder Finance, 2014).

Leasing for agricultural investments is another alternative. The biggest advantage of leasing is that the much needed finance and access to equipment is achieved without collateral, one of the biggest obstacles to smallholder finance. Repayments for leasing can be linked to crop cycles, allowing lessees (farmers) to manage their cash flows effectively. Lessors maintain the legal ownership of the equipment throughout the leasing period, which reduces the immediate credit risks. Conversely, lessors still face major issues in agricultural finance such as natural disasters and high transaction costs. Lessors also need to ensure that the leased equipment is used with care, effectively backed by support services to prevent rapid depreciation of their value. Existence of the resale market is another important prerequisite which enables lessors to recoup the residual value of the leased equipment. In Africa, not many experienced leasing companies are available in the agriculture sector. Therefore the potential leasing market has to be attractive enough for prospective lessors to make necessary investments to build their skills and products. Needless to say, the market should be backed by

[8] AGRA website (https://agra.org/news/agra-yieldwise-maize-program-in-tanzania/) (accessed on May 29, 2017).
[9] Incofin website; accessed at https://www.incofin.com/en/fund/fairtrade-access-fund.

a conducive regulatory environment. A recent analysis on agricultural leasing in Africa suggests that Ghana, Kenya and Zambia, among others, may have the potential to expand leasing products in agriculture (Nathan Associates & FSD Africa, 2017). These three countries have strong supporting infrastructure for leasing, namely equipment dealers, leasing companies, and conducive regulatory frameworks. The countries also have development efforts, and a group of financial service providers interested in expanding their service offerings to agriculture.

One of the notable examples of agriculture equipment leasing in Africa is CenteLease, offered by the Centenary Bank in Uganda. It is a short- to medium-term lease product for both agricultural and non-agricultural SMEs and entrepreneurs. The bank leases various pieces of equipment such as agro-processing machinery (e.g. groundnut shelling machines and coffee pulping machines), animal traction packages (ox-carts, ploughs, planters, oxen and yokes), and tractors etc. for a maximum of five years. The ownership is transferred to the lessees once all the agreed payments are made.[10]

Savings and payments

Savings

Savings play a key role in contributing to the financial sustainability, growth, and stability of smallholder households.

Saving functions as an effective mechanism to enable long-term financial planning. Given the irregularity of agricultural income, farmers need to save to support on-farm operations—such as the purchase of inputs for the next planting season—or household needs including children's school fees. Smallholder farmers are often faced with unexpected life events such as birth, marriage, illness, death, and other emergencies. In the absence of viable insurance products, back-up savings can serve as a substitute for insurance, enabling farmers to absorb shocks and cope with emergencies.

For financial institutions, savings collected serve as an important and relatively cheap funding source for local financial institutions to offer affordable credit. Savings products also represent a source of information for lenders, sometimes the only source of information for assessing the behavior of potential borrowers. SACCOs, in which individuals save their money and obtain loans to invest in various activities, have been one of the closest local financial institutions to farmers. They help farmers develop financial discipline, enable them to accumulate funds and sometimes have educational missions to improve members' financial literacy and help improve education and health through credit. However, the performance of SACCOs varies widely in quality and accountability. Most operate at very poor levels of financial management, transparency, and governance; offer few products; and do not pay interest on savings accounts (USAID, 2007).

Despite the importance of savings for smallholder farmers, several challenges and constraints hinder their ability to save. Financial institutions which provide formal saving options are often beyond their reach. Low returns to savings, and the high transaction costs associated with traveling to bank branches coupled with unreliable transport, impede farmers' ability to access formal savings products. Where these options exist, products offered by formal financial institutions often require high minimum balances or mandatory deposits. Informal savings mechanisms such as village savings and loans groups (VSLAs) or rotating saving groups (ROSCAs) serve as important mechanisms to enable saving. However, these informal savings methods are often inadequate or function ineffectively, as households cite the lack of privacy of these savings groups as a key deterrent for participation (Kendall, 2010). Finally, and perhaps most telling, the high level of dependency among rural households is a key constraint in enabling savings. Rural households are often obliged to share their income and savings with relatives and friends, impeding their ability to exercise self-control in accumulating assets and smoothing out consumption.

In responding to the challenges, the commitment savings account has emerged as a key product enabling farmers to save. A commitment savings account restricts individuals' ability to withdraw funds from the account until they have reached a specified goal. In West Africa, myAgro has emerged as a viable model that enables smallholder households to make micro-payments throughout the year to save for the purchase of fertilizers and seeds. Farmers purchase scratch cards at a village store (just like buying credit for a mobile telephone) and then text a number on that card to the myAgro system to initiate a digital layaway payment—essentially making a savings deposit. Funds are held in mobile money accounts until they are sufficient to cover the purchase of seeds and fertilizers. These inputs are then delivered to farmers by a partner vendor. As a result of the model, clients of myAgro have increased their harvests, and raised their incomes by more than 70% compared to non-client farmers. Esoko exemplifies another successful

[10] Centenary Bank website; accessed at http://www.centenarybank.co.ug/?q=product/business-loans-leases/centelease

business offering saving product. With support from AGRA, Esoko in Ghana developed a mobile-based model called Fasiba which enables farmers to lay away and borrow towards the purchase of discounted agricultural inputs such as fertilizers, seeds and herbicides through mobile money wallets. Through Fasiba, farmers keep cash in a dedicated mobile wallet until they reach their goal which is determined by the price and quantity of inputs. Once the goal is reached, farmers receive an e-voucher to redeem agro-inputs at their community farm gate. Esoko also connects qualifying farmers with partner financial institutions to receive top-up credit for agro-inputs after making a minimum deposit. Since the launch of the product in November 2016 until April 2017, over 1,000 farmers have registered for the product and started saving using their e-wallets.

Payment

Access to payment services is critical to supporting farming operations throughout the value chain. Farmers require access to secure and reliable payment services to facilitate the purchase of necessary inputs, such as seeds and fertilizers. Traders, processors and wholesalers require efficient payment mechanisms to disburse large amounts of money to many contract farmers over a short period of time and to service loan disbursement and repayment. However, most agricultural payments still remain cash-based, which is often expensive and risky, subject to theft, loss, and fraud.

Digital payment offers significant opportunities for key stakeholders, including farmers, mobile money providers, governments and agribusinesses in the agricultural payment ecosystem (GSMA Intelligence, 2016). It provides farmers with a safer and more efficient way to transfer money at lower costs than traditional cash-based transactions. A randomized evaluation in Niger found that using mobile payments for unconditional cash transfers saved recipients 75% on payments (Martin, Harihareswara, Diebold, Kodali, & Averch, 2016). SmartMoney, a savings and payment system currently operating in Tanzania and Uganda, substitutes cash with SmartMoney payments in the entire value chain. Large agribusinesses transfer electronic crop payments through SmartMoney to e-wallets of intermediary buyers, who, in turn, also use the system to pay small farmers. Finally, farmers can spend received digital currency in the numerous SmartMoney shops and with other SmartMoney users in a village (Babcock, 2015).

Digital payments also create opportunities for users to gain access to formal financial services and products. For instance, digital payment records can be used by mobile providers and retailers to build a financial history for smallholder farmers that are generally unbanked and lack access to affordable credit. Agribusinesses and governments also benefit from digitizing agricultural payments through lower cost of distributing payment. When governments distribute subsidies, grants, income support and other transfers to farmers, digital payments facilitate real-time and scalable payments to smallholder farmers across multiple locations, and help mitigate cash handling risks, such as theft and fraud. For instance, in Rwanda the government identifies eligible farmers and collects their information to provide fertilizer subsidies. Eligible farmers are registered for mVISA, a bank-based mobile wallet through which governments disburse the subsidies. Farmers will no longer need to provide paper documents as the farmer's PIN-protected mVISA account guarantees that only eligible farmers redeem subsidies (Grossman & Tarazi, 2014).

Trust plays a key role in adopting new technology and mode of payment. Retail agents and merchants operating in and trusted by rural communities are key players in enabling adoptions of new technologies. However, the number of cash-out points and merchants that accept mobile payments is limited in many communities. Often, this is as a result of regulation limiting non-bank agents in accepting mobile payments. Where agents are available, a lack of liquidity oftentimes undermines their credibility. For instances, in a CGAP supported pilot in Uganda, mobile payments facilitated for sugar and coffee farmers were significantly undermined when farmers reported waiting long periods to receive payments when agents did not have adequate liquidity (Lonie & Makin, 2016). Finally, a lack of access to basic infrastructure such as electricity to charge mobile devices has been cited as another obstacle in the adoption of digital payment products.

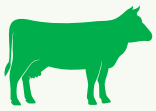
Risk management

Farmers and agricultural SMEs have various, but often insufficient, ways to manage risks. These include non-financial risk management solutions that reduce production risks (e.g. use of pesticides and irrigation equipment, and diversification); post-harvest-risks (e.g. investment in good quality storage); and market risks (e.g. contracts with buyers, market diversification). In addition, financial solutions can also help farmers and agricultural SMEs deal with the financial impact of risks when these arise. Such solutions include the use of income generating off-farm activities, savings, credit or remittances.[11] This section focuses on agricultural insurance which is a relatively new financial instrument in Africa which can help cope with the financial impact of high-severity low-frequency agricultural risks.

[11] In Kenya, for example, research shows that users of mobile payments are better able to face risks than non-users due to their quick access to remittances (see Jack & Suri, 2014).

Agricultural insurance offers financial protection against agricultural production risks. Such protection has a double objective: (1) reducing vulnerability ex post in case of shock by providing quick access to liquidity; (2) increasing productivity ex ante by increasing incentives to invest in agriculture.[12]

Several agricultural insurance products have been tested and can be classified into the following typologies:



What is covered?

Agricultural insurance can be used to protect a variety of agricultural activities such as crop, livestock and aquaculture. In each of these sub-sectors, insurance can cover assets (e.g. a coffee tree) or the expected harvest from this asset (e.g. annual harvest of coffee beans is insured). Insurance can also cover business disruptions due to climatic and/or other events that affect agricultural production, but could also affect other non-agricultural activities in the broader rural economy.

Against what?

Multi-peril crop insurance can cover a variety of perils generating losses for the insured (e.g. fire, theft, etc.). Weather insurance covers weather risks (e.g. drought, flood), while area yield insurance covers any risk that has an impact on (average) yields in a given area (e.g. weather but also pests and diseases).

How?

Traditional insurance requires on-site loss adjustments in each farm while index insurance is triggered based on an objective variable (e.g. rainfall deficit, wind speed, average or area yields, satellite imagery, Normalized Difference Vegetation Index (NDVI), etc.)

Who pays and who benefits?

Who pays and who benefits? Various models of micro-, meso- and macro-level insurance have been tested. Micro-level insurance covers individual farmers, meso-level insurance covers institutions (e.g. financial institutions, agricultural value chain players, local governments or municipalities, etc.), and macro-level insurance covers governments (usually government expenditures and budgets) against disasters.

Agricultural insurance faces a variety of challenges to effectively reduce vulnerability and increase productivity in agriculture: (1) product quality still requires improvement to ensure that insurance payouts are triggered when the insured party suffers damage, for example, basis risk[13] may arise with index insurance, when farmers suffer losses but insurance payouts are not triggered; (2) cost of insurance remains a barrier to access, even when products are subsidized; (3) while several pilots have shown the potential of insurance both to reduce vulnerability and increase the productivity of farmers, many insurance projects do not manage to scale-up therefore achieving limited impact; and (4) climate change is likely to increase the frequency of agricultural shocks, and their severity and

[12] In Andhra Pradesh State in India, farmers who received insurance were more likely to plant cash crops. In Ghana, farmers increased the share of land planted to maize, and to fertilizer use (Karlan et al., 2012).
[13] The mismatch between the pay outs based on the insurance index and actual losses.

uncertainty, all of which might contribute to an increase in the cost of insurance.

However, new trends show promising opportunities to address these challenges. First, governments are increasingly fostering the development of insurance mechanisms to cope with the financial impact of disasters. Such developments are due to growing awareness of challenges associated with ad hoc ex post disaster relief. Government support to agricultural insurance increasingly takes new forms that go beyond subsidies in premiums and include longer-term approaches such as investments in data (e.g. weather and yield data), risk financing arrangements, and providing an enabling legal environment. For example, the Global Index Insurance Facility (GIIF) supported several efforts in Africa to establish index insurance regulations in Uganda and West Africa through the Conférence Interafricaine des Marchés d'Assurances (CIMA), among others (see Box 4.4). The Kenya Government has also been supporting the development of innovative insurance to cover crops and livestock production using the concept of index insurance.

Technology (e.g. drones, satellite) may considerably improve product quality and reduce the cost of insurance in the future. Analysis undertaken by the World Bank Group (World Bank, 2011) in India showed that combining area yield data with satellite data could increase payout accuracies by a factor of 2 or reduce costs by a factor of 4. Finally, new stakeholders such as agriculture value chain players (see Box 4.5) and financial institutions are entering the market. Such approaches may both reduce costs and help achieve broader objectives (e.g. increased participation of farmers in value chains, increased access to credit). While these meso-level insurance products seem to be promising, experiences have been insufficient, especially in Africa, and their viability needs to be carefully assessed.

Box 4.4 • Global Index Insurance Facility

The Global Index Insurance Facility (GIIF) of the World Bank Group is leading the work in supporting the growth and development of sustainable catastrophic risk and index-insurance markets specifically in sub-Saharan Africa, Latin America and the Caribbean, and the Asia Pacific regions. To achieve this GIIF relies on support from private sector and governments actors to develop local markets by providing a range of solutions. These include, among others, feasibility studies and index insurance pilots to test the feasibility of index insurance markets (e.g. in Indonesia and Philippines, GIIF is working with specialized insurance companies and brokers to develop an Earthquake Index Insurance and Typhoon Insurance Index respectively). An important scope of the support provided by GIIF is helping countries develop regulatory frameworks to promote micro-insurance and commercialize agricultural index-based insurance products.

Under its regulatory, policy and legal component, GIIF works closely with governments (ministries of agriculture and finance) at regional and national levels on policy issues to create an enabling legal and regulatory environment for index insurance. For instance, in 2011 GIIF conducted a regional study of micro-insurance in 15 francophone West African countries—CIMA (Conférence Interafricaine des Marchés d'Assurances) or Inter-African Conference on the Insurance Market—and identified the need for micro-insurance regulation. In 2012 the countries ratified CIMA Book 7, which allowed micro-insurance operations to begin, including index insurance in the CIMA zone. At national level, GIIF has assisted the Senegalese Insurance Supervision Agency to develop supervisory and customer protection tools for index insurance. This regulatory change has allowed four countries—Benin, Burkina Faso, Mali, and Senegal—to develop index-insurance pilots. In Kenya GIIF supported the Insurance Regulatory Authority (IRA) to address overly restrictive regulations that are considered constraints to the development of micro-insurance and index insurance. As a result, new legal and regulatory frameworks for micro-insurance and index-based insurance were drafted (2015) and are awaiting gazettement by the relevant minister. In Uganda GIIF supported redrafting of the Ugandan Insurance Act with specific provisions on agricultural insurance and authorization of index insurance regulations to be issued for crops and livestock.

Box 4.5 • An example of meso-level insurance for an agricultural processing firm

In Bangladesh, PRAN Foods, the largest agricultural processing firm in the country, purchased a meso-level index insurance product from Green Delta Insurance Company for January to June 2016. The Global Index Insurance Facility (GIIF) has supported Green Delta's development of the index-based product, which protects cassava crops from cold spells and excess rain at critical stages of the crop cycle. For the first half of 2016, the product is covering 60 farmers on 100 acres.

As cassava is not a traditional crop in Bangladesh, PRAN Foods previously imported cassava from Africa for extracting glucose, which is used to manufacture energy drinks. However, PRAN recently began developing a local supply of cassava by operating a contract farming scheme, employing small- and medium-scale farmers on a farm on leased land. The total cassava crop area associated with PRAN is now approximately 7,000 acres.

PRAN purchased the insurance product to cover the value of the deliveries expected at harvest for the 100 acres selected for the pilot (approximately US$130/acre for a total of US$13,000). PRAN is both the policy holder and the insured party. It paid the premium and will be the sole beneficiary of any payouts. The company anticipates using any payouts to help cover liquidity needs in the case of insufficient local supply due to a major weather shock. In the case of less severe shocks that do not significantly threaten local supply, however, PRAN is considering providing the funds from any payout to farmers as a "bonus".

Source: Dugger and Sberro (2016).

Agricultural insurance is a financial solution that may address some key constraints to agricultural development, and which has provided promising results. It should be promoted as part of a broader agricultural risk management framework, whereby other risk mitigation tools (e.g. training in good agricultural practices, irrigation, etc.) are promoted to cover low-severity/high-frequency risks.

Cost-effective delivery mechanisms and role of technology

The high transaction costs associated with on-site loan appraisal and monitoring of loans along with the opportunity cost in serving low population density markets with poor infrastructure has hindered formal financial institutions from setting up bank branches in rural markets (Höllinger, 2011). In turn, farmers are forced to spend significant amounts of financial resources and time traveling to urban areas to obtain access to basic financial services. In responding to these challenges, branchless banking has emerged as a viable option in delivering financial services outside conventional bank branches (Dias & McKee, 2010). Branchless banking enables users to gain access to basic financial services such as savings and deposit accounts, insurance, payment mechanisms, and credit without traveling long distances.

Agent banking—a model of delivering financial services through partnership with a retail agent (or correspondent) in locations for which bank branches would be uneconomical (Dias & McKee, 2010)—provides cost-effective solutions to promote agricultural financing from both the supply and demand sides. On the supply side, it lowers the cost to banks in establishing physical banking infrastructure to unbanked areas. For instance, the set up costs of a retail agent in Brazil can be as little as 0.5% of the cost of setting up a bank branch (Lyman, Ivatury, & Staschen, 2006). On the demand side, branchless banking provides farmers with more economical options for gaining access to financial services as they do not need to spend out of pocket to reach a bank branch (Jayanty, 2012). According to the Central Bank of Kenya, agent banking was launched in 2011 and by March 2013, a total of 11 commercial banks had contracted 18,082 active agents and were facilitating over 48.4 million transactions valued at US$3 billion (iVeri, 2014). However, the regulatory endeavors have not caught up with the rapid rate of development agent banking activities in SSA. Ethiopia, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, and Tanzania are among the few countries that have dedicated legal frameworks on agent banking. Among the countries with regulation on agent banking, only Ethiopia allows agents to enter into both exclusive and non-exclusive contracts with financial institutions to provide services on their behalf.

The rapid growth of mobile subscription and Internet services has triggered the rapid expansion of digital financial services (DFS) in providing access to a range of financial services, including payment, transfer, and credit, all from the convenience of a mobile phone or e-platform (Dias & McKee, 2010). As of August 2016, a total of 295 live mobile

money services existed in 97 countries, extending financial services to the unbanked population (GSMA Intelligence, 2016). The global number of mobile subscribers and Internet users was estimated to be 4.9 billion and 3.8 billion respectively by January 2017. Among them, 995 million of the mobile users and 362 million of the Internet users are in Africa (Kemp, 2017). The expansion of mobile networks and Internet creates great potential to decrease the cost of delivering financial services. Studies have shown that mobile wallets and bank accounts are able to acquire customers at less than 70% of the cost of a branch or Point of Sales (POS)-enabled agent (Veniard, 2010). Digital Finance provides one of the best opportunities to address smallholder finance due to three key reasons: 1) the ability to reduce transactions costs, especially delivery costs thereby making finance affordable to smallholders; 2) reducing the cost of information and credit analysis for FIs thereby addressing the problem of information asymmetry; and 3) the ability to provide support to smallholders on areas such extension and market access through add-on non-financial services.

$24 billion

total transactions on M-Pesa in 2014

One of the most well-known mobile banking stories in developing countries is M-Pesa, a small-value electronic payment and e-wallet product, which was launched in Kenya in 2007 (Mas & Radcliffe, 2010). Due to its rapid growth, 17 million Kenyans (more than two-thirds of the adult population) used the service to transfer money and pay their bills by the end of 2013 (World Bank, 2016b). The simplicity and convenience of M-Pesa led to roughly US$24 billion in total transactions transferred through the system in 2014 (World Bank, 2016b). It also created additional job opportunities, generating income for more than 80,000 agents (World Bank, 2016b). The success of M-Pesa has also attracted other players to the market. Zap, introduced by Zain, a leading mobile network operator in the Middle East and Africa, enables customers to easily manage their accounts, pay utility bills and school fees, and pay for goods and services and transfer money to other customers. Within one year of its launch in 2009, Zap had attracted 12 million customers (Zain, 2010) and became the most widely available mobile money service in the world, with deployments in the Africa region in countries such as Kenya, Tanzania, Sierra Leone, Ghana, Niger, Malawi and Uganda.

In addition to the basic payment related financial services, DFS promotes greater financial inclusion by providing a wide spectrum of services to smallholder farmers and small- and medium-sized agribusinesses, ranging from credit, savings, insurance and value chain finance. For example, Umati Capital, a digital finance start-up in Kenya, offers two products, Supply Chain Finance (SCF) and Invoice Discounting (ID) to drive access to credit through agricultural value chains. Umati pays 80% of the value of approved invoices within 24 hours. Since 2013, Umati Capital has disbursed over US$4 million into different value chains including dairy, sorghum, maize, fresh produce, macadamia and coconuts. The products help to free up working capital in the value chain, thus creating opportunities for enhanced investments or transactions, and strengthening the relationship between buyers and smallholder farmers in the different value chains.

Other innovative technologies, such as distributed ledger technology (DLT), otherwise known as blockchain, have the potential to promote access to financial services for smallholder farmers and agribusinesses. Originally conceived as the backbone of the cryptocurrency Bitcoin, the blockchain is a digital shared record of events, organized into "blocks" and distributed across a network of computers. DLT could be used to record ownership and transfer of property in countries where land title registries are non-existent or poorly maintained, which in turn could allow smallholders to access financing using their land as collateral.[14] The technology could also be applied to collateral registries, in which ownership of even moveable collateral like livestock could be recorded and verified by financial institutions. Additional applications include insurance policies with automated payouts triggered by smart contracts that monitor weather or sensor data, digital WRS,[15] traceability of commodities along the value chain, and receivables financing. However, blockchain technology is still in its infancy (particularly when it comes to agriculture finance applications), and more research is needed to understand its potential application.

Yet despite the huge benefits, flexibility and convenience associated with DFS, numerous challenges arise for market regulators, providers, customers, and agents of DFS. Highlights of the issues include protecting clients' funds collected against fraud usage, and ensuring the safety and reliability of services. Regulations should be adopted and

[14] Bitland in Ghana.
[15] Company GFT Technologies SE.

implemented in proportion to the risks posed by DFS to the level that does not hinder the continuous innovation of the sector. The low level of financial literacy among poor and unbanked customers, and a lack of familiarity and trust for financial services providers remain among the most crucial challenges for further development of branchless banking activities. Addressing these challenges requires solutions that are relevant, compelling, and secure for underserved markets, which in turn have the potential to facilitate increased demand for these products.

Key Takeaways and Broad Policy Framework for Consideration

Key takeaways

- Financial demand and access to financial services vary widely depending on the nature of smallholder farming. Understanding the financial demand of smallholder farmers depends on suitable segmentation and access to demand surveys. On the supply side, a wide range of formal and informal financial service providers offer various solutions, but their penetration is still low compared to demand.

- Value chain financing is widely used as a risk mitigation mechanism in providing short-term finance in tight value chains. Lessons from experiences in Africa indicate that to be effective, value chain finance needs to combine finance with other services, such as access to technology, inputs, technical assistance, access to markets, etc. as well as imbed incentives for farmers to reward loyalty and develop a long-term relationship with the offtaker in the value chain. Conversely, farmers in loose value chains and non-commercial farmers are mostly outside formal agricultural credit. Financial institutions are usually absent in long-term finance for agriculture and alternative funding sources such as investment funds and leasing products started filling the gap in certain value chains and countries. Although progress is gradual, Africa is experiencing the emergence of impact investor funds that aim to grow both short-term and longer-term finance in agriculture.

- Diffusion and development of ICT has been changing the agricultural finance landscape in Africa quickly. A growing number smallholder farmers is gaining access to payment services through mobile telephones, which are also used in agricultural transactions. Formal financial institutions also deploy ICT and new business models to reach dispersed rural population.

- Among other risk mitigation tools, agricultural insurance products have been tested in many African countries to mitigate high-severity low-frequency agricultural risks. While most attempts have not been sufficiently scaled-up, technology may considerably improve product quality and reduce the cost of insurance. Combining insurance with other financial and non-financial services, for example, along value chains and input suppliers, could increase the uptake.

- An enabling environment, with smart financial regulations, targeted and effective agricultural finance policies, and well-established financial infrastructure, is essential to ensure a well-functioning financial system that promotes the development of agricultural finance. Relative to other regions, SSA has endeavored to improve regulatory environments for activities on electronic money and local financial institutions such as deposit-taking MFIs and financial cooperatives. However, areas for further improvement remain, such as agent banking and warehouse receipts. In addition, a set of policy tools exists that many African governments have been testing, but have produced mixed results. Country context and implementation matter to ensure positive results of policy interventions.

Broad policy framework for consideration

Pay closer attention to many heterogeneous actors in both the demand and the supply side of smallholder finance. A comprehensive agricultural finance assessment is needed to understand financial demand of smallholder farmers and the unique strengths of different financial service providers and services before introducing policy interventions or market solutions. Farmers require a wide variety of financial solutions which cannot be served by any single financial service provider. Recent research work revealed that non-commercial farmers are mostly excluded from agricultural financial services and their financial requirements are very different from those of commercial farmers. Formal and informal financial service providers have their strengths and provide unique yet partial solutions to smallholder farmers.

Design consistent policies and regulatory frameworks where appropriate instruments are applied to specific problems. Focus on facilitation of private investment and innovation that induces sustainable provision of finance by formal and informal financial institutions. Particular focus needs to be given to agricultural finance policies that leverage funding from financial institutions and value chain players. Such policies often include credit guarantees,

matching grant schemes, agricultural insurance, warehouse finance, etc. Creating a conducive enabling environment with policy interventions tailored, designed, and implemented to country contexts is one of the important prerequisites to growing the market of key financial services, including insurance, leasing, and DFS.

Establish consistent and clear standards and guidelines to support and guide the fast growing supply of digital finance and its further application in the agriculture sector. Digital finance has shown its great potential to promote financial inclusion and agricultural finance by providing a wide spectrum of financial services, ranging from credit, savings, insurance and value chain finance through digital initiatives. Regulatory frameworks shall support continuous innovation of the market without imposing overly restrictive entry and operations requirements, while at the same time manage potential risks imposed by those initiatives and ensure customer protection.

Build an effective coordination mechanism among different ministries and government agencies each of which assumes critical, but partial responsibility in shaping enabling environments for agricultural finance. In many African countries, access to finance is considered one of the most critical elements to support smallholder farmers. However, policy solutions are often not comprehensive enough mainly due to lack or limited coordination among key ministries and agencies in governments such as ministries of agriculture, finance, trade, and industries, and central banks. Effective coordination among these actors would contribute to offer consistent and comprehensive solutions for this highly complex subject.

Adopt a holistic approach to promote agricultural finance by taking into account various stakeholders from both public and private sectors. Agricultural finance does not function on its own. It helps enhance smallholder productivity and contributes to business operations across the agricultural value chain. In return, tight and well-developed agricultural value chains and mature agribusiness markets, which need joint efforts from market players and governments, help further channel financing resources by lowering the perceived high risks associated with the agriculture sector by financial service providers. Often, finance is best if it part of a holistic package of additional financial (e.g. insurance, payments, etc.) and non-financial (e.g. technical assistance, capacity building) services that improve productivity, increase value added, and enhance post-harvest marketing.

Develop information systems which facilitate designing and provision of agriculture financial services. Critical information includes climatic data for agricultural insurance and information on business transactions between producers and buyers for value chain financing. In view of increasing demand for high value and processed food products, basic data on agribusiness SMEs could also help financial institutions analyze them and provide suitable financial services and products. The establishment of agroclimatic information systems assists financial institutions, insurance companies, policy makers, agribusinesses, and farmers to better assess risks, design the right products to address them, and make the necessary investments to promote improved resilience of agriculture to climate risks.

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CHAPTER 5

Creating Resilient Value Chains for Smallholder Farmers

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KEY MESSAGES

ONE

Value chains can provide greater value and opportunities, arising from increased production and income, for African smallholder livelihoods.

TWO

In addition to benefits, smallholder farmers may also face risks, many of which are outside their control. They include the consequences of climate change, of land degradation, of the damages caused by pests, diseases and weeds, financial crises, post-harvest losses, and of the price volatility of agricultural products.

THREE

The losses incurred in Africa may total many billions of US dollars. For individual farm families, the consequences may be increasing hunger and poverty and, in extreme situations, total loss of their farms and their livelihoods, leading to destitution.

FOUR

Smallholder resilience can be analyzed and measured in terms of the response of the farmer's development pathway to stress or shock. The pathway may be little or non-affected, may fall and recover, may fall to a new lower pathway, or the pathway may collapse altogether.

FIVE

Few, if any, magic bullets exist that improve resilience. Instead, the solution lies in integrated approaches, such as integrated soil management, integrated pest management and climate smart agriculture, integrated insurance and integrated storage. Such integrated approaches comprise complementary technological, economic, social or political responses.

SIX

The resilience of whole value chains depends on the sustainability of each component of the chain and the nature of the links between the components.

Introduction

In this chapter, we first discuss the value of value chains and how they can benefit from resilience. We follow this with a detailed analysis of the risks and resilience of different components of the value chain. We conclude with a discussion of the business of resilience.

The Vulnerabilities of Smallholders

Eighty percent of African family farms are smallholdings, with a farm size of less than 2 hectares (IFAD, 2012). Most are subsistence farmers living a precarious existence: farm families are often large, one or two adults and several children of various ages. Often living in the compound of the home are grandparents and members of an extended family.

Inevitably, they are chronically hungry and the children under 5 years old lack essential micronutrients, such as vitamin A, iron and zinc. As a consequence, they grow up physically and mentally stunted. In sub-Saharan Africa (SSA), average stunting rates are often over 40% (Global Panel on Agriculture and Food Systems for Nutrition, 2016). This is a shocking statistic. The cost of undernutrition to African economies in terms of lost national productivity is estimated at 11% of gross domestic product (GDP) annually (IFPRI, 2016).

Smallholder farmers and their families have limited access to health care and education. Often, they also live in remote areas, lacking good roads and access to input and output markets, adding to their insecurity.

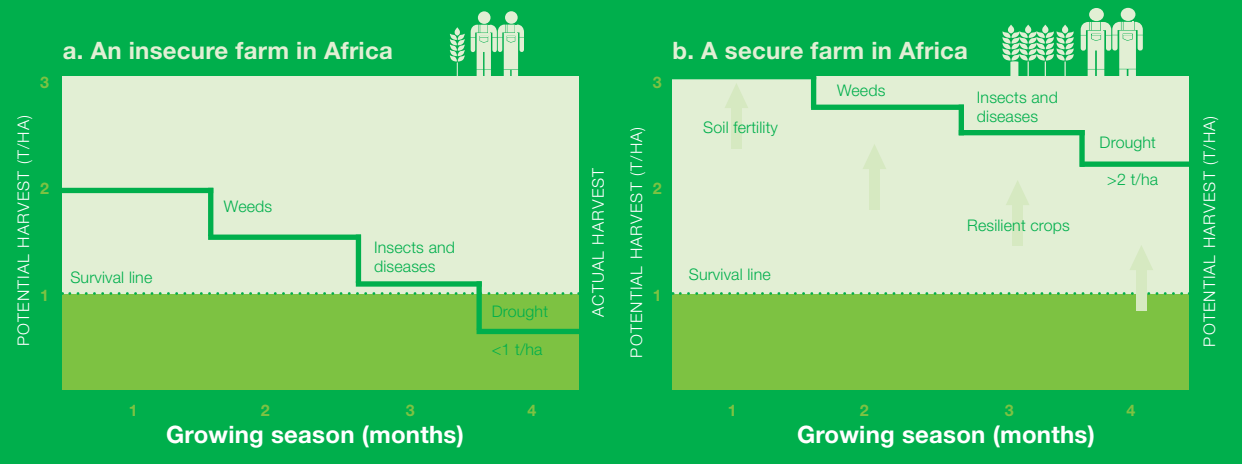
What this insecurity means in practice is well illustrated by the conditions under which an African woman farmer, such as Mrs. Lindiwe (who represents a composite of situations existing in Africa), struggles to feed herself and her family (Box 5.1).

Box 5.1 • A smallholder farmer in Tanzania

Like many other farmers in northern Tanzania, Lindiwe raises her family on a small farm of three acres (1.2 hectares). She grows maize (corn) during the long rains that start in late December and plants beans during the short June rainfall. Lindiwe grows her crops on a piece of land that has suffered erosion and nutrient depletion.

Lindiwe's family faces various risks that often bring their household to the brink of poverty and hunger. If all goes well, she can expect to harvest around 2 tons of maize per hectare. But Lindiwe needs a minimum of about 1 ton per hectare to feed her family of five. As shown in Figure 5.1a, if there is a drought (the major risk to production in the area) or a disease or pest outbreak, the yield can drop below 1 ton per hectare.

Figure 5.1a Crop harvest from an insecure farm 5.1b from a resilient secure farm



Source: Buffett, Chavez and Conway (2016)

Box 5.1 · A smallholder farmer in Tanzania (Continued)

As shown in Figure 5.1b, with access to fertilizers that temporarily increase soil fertility, hybrid drought tolerant seeds, and some herbicide and pesticides to contain weeds and pests, Lindiwe could produce reliable yields of at least 2 tons per hectare, even in the event of a mild drought or pest and weed outbreak. This would enable Lindiwe and her family to produce enough to feed themselves, and to sell enough grain every year to pay for a more diverse diet, medicines, school fees, and other needs.

Yet to buy the necessary inputs she needs from the local agricultural supply dealer, Lindiwe would need a loan from the local bank. But she does not have any credit history or any training in how to use advanced inputs. Moreover, she knows that a loan may add to her risks. If the rainfall fails, she might not make enough surplus to repay the loan and its interest, and she is unwilling to risk losing the collateral.

As weather extremes increase in severity and frequency, and rainfall patterns become less certain, Lindiwe and her family remain in a state of semi-subsistence and increasing vulnerability.

Source: Buffett et al. (2016)

The Value of Value Chains

During the Green Revolution in Asia in the 1960s and 1970s, value was pushed from the base of the cereal value chain, deploying the new short-strawed wheat varieties. Now it is pulled from the top by urban demand that encompasses not only more staple food, but also a greater variety of foods, especially more nutritious foods.

Today, increasing globalization and urbanization present African smallholders with considerably greater challenges than those faced by Asian farmers during the Green Revolution. Rising urban demand for more and better food can provide opportunities to increase and diversify food production in rural areas (Graziano da Silva & Fan, 2017). However, rapid urbanization can also add stress to agricultural systems, not least as a result of rural–urban migration.

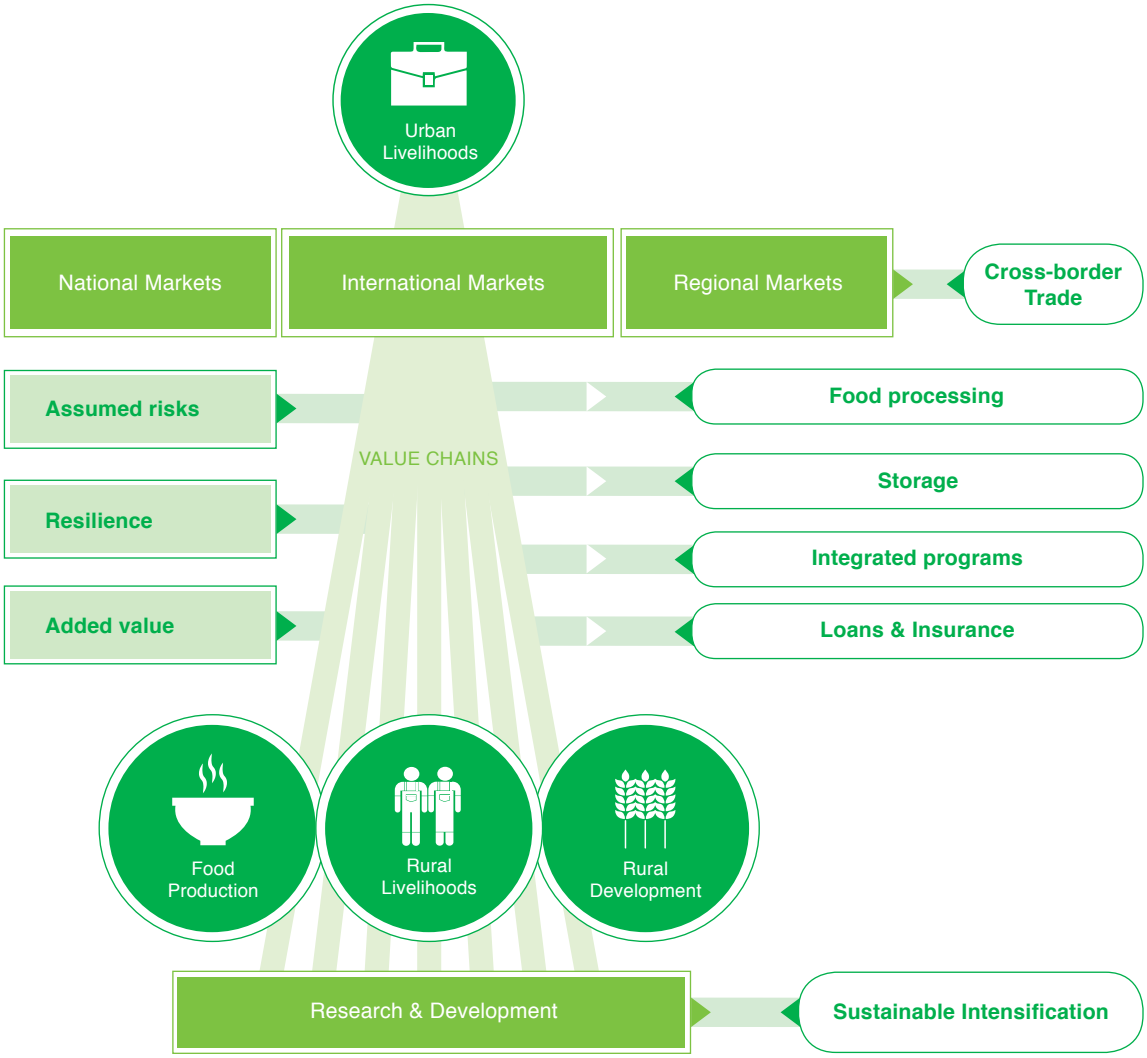
As a result, African smallholders not only need to produce more efficiently, but also to contend with far more complex and competitive markets. Growing specialization, rapidly changing consumer preferences, and increasingly intricate technical specifications place significant demands on the average smallholder. Institutional and technical innovations, including better access to input and output markets, and enhancing rural–urban linkages constitute key components of future agricultural transformation strategies.

For smallholders, such as Lindiwe, a successful agricultural and livelihood transformation depends on the effective and inclusive integration of smallholder farmers in value chains. Such integration, up and down the value chain, can lead to:

- Increased accumulated productivity and value
- Increased diversity in the chain
- Reduced risks and greater resilience

A value chain can be defined as the process of transformation of a physical product from input and production through processing and consumption (Conway, 2012). Along this process, several actors are involved, who usually interact either through contractual arrangements (formal/informal) or on the free market. Physical goods flow down the chain until they reach consumption, in exchange for financial flows that flow up the chain from the final consumer back to the original producer. Each actor along the chain retains a share of the final price, which is necessary to make his/her business profitable and sustainable. Figure 5.2 describes a simplified value chain.

Figure 5.2 • Schematic diagram of value chains appropriate for African smallholders



Creating resilient value chains depends on building sustainability up and down the chain (Figure 5.2):

- Each component (in the white boxes) needs to be sustainable and resilient
- As do the links between the components
- Resilience also needs to be systemic

The Dynamics of Resilience

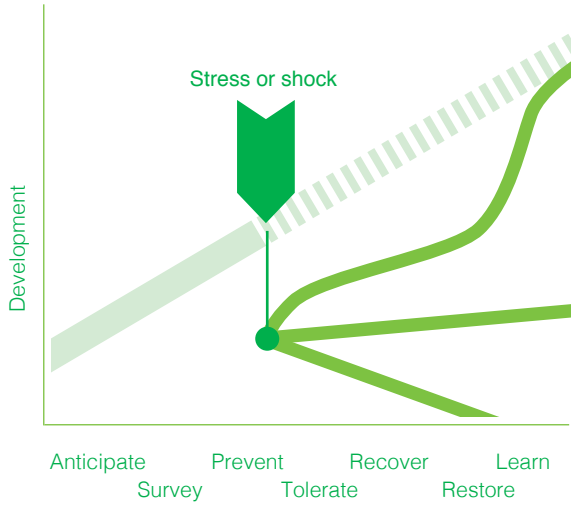
Resilience, like sustainability, is one of those terms that means all things to all people (The Montpellier Panel, 2012). In the context of this report, resilience is the capacity of an agricultural value chain and its elements to withstand or recover from stresses and shocks and thus bounce back to the previous level of growth and development (Figure 5.3).

A stress can be defined as a regular, sometimes continuous, relatively small and predictable disturbance, for example the effect of growing soil salinity or lack of rainfall or indebtedness. Such stresses or chronic crises are directly damaging, but sometimes slowly culminate to cause a shock or acute crisis.

A shock is an irregular, relatively large and unpredictable disturbance, such as is caused by a rare drought or flood or a new pest outbreak, or when slow onset disasters pass their tipping points and become extreme events.

Many stresses and shocks are interlinked, for example, energy and input price volatility, extreme weather events and climate change, growing scarcity of natural resources and poverty and inequality. Because African communities are becoming more densely populated and increasingly urbanized, value chains are increasingly more complex and fast moving. As a consequence, minor adverse events become amplified, and the threats are multiplying in frequency and scale.

Figure 5.3 • The dynamics of resilience



Source: The Montpellier Panel (2012)

We believe that linking farmers to value chains is a key route to a better future; it is essential if farmers and their families are to achieve greater labour productivity and move beyond subsistence. Of course, that linkage may also be fraught with risks, not least that the farmers have insufficient education or skills or are otherwise unable to engage in a profitable participation in value chains. That can be a serious risk, but in this chapter we are primarily concerned with the major risks that arise, from severe stresses and shocks due to external forces.

Strengthening Resilience in Value Chains

Resilience can be strengthened in many different ways, and at different levels in the value chain, through political, economic, sociological or technological interventions. For example, drought can be countered by building irrigation systems, through agro-ecological technologies such as conservation farming and by breeding new crops or livestock that are tolerant of or resistant to drought. Resilience can also be strengthened through more open trade policies to facilitate trans-border access to food. Some approaches are expensive, some more affordable.

The steps, described in Figure 5.3, that need to be taken to build resilience include:

1. The anticipation of the likelihood and location of a stress or a shock, through some form of survey, for example, the use of agroclimatic monitoring to inform famine early warning systems.
2. Preventative measures, such as building dams or sea walls, may allow agricultural development to continue unhindered.
3. Often, the best option is some form of tolerance that reduces the damage or allows rapid recovery.
4. Sometimes, of course, damage is unavoidable and the only response is to rebuild or restore the basis for growth.
5. Finally, building resilience is about learning from past experience. How did a value chain and its elements cope with a severe stress or shock? How can it do better in the future?

As a general rule, the more effort put into anticipating stresses and shocks and into designing preventative or tolerant responses the lower the likely damage and costs of action will be.

At first sight, the goal of resilience may seem at odds with growth and development of the value chain. Indeed, there is often a trade-off. It is possible to have a highly resilient but stagnant development, or a rapid development that is destructive and highly volatile. The ideal is somewhere in between, where appropriate resilience is built in at the outset in a way that exploits the synergies between development and resilience. Moreover, development is likely to be unpredictable unless resilience is built in. If growth is steady and assured it will encourage further investment, so creating a spiral of development.

Resilience is not only about acute crises with one-off solutions. Very rarely does resilience depend on magic bullets. The lesson for practical resilience is that it has to consist of a system of interlinked components that reinforce each other. The challenge is to identify the risks arising in the value chain, analyze their causative factors, and identify components that combined together create a truly resilient approach.

In the following section we discuss examples of the risks farmers face and how they can be reduced by resilient approaches.

Risks and Resilience

Sustainable Intensification

Resilience and sustainability of the value chain depends on research and development at the base of the chain that focuses on the development of the innovative practices and technologies of sustainable intensification.

Agricultural intensification results in greater amounts of output

In simple terms, "agricultural intensification" results in greater amounts of output, whether of food produced, the income generated or the nutrition received by subsistence farmers themselves or consumers of farmers' agricultural produce. Yet this will have to be met under conditions of decreasing amounts of available land area, reduced water availability, and a warming climate. Horizontal expansion of cropland through deforestation and conversion into agricultural land is undesirable, if we are to conserve biodiversity and reduce greenhouse gas emissions.

This implies that intensification will have to be sustainable and resilient. In effect, we need value chains that are deeply rooted within the concept of sustainable intensification (The Montpellier Panel, 2013):

- producing more with less,
- but also, using inputs, such as seeds, fertilizers and pesticides, more prudently,
- adapting to climate change,
- reducing green house gases emissions,
- improving natural capital, such as soil moisture capacity and the diversity of pest enemies, and
- building resilience.

There is no panacea to achieving this goal. Multiple paths and approaches must be followed and appropriate choices made, based on local, site-specific economic, social and biophysical conditions.

Sustainable intensification can derive from increasing the use of inputs, introducing a new input to the system or using an existing input in a new, innovative way. Examples include a new and improved rainwater harvesting technique to increase access to water, planting new high-yielding seed varieties or employing more farm labourers. All the changes require both access to technologies and information as well as the fundamental science that generates new inputs or novel ways of using them.

It is a tough challenge, but it is also an immense opportunity for Africa and for the millions of smallholder and family farmers on who we depend to feed the continent.

The Approaches to Sustainable Intensification

In practice, there are three approaches to sustainable intensification: the ecological, the genetic, and the socio-economic:

- Ecological approaches use ecological principles to design agricultural practices. Examples include conservation farming, agroforestry, integrated pest management, and organic farming.
- Genetic approaches rely on developing plants and livestock with a combination of traits promoting sustainable production. Examples include modern drought tolerant maize varieties, the new rice varieties of Africa (the NERICAs) and heat tolerant new cattle breeds.
- Socio-economic approaches depend on strengthening the links between farmers, for example, through farmer associations and cooperatives, or through their links to value chains.

Precision Farming

Often the sustainability of intensification depends on the greater precision of the farming practices that are applied (Box 5.2).

Box 5.2 • Precision farming in Rwanda

Everest and Joyce are a young couple living in Kagabiro village in Rwanda. Like most of their neighbors, they grow maize, beans, coffee, and bananas. A few years ago they decided to join One Acre Fund (OAF) which works with smallholder farmers in Rwanda, Burundi, and Kenya. Joyce and Everest wanted access to seed and fertilizer, financing, training, and market facilitation. OAF taught them proper seed spacing methods and provided them with a planting kit which cost a little over US$0.50.

Box 5.2 • Precision farming in Rwanda (continued)

The kits improve yields of crops such as maize by as much as 10%, representing a US$30 increase in income. The kits include a fertilizer scoop for microdosing, a planting string and a top dressing stick, which farmers are taught to use properly through regular training sessions. These tools ensure appropriate seed spacing and use of fertilizer for two main reasons:

- Replacing traditional methods of seed planting, such as broadcasting, with precision seed spacing, improves germination rates by ensuring better seed to soil contact and that seeds are planted at the optimal depth.
- Microdosing of inputs such as fertilizer, pesticide, or water minimizes the application and over-use of inputs, by applying small quantities of the input directly on to the seed. This curtails their impact on the ecosystem, where numerous problems can arise from inappropriate input use, such as algal blooms resulting from overuse of fertilizer.

In the first season with their OAF kit, Joyce and Everest planted 2 kg of beans from which they harvested 100 kg. This is highly significant in comparison to previous efforts where they had planted 30 kg of beans and yielded only 40–50 kg. They are on track to a more productive yet sustainable livelihood.

Source: Marks (2015)

Financial Instruments

Financial crises

Financial crises occur at different levels, from the global to the national to the individual household. Whatever the level, the consequences for smallholder livelihoods and food security can be severe.

The global crisis from 2007 to 2008, triggered by a crisis in the US subprime mortgage market and developing into a full-blown international banking crisis, was considered to be the worst financial crisis since the Great Depression of the 1930s (Eichengreen & O'Rourke, 2009; Eigner & Umlauft, 2015; Pendery, 2009; Temin, 2010). Some developing countries that had seen strong economic growth saw significant slowdowns. For example, Kenya slowed from 7% in 2007 to only 3–4% growth in 2009 (Masha, 2010). As a result, some 100 million people were added to the global list of chronically hungry and the crisis has had a continuing, damaging effect as grain prices have remained high.

National economic crises in SSA are often the result of conflict and civil strife. Currently, 15 African countries are involved in war, or are experiencing post-war conflict and tension. Such conflicts often occur together with, and are related to, other shocks such as economic crises, price shocks, and natural disasters (Breisinger et al., 2014). Thus, Mali was hit by a severe security and political crisis linked to the attacks by armed groups in the north of the country in 2012. As a result of the drought in 2011 and the political and security crisis of 2012, Mali's poverty rate increased by two percentage points. But the country proved highly resilient: there was a dramatic rebound in agricultural production in 2012 by 14% and the growth rates have returned to over 5% (World Bank, 2013). Critically, food security-related policies and programs can also build resilience to conflict.

Of most concern in this chapter are the economic crises at the household level arising from the risks. Farmers may lose all or part of their produce and fall into poverty or even destitution, because of adverse weather, soil erosion or pest attack. These risks are particularly acute if farmers take out loans to purchase inputs such as seeds, fertilizers, and other inputs. If the crop or livestock production fails, the loans may not be repaid, causing farmers to lose their collateral, creating a permanent state of poverty. There are also risks arising from possible collapse of local banks or savings and loan associations.

Bank Crises

Only a minority of African smallholders has access to the financial services that would enable them to purchase the inputs they need for profitable production. Unfortunately, the willingness of banks to provide credit to farmers has remained limited across SSA. Moreover, they often require upfront cash collateral of 20–50% which acts as a disincentive for smallholder farmers.

One solution, acting as a partial substitute for the collateral, is that a bank receives a guarantee against loan default repayment risk in exchange for a guarantee fee.

Nigeria was the first country in SSA to develop a Credit Guarantee Fund for the agriculture sector. The scheme, set up in 1977, is funded jointly by the central government and the Central Bank of Nigeria. It allows banks to recover up to 75% of the principal in case of default as well as the equivalent of the interest lost from defaulted loans. The operational costs of the Fund are covered by the interest. From 1997 to 2015, the proportion of Nigerian bank loans made to the agriculture increased from 0.7% to over 5% (Central Bank of Nigeria, 1990).

Insurance

Even when loans are obtained, African farmers face a variety of risks. The most important is the loss of crops due to adverse weather events such as droughts or hail during crop growth. Such risks can be managed through different strategies ranging from risk avoidance, mitigation of risk, to the transfer of risk. A farmer can decide not to grow a crop in a given high risk area. Reduction of drought risk can also be achieved through investment in irrigation infrastructure. However, when such investments are prohibitive or not physically possible, the transfer of risk through financial instruments such as insurance, derivatives or bonds can provide a useful solution that diminishes and smoothes the risk exposure of smallholder farmers and supply chain partners. Here, we focus on the different forms of agricultural insurance that can be deployed to reduce the risk of supply chain disruption.

Types of insurance

The act of purchasing insurance can be defined as agreeing to incur a small and quantifiable loss to prevent the effects of a large and disruptive loss. A risk is characterized as insurable if the premium paid is sufficiently small in comparison to the value of the asset insured. While a variety of agricultural risk transfer solutions are available across the supply chain, here we focus on the risk of crop production loss that farmers incur and is the first cause of supply chain disruption.

Agricultural insurance worldwide has grown over the past 10 years to surpass US$20 billion in premiums today (Iturrioz, 2009). However, while developed markets—North America, Europe, and Asia—represent jointly more than 95% of global agricultural insurance volume, the African market represents less than 2% of the volume.

The African agricultural insurance market represents less than 2% of the global volume.

The commercial unsuitability of traditional agricultural insurance products in the context of smallholder agriculture triggered the development over 10 years ago of a new type of insurance known as “parametric insurance”. This is based on the estimation of crop loss using a parameter or index that acts as proxy for yield loss and can be computed without the need to visit the farm. For instance, the rainfall data recorded by a weather station is used to build an index that acts as proxy for crop yield loss in the vicinity of the station. Such insurance has been developed using satellite data, and several pilots have been implemented in SSA. While this type of insurance provides the advantage of shielding the insurance company against moral hazard, the potential of mismatch of index-estimated losses compared to real losses can limit its usability.

Examples of different forms of African crop loss insurance:

- Large-scale financing, Nigeria: A loan guarantee mechanism set up as a crop loss insurance that triggers a payout to banks in order to mitigate input loan default risk from smallholder farmers. As mentioned above, the share of loans to agriculture in Nigeria jumped from 0.7% to 5%, two years after the introduction of the programme in 2005.
- Malawi country level (Sadler & Mahul, 2011): In 2008–2009, Malawi was the first low income country to adopt a weather derivative instrument. Using a set of 23 weather stations managed by the national meteorological agency, a national “maize index” was designed to act as a proxy of national maize production driven by precipitation. It allowed the country to receive an immediate payout of up to US$4.4 million as soon as the index fell below 10% of its historical average. The World Bank acted as intermediary between the country and the international reinsurance market while the premium paid by the Malawi Government was financed by the UK Department for International Development.
- Large scale insurance—Africa Risk Capacity Ltd (African Risk Capacity, 2016): This company developed an index insurance-based design to compensate governments in case of large-scale droughts. It was designed to quantify the loss in real time and enable the rapid disbursement of a payout so enabling governments to proceed to humanitarian relief actions in a timely fashion. It has been supported by the World Food Programme (WFP) and the African Union.
- Microfinancing—ACRE/Syngenta (Syngenta Foundation for Sustainable Agriculture, 2017): The Syngenta Foundation launched an index-based micro-insurance scheme in Kenya and Rwanda that has reached over 300,000 smallholder farmers. It was introduced by the *Kilimo Salama* programme as a form of credit enhancement mechanism to facilitate the purchase of inputs

from Syngenta and partnering input companies. In the event of delayed rainfall affecting germination, farmers are given access to new seeds as a form of payout for the insurance purchased when the input loan was contracted.

Insurance linked to loans

A potentially more resilient approach is to link insurance to loans. An example is provided by a pilot study in Tanzania under the Farmer to Market Alliance of WFP, where insurance is coupled with loans for inputs given to farmer associations (WINnERS Project, 2017).

The project, supported by the European Union's ClimateKIC program, has developed a new technology based on big data, supercomputing, and satellite data. The aim is to build new financial instruments that de-risk the participation of smallholder farmers in local to global supply chains, and de-risk the supply chains of banks, food buyers, and retailers to weather risk.

At the core of the approach is a mathematical construct that provides information on yields for 5 km^2 pixels using weather data from satellite imagery, combined with information on technologies and management practices. Among the various stakeholders, in addition to WFP, are Yara, Cargill, and SAB Miller, with insurance provided by a local company and through Munich Re. All stakeholders have an incentive to increase resilience and productivity that directly translates in higher profitability for all.

Once farmers have access to new and innovative inputs they are able to undertake integrated approaches to resilience.

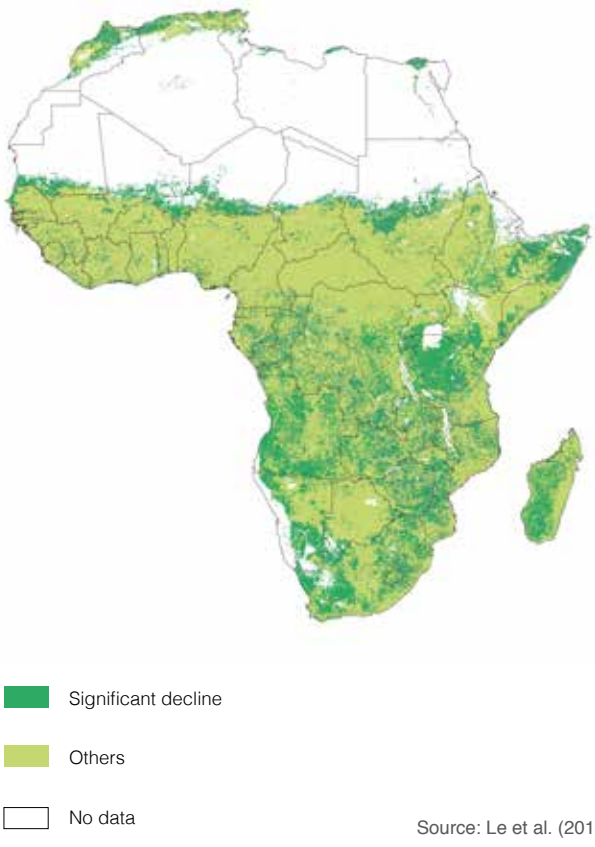
Integrated Soil Management

The quality and amount of food that African farmers produce directly depends on the health and fertility of the soils on which they farm. But soils and land will degrade if they are not managed appropriately. Soil will erode through the action of wind and water and will lose its structure and nutrients; essential physical, chemical and biological processes will be damaged and fertility reduced. As a result, the productivity and quality of both natural vegetation and crops will be reduced and the livelihoods of farm households damaged.

The burden is disproportionately carried by smallholder farmers because they do not have the labor, cash or knowledge to repair the damage. Estimates of land degradation vary widely: while early estimates were largely subjective, in recent years the advances in remote sensing and satellite technologies have enabled efforts to measure vegetative growth at a resolution of 8 km^2. This has been used to provide a worldwide measure of land degradation "hotspots". Initial results show that land degradation hotspots stretch to about 29% of the total global land area. For SSA land degradation hotspots affect about 26% of land (Figure 5.4) (Le, Nkonya, & Mirzabaev, 2016).

In SSA an estimated 180 million people are affected by degraded soils (Mirzabaev et al., 2014); the economic loss due to land degradation is estimated at US$68 billion per year (Nkonya et al., 2016).[1] While national level data is limited, it is striking where available. For example, in Ethiopia over one-quarter of the land is degraded, affecting about 20 million people, almost a third of the total population; annual losses reach an estimated 4% of GDP (Kirui & Mirzabaev, 2014). In Malawi the costs could be as high as 11% of GDP (Eswaran, Lal, & Reich, 2001). Nearly one-third of South Africa and 40% of all cropland suffers from land degradation; some 17 million people or 40% of South Africans depend on these degraded areas for their livelihoods (Bai, Dent, Olsson, & Schaepman, 2008).

Figure 5.4 • The decline in biomass productivity in Africa



Source: Le et al. (2016)

[1] Using the Total Economic Value Framework, i.e., including the value of lost land ecosystem services.

Better soil management

Land degradation and soil fertility decline in Africa are deeply complex, with intertwining and cyclical causes. Without stemming the causes, farmers will continue to make the same choices, even at the expense of their future well-being.

Thus, conventional means of soil management often cause more harm than good, while organic approaches are sometimes too demanding of labor, reliant on scarce or unavailable inputs and insufficient to produce the yields required to achieve local or global food security. The solution is to combine the best of organic and conventional approaches in a way that is environmentally appropriate and sustainable.

Integrated soil management (ISM) is "a set of soil fertility management practices that include the use of fertilizer, organic inputs and improved germplasm combined with the knowledge on how to adapt these practices to local conditions, aiming at maximizing agronomic use efficiency of the applied nutrients and improving crop productivity. All inputs need to be managed following sound agronomic principles" (Vanlauwe, 2013, p. 34).

In practice, this requires harnessing the skill and knowledge available in traditional farming, together with ecological approaches and precision farming using modern inputs. In many, environments the principles of conservation farming are appropriate—minimal soil disturbance, permanent soil cover and crop rotations, including legumes. Other practices include intercropping with nitrogen enriching legumes, mixing crops with livestock and trees, conserving water by building bunds and terraces, digging planting pits and erecting windbreaks to minimize wind erosion.

The Economics of Soil Management

Improved land management could deliver up to US$1.4 trillion globally in increased crop production, or 35 times the value of estimated losses (ELD Initiative, 2015). Nevertheless, the uptake of ISM practices in Africa remains low. Often the longer-term benefits may be significant, but costly to achieve. Farmers may be able to invest, for example, in small-scale rainwater harvesting (e.g. placing plugs in gullies to conserve moisture), but large-scale harvesting may be too costly in time, labor or materials. Too often for farmers, the choice is made to forgo better land management practices in lieu of more affordable, less labor-intensive or alternative uses of resources. Resilient ISM depends on governments establishing the appropriate incentive structures for sustainable land use.

Integrated Pest Management

African farmers can sometimes wake up in the morning, walk to their fields and discover that their crops are almost totally destroyed, or their livestock are sick and dying. They may have lost the basis of their livelihood and be reduced to prolonged poverty and hunger. Such threats are numerous and ever-present.

In the 1950s and 1960s, when it became apparent that the overuse of pesticides was polluting and making problems worse, the concept of integrated pest management (IPM) was created and applied in several different environments. IPM focuses on utilizing practices of biological and ecological control, coupled with other approaches, including targeted and highly selective use of pesticides or vaccines, aimed at the minimum needed to control the pest or disease in a cost-effective manner. Over the years IPM has become the cornerstone of control for many pest and disease problems (Conway, Badiane, & Glatzel, in press).

We have selected just four examples.

1. Locusts

Locust plagues were largely brought under control in the 1960s, but they have recurred with a vengeance in recent years. From 2003 to 2005, West Africa faced the largest Desert Locust outbreak in 15 years (Ceccato, Cressman, Giannini, & Trzaska, 2007). Nearly 130,000 km² were treated by ground and aerial spraying in more than 20 countries. The costs of treatment have been estimated to have exceeded US$400 million; harvest losses were up to US$2.5 billion.

The long remission in outbreaks since the 1960s had led to a decline in support for the regional and national control bodies. An integrated approach requires satellite imagery and global positioning system (GPS) to detect likely breeding sites and hence provide early warning of swarms. This should be coupled with control using mycopesticides, containing the spores of fungi lethal to the locusts, that are likely to be much less environmentally harmful (Lecoq, 2001).

2. The burden of weeds

Most farmers spend a great deal of time and effort trying to control different weeds. The most serious in Africa is Striga, otherwise known as witchweed. It is a devastating weed that causes yield losses in maize, sorghum, millet and upland rice, ranging from 20% to 80%, and even total crop failure in a severe infestation. Some 50 million hectares are infected

with annual damage in Africa worth US$8 billion, affecting the livelihoods of more than 100 million people (AATF, n.d.).

Herbicides can be effective against Striga, provided they are selective and do not harm the crop. However, they are expensive and have to be applied carefully to avoid health risks. Hand weeding is often preferred because it is cheap, but it is hard work. An alternative is to interplant a legume, Desmodium, that suppresses the weed by secreting a chemical that interrupts the root attachment of the Striga. In an IPM approach known as "push-pull", based on maize and Desmodium intercropping, the Desmodium emits volatile maize chemicals that repel stem borer moths ("push") and attracts parasitic wasps ("pull"). It also causes the "suicidal" germination of Striga seeds.

3. Newcastle disease

Newcastle Disease is one of the most important viral diseases of poultry. It is endemic in Africa and outbreaks are "rampant" (Snoeck et al., 2009). The disease is highly contagious, affecting a wide variety of bird species, but it is particularly damaging to domestic poultry. In 2011 over 30 African countries reported the disease, with nearly half a million cases resulting in over 300,000 bird deaths.

There is an effective vaccine that is stable in hot conditions, but the challenge for smallholder farmer communities is to get the vaccination rate above 85% and so achieve "herd immunity". In this situation, there has been some success in implementing participatory epidemiology approaches. In Nigeria these have revealed a considerable depth of knowledge of the disease among farmers that can be utilized to develop more effective and sustainable vaccination programs (Jibril, Umoh, Kabir, Gashua, & Bello, 2015).

4. Fall armyworm

Many new and unexpected epidemics also affect smallholders. A recent example is the fall armyworm, which first arrived in Nigeria from the Americas in January 2016, and a year later was in South Africa (Kruger, 2017). It now affects 20 African countries.The moths are strong flyers and their larvae feed on maize, sorghum, and a wide variety of other crops and plants. This year they may cause damage of up to US$3 billion. In the USA their damage has been mitigated by the use of genetically-modified maize (Aglionby, 2017).

Finding highly resilient approaches to pest, disease and weed attack is not easy; there are no simple answers. Pesticides can be very effective, so can vaccines in appropriate circumstances and breeding for resistance can give protection. But these may be too expensive for smallholder farmers and, in certain circumstances, can have negative or harmful effects.

In essence, the history of pest, disease and weed control emphasizes that there are no magic bullets, even when there appears to be an appropriate pesticide or vaccine. But many tools are to hand, both traditional and modern. The most economical and sustainable approach maybe to combine these in an integrated fashion to suit the local ecological and socio-economic conditions, and to fully involve smallholder farmers in finding practical solutions.

Climate Smart Agriculture

The nature and consequences of climate change for Africa were discussed in considerable detail in the Africa Agriculture Status Report for 2014 (AGRA, 2014). In this Status Report, we emphasize the risks arising from climate change and the implications for value chain resilience.

What are the risks?

Africa is already battling the impacts of climate change and smallholder farmers are amongst the most vulnerable. Rising temperatures and variable rainfall are increasing their exposure to drought, famine and disease. Virtually all smallholder farms in SSA are rainfed.

The risks include (AGRA, 2014):

- Droughts and high temperature affecting crop and livestock yields and productivity.
- More frequent extreme weather events, including cyclones, tropical storms and flooding affecting yields and productivity.
- Shorter, more irregular growing seasons.
- Movement of farming systems to the margins.
- High temperature effects on maize yield.
- Failure of large and small irrigation systems.
- Increases in soil salinity.
- Coastal seawater rise and surges.
- Damage to infrastructure.
- Increasing green house gases emissions from agriculture, generating a feedback loop.
- Increased migration, within and between countries.

As a consequence, the land area suitable for crop production in SSA will decline by about 3% due to climate change alone, most of the decline occurring in the Sahelian belt and Southern Africa (Lane & Jarvis, 2007). Farming systems will move progressively towards the margins—semi-arid croplands may become rangelands; humid, seasonally dry

lands may take on a more semi-arid nature; and semi-arid zones may turn to deserts.

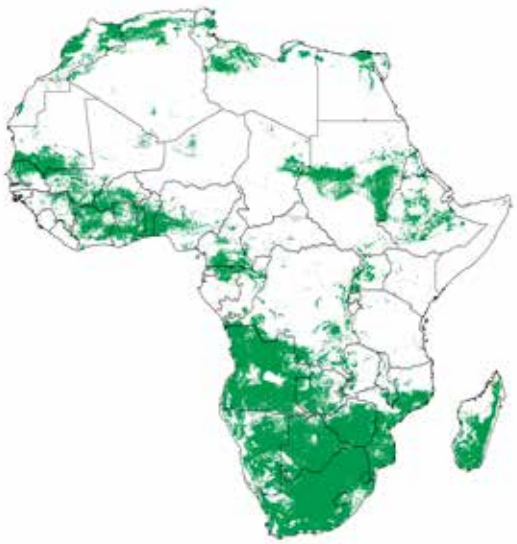
Two significant risks to crop production are already affecting farmers. First, growing seasons are becoming shorter, resulting in lower yields (Figure 5.5a). For example, in northern Ghana the rainfall is erratic and has become increasingly so in recent years. In 2011 the rains were a month late and finished a month early, leaving only 100 days to grow and mature a rice crop. Rice yields were low and the hot weather meant the grains were likely to shatter on milling.[2]

Second, yields of maize in Africa are being severely affected by rising temperatures (Figure 5.5b). Each "degree day" spent above 30°C reduces the final yield by 1% under optimal rainfed conditions and by 1.7% under drought conditions (Lobell, Bänziger, Magorokosho, & Vivek, 2011). More than 60% of current maize-growing areas in Africa will experience yield losses and wheat production in northern Africa is also likely to be adversely affected.

Significantly, most livestock species are also sensitive to temperatures over 30°C. They thrive in "comfort zones" between 10°C and 30°C. Above this zone, animals reduce their feed intake by 3–5% for each degree rise in temperature (Thornton & Cramer, 2012).

In the Sahel, the risk of heat stress by the end of this century will be so high that it may constrain people's ability to engage in any sort of agricultural practices at all (Osman-Elasha, 2015).

Figure 5.5a + b • Growing period and temperature status



A. More than 5% reduction in the length of growing period

B. Average annual maximum temperature >30°C

Source: Ericksen et al. (2011)

Overall, agricultural losses in Africa will amount to 2–7% of GDP by 2100 (FAO, 2009). By 2050, hunger and child malnutrition could increase by as much as 20% (WFP, 2017) as a result of climate change, reversing the gains achieved through the Millennium Development Goal (MDG) process and jeopardizing the success of the Sustainable Development Goals (SDGs). Given the importance of agriculture as a revenue earner and as the biggest employer in most African countries, the livelihoods of millions are at stake.

The Nature of Climate Smart Agriculture

Governments, development agencies, the private sector and farmers need to increase the resilience of their agricultural systems to withstand, and to adapt to, climatic stresses and shocks. As with other risks there are no magic bullets and a truly resilient approach has to integrate a range of different technologies, tools, and processes. Central to this approach, known as climate smart agriculture (CSA), is that where possible and when tailored to specific agro-

[2] Gordon Conway, Personal Communication, 2012

ecological zones and farming systems, adaptive actions can generate mitigation co-benefits (IPCC, 2014). In the face of intensifying climatic stresses and shocks, policies that both reduce the risks posed by climate change and enhance the resilience of the agriculture sector and farmer livelihoods are ever more important.

What can farmers do?

Farmers throughout Africa are already adapting to climate change. When visiting a village and asking the farmers whether the climate and weather is changing, they will say *"yes!"* And if asked how, they will have a clear sense of what is happening. And if asked if they are doing anything about it, they will say, *"yes of course!"* And they will tell you what they are doing.

Farmers faced with the threat of drought may buy one of the new drought tolerant maize varieties, or if they are a rice grower may plant a flood-tolerant variety if flooding is likely. They may try out the technique of conservation farming, or plant a greater diversity of crops. Some mulch may be found to apply to their crops or they may even construct a terrace on the contour across their field to prevent erosion. More generally, they may invest in a more diverse livelihood so that other sources of income will offset the losses from drought or flooding.

Many forms of adaptation rely on the informal sector. Governments can help by creating links to the formal sector and by providing skills, knowledge, and access to markets. Resilience is a family affair involving both men and women and, as they grow older, the children. Attempts to enhance livelihoods must take this wider holistic and more long-term approach.

Community Adaptation

But not all farmers may be able to respond on their own; they may need to work as a community to find a sustainable solution (Box 5.3).

Farmers may also need governments to build suitable protective infrastructure or to develop specific policies that mitigate the effects of drought or flooding. They may benefit from insurance or from safety nets, agricultural research and extension, new irrigation schemes, or dissemination of appropriate agrometeorological information. Some of these strategies will be technological, others social, economic, or political.

Paying for Mitigation

Farmers can and will undertake actions that have co-benefits for mitigation, but they need to be provided with the right incentives. Payments to farmers or landowners to better manage their land or watersheds, to conserve biodiversity or to sequester carbon have been shown to help conserve and restore forest areas and aquifers.

To improve soil quality and to support local livelihoods, Niger has embraced a set of wide-ranging approaches which have helped restore arable land and increase farmers' capacity to withstand droughts (Box 5.4).

Box 5.3 • Community adaptation in Mozambique

In the village of Nwadhajane in southern Mozambique, the birthplace of the great Mozambique leader, Eduardo Mondlane, the villagers are aware of climate change and its effects. They have already taken significant measures to counteract the worst features.

The villagers irrigate both the fertile lowlands and the higher dryland fields, but severe floods and droughts increased demand from households for plots of land in both areas. Whilst the lowlands can produce good crops of rice, vegetables and potatoes, these can be destroyed during floods. Highland areas, however, can produce good crops of maize and cassava during flood years, but during drought years families rely on lowland production.

To respond to this challenge, households with land in just one area developed informal farming associations to lobby those responsible for land allocation to gain access to new areas to farm. Portions of lowland and highland were reassigned, which helped farmers to improve their families' food security during droughts and floods. The farmer associations are also now experimenting with drought-resistant crops.

Source: Osbahr, Twyman, Adger, & Thomas (2008)

Box 5.4 • Rights to trees and livelihoods in Niger

With no incentive to maintain trees on their property—and with families to feed—farmers in need of agricultural land regularly removed trees and other natural vegetation across Niger. This practice led to worsening soil erosion and reduced soil fertility and yields, which pushed farmers to cultivate ever more marginal lands. By the late 1960s farmers had become extremely vulnerable to droughts.

After independence, international NGOs and donors began to promote simple, low-cost soil and water conservation techniques combined with agroforestry to support local livelihoods. Around the same time, Niger's government enacted new laws and regulations that strengthened local rights to benefit from trees, whilst the Forest Service was transformed from a paramilitary institution that punished farmers for cutting trees into an extension service that helped them adopt simple tree management processes. As a result, farmers began nurturing underground roots and tree stumps in their barren fields.

Today, more than five million hectares of land have been revitalized by smallholder farmers. The trees that grow have enriched the soil and provide food, fodder, fuel wood and other goods. Crop yields and incomes have increased too. Moreover, the increased carbon in the trees and in the soil serves to reduce green house gases emissions

Source: Stickler (2012)

Resilient Post-Harvest Systems

If a farmer's crops or livestock have developed well and survived exposure to the risks of climate change, soil degradation or pests, diseases and weeds—and been successfully harvested—this is not the end of the risks the farmer faces. Most immediate are the risks of post-harvest loss.

In SSA, most post-harvest loss is towards the farm end of the supply chain, that is, during harvesting and post-harvest handling (Lipinski et al., 2013). In particular, over 80% of the losses occur during storage. The losses can be caused by shrinkage of the volume of food or its deterioration due to insects, disease or contamination (for example, with aflatoxin), or the damage caused by mechanical farming implements (for roots and tubers).

Depending on the definition, methodology and data there is significant variation in post-harvest loss estimates. Figures between 10–40%, and as high as 50–70% are regularly quoted, often from untraceable sources that rely on fragmentary and unconsolidated data. However, a recent meta-analysis of 6 countries estimates that the losses for cereals (maize and rice) and pulses (cowpeas and beans) amount to about 25% (Affognon, Mutungi, Sanginga, & Borgemeister, 2015). The largest losses occur in fruits (56%) and vegetables (44%).

However, losses over 10 years, based on in-depth case studies of both on-farm and off-farm post-harvest losses, for wheat, maize and rice are in the range of 12–20% per annum, while a methodology based on self-reported post-harvest loss from annual household surveys in 3 SSA countries provides estimates, at only 1.4% to 5.9% of the national maize harvest being lost on farm (Kaminski & Christiaensen, 2014; World Bank, 2011).

It is clear that credit guarantee funds, may not be enough to secure a harvest. Investment in aggregation systems such as farmer organizations, harvest collection points and warehouse systems, as well as extension services should be considered in combination with credit guarantee funds.

National Food Reserve Systems

One of the main instruments of government intervention in low- to mid-income countries is national food reserves, or buffer stocks and related agencies. The role of these systems has been very contentious, especially in SSA and to a limited extent in Asia, mainly due to rent seeking and monopolistic practices. These well-documented maladies gave way to structural adjustment that dictated restructuring or dismantling buffer stock systems in the late 1980s.

In recent years, however, national governments in many countries in SSA have restructured food reserve systems. This is part of a broader regulatory shift in agricultural market policy from hard controls to a soft touch catalytic approach. Some of the elements of this transition include increased public–private partnership (PPP) arrangements in procurement and stock management, dynamic market pricing, small farm engagement and diversified commodity baskets.

New mechanisms for procurement such as forward contracting with registered farmer organizations are being tested to ensure that benefits accrue to smallholder farmers. Diversification of the commodity basket beyond cereals can also benefit value chains of commodities across different axes. For example, adding specific commodities such as cowpeas can benefit women farmers since most of the production and marketing activities in SSA is undertaken by them (FAO, 2011). Procurement of processed commodities with low volume to weight ratio and easy storage such as gari, made from cassava in West Africa, strengthens the entire value chain.

Besides national reserves, initiatives are also underway to create regional food reserve systems. If placed under the auspices of the regional community blocs they can play a major role in optimizing supply chain efficiencies across national borders and enhancing national and regional food security. The West Africa Regional Food Security Reserve under the Economic Community of West African States (ECOWAS) is currently under development.

Warehouse Receipt Systems

Warehouse receipt systems (WRS) are complex instruments which require sophisticated regulatory systems. National food reserves need to be closely integrated with WRS and associated infrastructure. Broadly speaking, WRS provides a system wherein farmers deposit their produce in certified storage facilities in exchange for a warehouse receipt. The goods deposited are valued based on uniform and objective grading criteria and pricing, while the receipt serves as a legal negotiable instrument backed by law and can be used for a variety of purposes including credit. WRS models of varying scale have been established or piloted in many countries such as Ghana, Nigeria, Kenya, Uganda, Tanzania, and Zambia.

Appropriately designed WRS can play a major role in addressing critical bottlenecks in agriculture markets such as standards and grading, storage, access to credit, etc. and incentivizing private capital investment. The success of WRS systems is based on appropriate legislation, a network of standardized storage facilities, and a credible credit mechanism.

Home grown school feeding

Home grown school feeding (HGSF) is a form of decentralized food reserve that can play the role of a reliable market intermediary from both the demand and supply sides. Typically an HGSF consists of procurement from local communities that supplies food based safety net programs such as school feeding.

Key principles include local food procurement, smallholder engagement, nutrient-rich and diverse foods, and high regularity in meal provision. These principles are an important step in recognizing the need to develop shorter, localized value chains and supply chains through a structured demand program. They present an instructive example of a government-led effort to develop alternate food networks which can be more resilient to demand and supply risks while promoting food and nutrition security.

HGSF procurement also presents a unique example of mediated markets, since the structured demand is explicitly shaped by considerations of geographic localization and a diversified commodity basket based on menus. These are designed according to accepted nutrition requirements, based on local availability and/or agro-ecological suitability. HGSF through the menus-based demand also addresses the market bias towards staples. This makes food networks more resilient and improves small farm and women's participation in the production and through the supply chain. Thus, localized market interventions like HGSF strengthen commodity-specific value chains and promote sustainable food networks.

Food Processing

The authors of Chapter 3, argue that small and medium enterprises (SMEs) are, now and for at least the next one to two decades, the foundation of Africa's agri-food system and must be at the center of any strategy to promote strong smallholder farmer links to growing agribusiness.

Processing SMEs and micro-firms are proliferating following liberalization and privatization of parastatals. An example is the rapid diffusion of such firms in milled, packaged, and branded maize in Tanzania (Snyder, Ijumba, Tschirley, & Reardon, 2015). The emergence of such firms has been called the "Quiet Revolution" in agri-food systems (Reardon et al., 2015).

These trends also create an opportunity for smallholders, especially in relation to the half to two-thirds of marketed food that is not grain. Examples include the growth of dairy smallholdings in the Kenya highlands, and women producing chickens and eggs for market in northern Nigeria.

Because many of these systems are not mechanized and do not show economies of scale, smallholders can create improved livelihoods with intensive use of labor. They can compete on costs and quality if they invest in production and can market their crop quickly.

However, this requires a major shift by smallholder farmers not only to new products other than basic grains, but also to a market orientation that matches and integrates with that of the SMEs. Basically, they need a "threshold" of knowledge of how to grow what is essentially a non-traditional product. The farmers may need a vehicle to get the produce to market. They very probably need an all-season road and maybe a bridge. They might need a packing shed to sort the product so they can get better prices. And they might need to have some kind of aggregation facility or even a cooperative. In effect, they are creating "pre-processing informal SMEs".

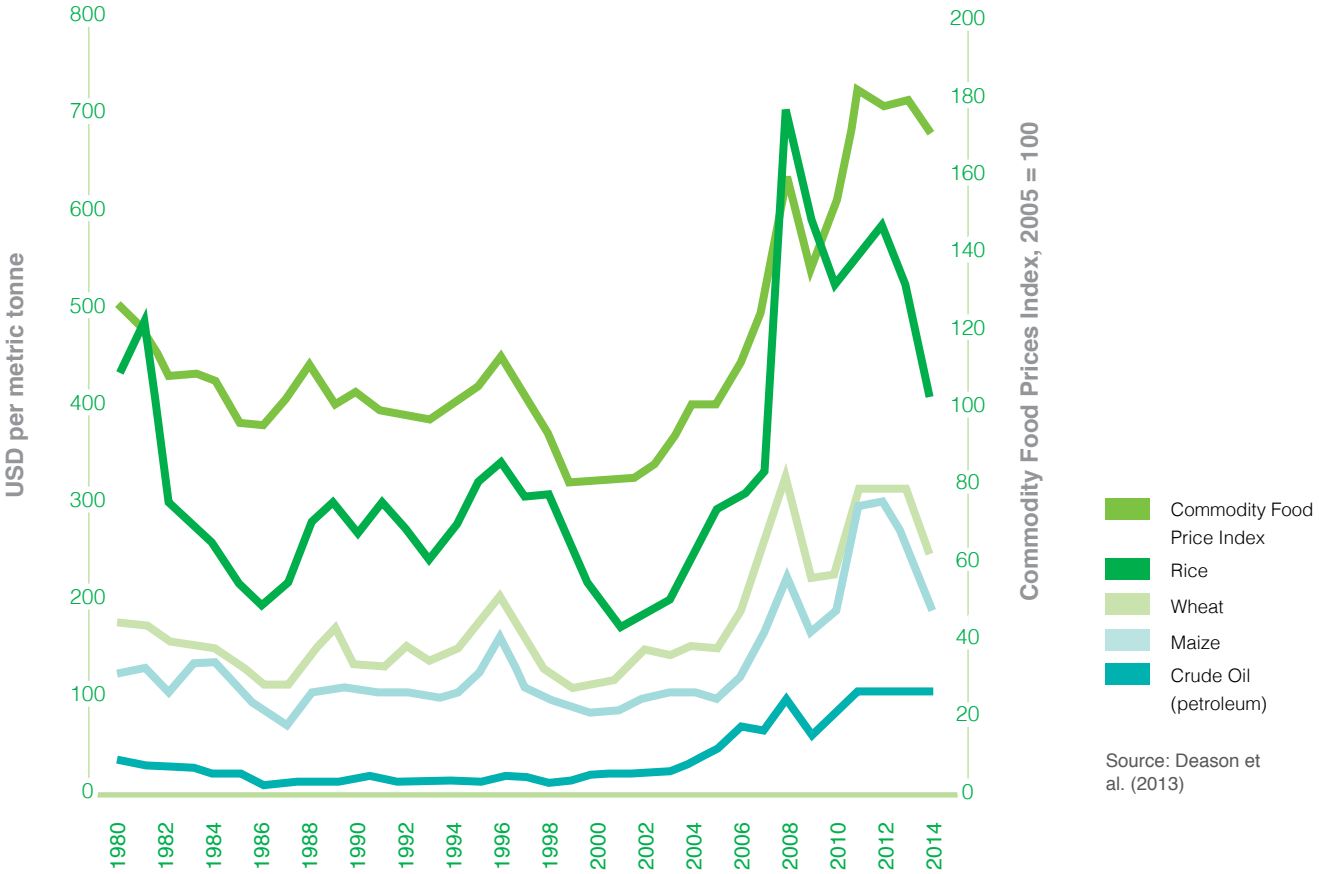
The challenge for the processing SMEs is to raise the necessary finances, which depends on the reliability of supply. A reason now for some optimism is that the rise of demand for processed foods and quality-branded foods creates more "focused points of demand" (Tschirley et al., 2017). A more sustainable and resilient approach is likely to arise from clustering similar firms, so creating a critical mass of demand.

Resilient Markets

Recent years have seen extreme volatility in the prices of cereals and other staple crops. For traders, volatility provides opportunities for making profits. But crop price fluctuations have persistent deleterious effects on food prices in developing countries. Food price volatility affects the poorest the most (The Montpellier Panel, 2012).

According to the Food and Agriculture Organization of the United Nations (FAO) and the Organisation for Economic Co-operation and Development (OECD), average wheat and coarse grain prices are projected to be 15–40% higher over the next decade in real terms relative to 1997–2006, while for vegetable oils real prices are expected to be more than 40% higher (Figure 5.6) (Deason, Laborde, Minot, Rashid, & Torero, 2013).

Figure 5.6 • Commodity food prices in Africa



Source: Deason et al. (2013)

Price volatility creates imbalances in markets, unpredictable shortages and surpluses, creating profits and losses which make it difficult for consumers and producers to plan expense, savings and investment decisions. The risk and uncertainty, unless managed efficiently, tend to reduce consumption and output levels below what they would be in a more stable environment. In African countries with limited capacities, high prices are likely to have negative growth and welfare effects. These are manifested at the micro-economic level (income, consumption pattern, productivity, and private investment) and at the macroeconomic level (public investment, and economic growth).

For poor smallholders, price volatility in staple crops affects the availability and access to food with possibly severe consequences for nutrition and health. With limited food budgets consumers are forced to adapt to volatility by altering their consumption patterns, increasing the risk of hunger and undernutrition when more nutritious foods are foregone.

Farmers also have limited capacity to manage variations in their sales, which in turn makes it more difficult to plan production activities: which crops should they produce; and whether to invest more in improved seeds, fertilizers, and pesticides. Moreover, the limited capacity makes it impossible to anticipate earnings and returns to investment and difficult to undertake actions to raise productivity and expand production. Thus price volatility tends to slow the pace of growth in the agriculture sector, reduce supplies in local markets, and limit the capacity of local producers to respond to future prices, thereby generating more volatility in the future.

Policies to stabilize prices

Price volatility is an international event that requires international action. Currently, most policy decisions appear to be panic responses, with little attention to program design and potential market consequences. There appears to be no systematic thinking behind determination of optimal food stocks. As is now evident, food markets must not be excluded from the appropriate regulation of the banking and financial system, as the staple food and feed markets (grain and oil seeds) are now closely connected to the speculative activities in financial markets.

It is clear that price volatility has several causes. They include: seasonal variation in domestic production; inter-annual variation in domestic production; fluctuation in world prices; and changes in policy. Of these, global price volatility tends to draw a great deal more attention than other sources. Yet in Africa, as shown in Table 5.1, local prices for commodities that are traded in global markets (tradables) such as wheat and rice have shown relatively lower levels of volatility, even in the face of rising instability in global markets, compared to traditional grains that are not traded globally (non-tradables) such as millet, sorghum. The price volatility of tradables is 0.106, while that of non-tradables is 0.133, a difference that is statistically significant at the 1% level.

This fact challenges the widespread belief that increased openness to global markets has exposed Africa to more instability.

More than world market conditions, local factors are the main drivers of local price volatility in domestic markets in Africa. This is due to the large dependence on rainfed agriculture and thus higher exposure to weather shocks in the context of limited domestic and regional market integration that, in turn, are due to underinvestment in infrastructure and other policy and regulatory constraints in major food value chains.

Integrated markets and trade

The causes of production variability are such that an entire region is less likely to be affected than individual countries. Moreover, fluctuations in national production tend to partially offset each other, so that such fluctuations are less than perfectly correlated. For most African countries, national production volatility is considerably higher than regional level volatility. The only exceptions are the Democratic Republic of Congo (DRC) and to a lesser extent Côte d'Ivoire (Badiane, Odjo, & Jemaneh, 2013). Consequently, expanding cross-border trade and allowing greater integration of domestic

Table 5.1 • Price volatility of tradable and non-tradable products

Product	N	Number of prices	Volatility
Non-tradable products	9,280	126	0.133
Tradable products	3,018	41	0.106
Total	12,298	167	0.127

Source: Minot (2012)

food markets would reduce supply volatility and price instability in these markets.

Market integration and trade raise the capacity of domestic markets to absorb local price risks by:

- Enlarging the area of production and consumption, thus increasing the volume of demand and supply that can be adjusted to respond to and dampen the effects of shocks.
- Providing incentives to invest in marketing services and expand capacities and activities in the marketing sector, which raises the capacity of the private sector to respond to future shocks.
- Lowering the size of needed carryover stocks, reducing the cost of supplying markets during periods of shortage and hence decreasing the likely amplitude of price variation.

The likelihood that a given country would benefit from the trade stabilization potential will be greater if its production fluctuates more than the regional average and is weakly correlated with that of the other countries in the region. The combination of high volatility and weak correlation, shown in estimates by Badiane, Odjo and Jemaneh (2014) suggests that Southern African Development Community (SADC) countries would benefit the most from increased regional trade in terms of domestic market stabilization, followed by Common Market for Eastern and Southern Africa (COMESA), then ECOWAS countries.

Production levels in the ECOWAS region tend to fluctuate more in synchrony than in the other two regions, reflecting the existence of two more uniform clusters of countries, Sahelian and coastal. Nevertheless, the patterns and distribution of production fluctuations among countries in all three regions are such that increased trade could be expected to have a stabilizing effect on domestic agricultural and food markets.

The Scope for Cross-Border Trade

There is considerable scope for exploiting the less than perfect correlation of volatility patterns across countries. Despite the recent upward trends, the level of intra-African and intra-regional trade is still very low compared with other regions. Intra-African markets accounted only for, on average, 34% of the total agricultural exports from African countries between 2007 and 2011 (Badiane et al., 2014). Among the three regional economic communities (RECs), SADC had the highest share of intra-regional trade (42%), and ECOWAS the lowest (6%). The COMESA share of intra-regional trade was 20% (Badiane et al., 2014).

Yet, contrary to conventional wisdom, countries in all three regions exhibit sufficiently dissimilar patterns of specialization both in production and trade that should allow higher levels of trans-border and interregional trade. A series of indicators confirm that significant scope exists to expand trade in this way, if major obstacles impeding the movement of goods and raising the cost of trading across local markets are addressed (Badiane et al., 2014).

The improvements include three possible scenarios:

1. Across the board reduction in trading costs by 10%.

2. Elimination of informal barriers to cross-border trade.

3. Increase in crop yields, also by 10%.

These show cumulative increases in intraregional trade in local staples of up to 3 to 4 million tons above current trends between 2008 and 2025 (Badiane et al., 2014). The level increase varies between commodities and regions and across the three scenarios but tend to be substantial. The same changes also reduce the volatility in domestic staples markets across all three regions compared to historical levels (Badiane & Odjo, 2016).

In summary, a more efficient and resilient approach is to integrate regional markets in ways that stabilize prices and hence reduce the impacts of volatility, especially on poor, small farm households.

Safety Nets

Finally, these integrated resilient approaches may not work. The stresses or shocks may be too extreme or the mechanisms insufficient. In these circumstances safety net programmes may be appropriate (Fan, Brzeska, & Ologinbiyi, 2015). They vary widely in terms of the type of assistance provided, conditionality of assistance, and targeting method. The types of assistance may include food, cash, inputs, and assets; the assistance may be unconditional or subject to behavioral conditions; and in-kind assistance may be free, subsidized, or provided in voucher form (Galtier, 2013).

One approach to providing a social safety net is the guaranteed employment program, sometimes referred to as food-for-work or cash-for-work. The Ethiopian Productive Safety Net Program (PSNP) reaches more than 7 million poor Ethiopians. A study of the impact of the program found variation in the size of benefits received, but those that received at least half of the intended benefits showed significant gains in food security.

An alternative to employment guarantee programs is conditional cash transfer programs, which provide cash grants to poor households which comply with certain

requirements such as keeping children in school, attending health clinics, or receiving pre- and postnatal care.

Safety net programs have been proven to provide significant benefits in terms of short-term food security and long-term investment in human capital. However, the budgetary cost is relatively high, and they require administrative capacity to identify poor households and monitor their compliance with the conditions.

The Business of Resilience

This chapter primarily focused on the role of resilience in reducing the serious risks that African smallholders face in a sustainable fashion. However, an opportunity also exists for seeing resilience as a target for business investment.

Fundamentally, we need to recognize that African smallholders are business people capable, at least potentially, of making profitable returns from their smallholdings. As noted at the beginning of this chapter farmers need cash, at the very minimum, to pay school fees, to purchase medicines, and in many cases to purchase food. If they are connected to value chains in a meaningful and dynamic way, as we have outlined above, this is more likely. In effect this requires policies that help farmers "move up"' to even more business focused livelihoods (Fan et al., 2015).

At the higher levels in the value chain there are futher business opportunities. These include:

- Climate finance. Between 2010 and 2050 the annual cost for adaptation to climate change in SSA will be at least US$18 billion (World Bank, 2010) and up to US$50 billion (UNEP, 2015) for the entire continent. But the level of financing currently reaching African countries is paltry. Of the US$34 billion pledged through various climate funds, SSA received just US$2.3 billion between 2003 and 2013.
- The provision of smallholder agricultural insurance linked to loans. Small and large companies are needed to provide the necessary farm inputs and insurance companies are required to underwrite the loans, while a variety of purchasers can create a more stable market.
- Development of storage to reduce post-harvest losses requires investments in procurement and stock management, dynamic market pricing, small farm engagement, and a diversified commodity basket.
- The creation of regional inter-government trade requires not only more government funding but also the building of small and large private trader capacities.

Resilient value chains also depend on enabling environments and policies and, in particular, on resilient rural infrastructure, for example, irrigation facilities, warehousing and processing facilities. These in turn need to be backed by increased spending on regional and national infrastructure. Included are the construction of all-weather roads to link farmers to markets, suitable protective infrastructure to mitigate the effects of drought or flooding, and investment in irrigation. In Africa, about 6% of cultivated land is irrigated, compared with 37% in Asia, and 14% in Latin America, (You et al., 2010).

Three countries, Sudan, South Africa and Madagascar, account for two-thirds of the irrigable area developed. Yet, potentially 20 million hectares of land could be brought under irrigation (The Montpellier Panel, 2013).

In all these cases the way forward is through public–a–private–community partnerships that bring a range of stakeholders from the private sector, government and local rural communities together in a working relationship that recognizes each other's strengths and complementarities. In many respects, if done well, the outcome can be value chains that are both highly productive and resilient.

The Resilience of Whole Value Chains

In this chapter we focused on the sustainability and resilience of individual components of value chains. However a further question is "How are whole value chains made more resilient?" In general, it seems likely that the resilience of whole value chains depends on the sustainability of each component of the chain and the nature of the links between the components. But there is an urgent need for more research on this topic.

One question is whether short or long value chains are more resilient. On the face of it, long and complex chains should be more resilient because of the multiple alterative pathways they may contian. But there is one telling example of highly resilient short value chain. This is the Home Grown School Feeding Programmes (HGSFs). Short systems such as

these ought to be highly vulnerable and prone to collapse, but the evidence is otherwise. In conflict areas, such as have occurred in Mali and Côte d'Ivoire, HGSFs have flourished. The reason appears to be the high level of stakeholders engaged in the value chains—farmers who produce the food crops, groups of women who purchase the food crops and make the meals, the school children, the teachers, the parents, and the local officials. They all benefit despite the surrounding conflict in the environment. Everyone has a stake in success.

The lesson seems to be that for value chains to be sustainable and resilient they need a range of stakeholder involvement obtaining positive and complementary benefits.

Conclusion

In some respects, the challenge can be related in relatively straightforward terms. It will be several decades before large-scale commercial farming comes to dominate African agriculture. Eighty percent of African farmers are smallholders with less than 2 ha of arable land. Currently, they struggle to make a living, yet we know from the experience of recent years that given access to drought tolerant crop varieties, blended fertilizers appropriate for their conditions, plus in some instances elements, such as boron or lime, they can produce high yields—3, 4, or 5 tons/ha in the case of maize. These farmers also have growing access to new appropriate technologies under the rubric of sustainable intensification.

What they need to become not only more productive but to "step-out" from poverty is to develop sustainable linkages to value chains that provide inexpensive loans, backed by insurance, followed by efficient warehousing and access to stable markets where they can get a fair and reliable return for their agricultural produce.

The more difficult challenge is to put this into practice and at scale, to ensure the various components of the value chains are each efficient and sustainable and link with each other in a resilient fashion. This will take not only technical knowledge and sound micro- and macroeconomic policies, but also leadership from government that recognizes the capabilities and understanding of African smallholders themselves.

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CHAPTER 6

A Policy Agenda for Achieving an Inclusive Transformation of Africa's Agri-food Systems

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KEY MESSAGES

ONE

Many past attempts at an African green revolution failed because government efforts were too limited and too focused on technological change while failing to create a complementary and enabling policy and market environment for its uptake.

TWO

In today's more urbanized context, the challenge is to transform Africa's entire agri-food system in an equitable and employment intensive way, through a more multisectoral approach to the problem that builds on partnerships between the public and private sectors.

THREE

A successful agricultural transformation today requires that governments provide an enabling business environment for farming and agribusiness; complement policy reforms through institutional reforms; invest in rural infrastructure; and undertake targeted interventions to help commercialize many more smallholders and to promote the development of local small and medium enterprises (SMEs).

FOUR

The real challenge is to convince governments to commit to and implement this agricultural and rural development agenda over several decades.

FIVE

Comprehensive strategies that cover the entire agriculture sector rarely translate into successful implementation strategies, and a more practical approach is to concentrate on a few first movers that can achieve early successes, build up political momentum, and open up new growth opportunities elsewhere in the sector.

Introduction

As argued in Chapter 1, Africa needs an agricultural revolution today both as an engine of growth for its agricultural and rural transformation, to meet its future food needs, and to reduce poverty. Achieving a green revolution by increasing the yields of staple food crops through technology adoption, and institutional, market and policy innovations, is necessary to resolve the first generation problem of accelerating the rate of agricultural growth (Mellor, 1990; Lipton, 2012; de Janvry, 2017). But this is not a sufficient condition to lift large numbers of rural households out of poverty. Reducing rural poverty across the board requires more than a green revolution. It also needs an agricultural and rural transformation. Agricultural transformation allows households to diversify their production systems, smooth out labor calendars over the year, engage in more profitable enterprises, reduce idleness in labor calendars, and improve their diets. A rural transformation allows the emergence of local, town-based, rural non-farm industries and services that are driven by agriculture. These offer complementary sources of incomes to rural populations.

Achieving a convergence of a green revolution and an agricultural transformation and a rural transformation to lift large numbers of rural populations out of poverty over a few decades has proved elusive in the past. Despite many past attempts, few African countries have achieved a successful smallholder-led green revolution. Successes include maize in Kenya, Malawi, Zambia and Zimbabwe; cassava in Nigeria, Ghana, Zambia and Malawi; cotton in Mali; horticulture in Kenya and Côte d'Ivoire; dairy in Kenya, Uganda and Ethiopia; and rice and cotton in Mali (Nweke, Spencer, & Lynam, 2002; Haggblade & Hazell, 2010). However, the challenge today is not just that of governments doing now what they have not been able to do before. The kind of agricultural and rural transformation required today has also changed thanks to the rapid pace of technological change in frontier technologies; globalization; urbanization; digitization; democratization; decentralization; high population growth rate, and an increase in the number of youths as a proportion of the population annually entering the job market; climate change; and extreme weather events. Consequently, new approaches are required. For example, many new opportunities now exist for smallholders to exploit their comparative advantage in labor-intensive farming to grow high-value products for urban markets. There are many new private sector opportunities for adding value and jobs along value chains. At the same time, value chains are changing in ways that threaten to exclude many smallholders. Climate change also poses new threats that require greater attention to resilience.

Although some of the basic roles of government have not changed (e.g. provision of public goods like publicly funded research and development, agricultural training and higher education and extension for small farms, and rural roads), more is required. Much more attention now needs to be given to more targeted policies and public investments that can help support smallholders and the agribusiness sector in developing food chains on a business basis.

Smallholder farm surveys carried out by Michigan State University in Ethiopia, Kenya, Mali, Mozambique, Rwanda, Senegal, Somalia, Tanzania, Zambia, and Zimbabwe between the mid-1980s and 2002 found that less than half the smallholders were net sellers of staples, the mode is around one-third (Staatz, 2010). Given this heterogeneity and varying profitability of adoption of new technologies, large numbers of African smallholders are not going to make it as commercial businesses, especially asset-poor farmers in unfavorable regions (Hazell, 2015). Some of these farms are already diversifying their livelihoods out of farming and that should be encouraged. However, many instances exist, especially in resource poor and remote areas where this is not yet possible on the scale required, or where the returns to non-farm activities remain too low for farm households to escape poverty. These kinds of subsistence-oriented smallholders need different types of support than commercially-oriented smallholders. So in addition to policies and investments that promote an agricultural transformation more generally, African governments will also need to target different kinds of assistance to different types of smallholders.

There is debate among African policy makers about whether smallholders are as productive as large farms and whether smallholder farmers should be amalgamated into large farms and used as labor on these farms (Pingali, 2010; Hazell, 2015). Pingali (2010) argues that this is a false argument. This is because once farms are amalgamated and become large scale, the binding constraint becomes management and supervision. If smallholder farms are amalgamated, the managers will mechanize and put households that they were set out to protect out of employment. Are African governments ready to expand investments to support smallholders and to implement what they have promised under the Comprehensive Africa Agriculture Development Programme (CAADP) agenda? Are they willing to partner with the private sector, non-governmental organizations (NGOs) and other key stakeholders in developing food chains in "inclusive" ways that benefit smallholders and small and medium enterprises along value chains? And if they are, do they have the capabilities to do these investments? This chapter considers these questions and proposes some practical ways forward.

The chapter is structured as follows. We first review why many African governments failed in their past attempts to launch green revolutions. But not all is gloom and doom and we examine some past success stories from which to draw lessons. This leads to a discussion of the kinds of policies, investments and partnerships that are now needed. Then, recognizing the complexity of the task, and weak state capabilities, we consider some practical "first mover" approaches that could help focus effort, and lead to some quick wins.

Why Did Past Attempts at an African Green Revolution Fail?

The Green Revolution that was launched in the 1960s helped transform Asia from a continent of hunger and despair to a regional success story within 25 years (Rosegrant & Hazell, 2000). That revolution was built on a game changing technology package, but less widely recognized is that it also depended on game changing policies—policies that provided smallholder farmers with the package of modern inputs and credit they needed to adopt the new technology, and an assured market and stable, remunerative prices.

Yet attempts to bring the same type of policy and technology package to Africa largely failed, despite tens of billions of dollars of investment during the 1970s and 1980s. In many ways this has been more of a policy failure than a technology failure, because many proven technologies have long been available in Africa that can substantially raise productivity. However, the technologies have either not been accessible or have been unprofitable to farmers under the prevailing policy environments.

Why did these past attempts fail? The "maize revolution" is a good example of what went wrong. In the 1980s, a major revolution of smallholder maize production occurred in Southern African countries and in the East African highlands. Spurred by the development of appropriate high yielding maize varieties in Zimbabwe (SR 52) and the provision of subsidized fertilizers, subsidized credit, price guarantees and market price support, the new crop varieties spread rapidly—first on large farms and then later on small farms. The maize revolution brought about rapid adoption of improved varieties and fertilizers and rapid growth in yields on smallholder farms; and several of the countries achieved surplus maize production. Malawi, Zimbabwe and Zambia became major maize exporters. Development experts drew parallels with the Asia Green Revolution for rice and wheat calling it the "emerging green revolution for Africa" (Byerlee & Eicher, 1997; Smale & Jayne, 2010).

This success collapsed with the structural adjustment programs (SAPs) that began in the mid-1980s. Partly because of the high budgetary costs of their agricultural programs, governments fell into debt and macroeconomic imbalances and had to turn to the International Monetary Fund (IMF) and World Bank for support (Lele, 1989). The agricultural reforms that were part of the SAPs called for liberalization of markets, privatization of parastatals, drastic reduction in public expenditures on agricultural research, extension, and support systems for farmers; elimination of input and credit subsidies; and removal of price support systems (Kherallah, Delgado, Gabre-Madhin, Minot, & Johnson, 2002). The assumption was that the private sector would move in to replace the public sector and that more efficient markets would emerge with greater incentives for farmers. While removal of the over-valued exchange rates that implicitly taxed agriculture led to improved incentives for exports, the general effects of the structural adjustment reforms have been largely negative for most smallholder farmers. Prices of agricultural inputs rose. Prices of outputs fell due to poorly developed markets. Because the private sector was unable to replace earlier functions played by the state, the end result was underinvestment in extension, roads, rural finance, research, etc. The adoption of improved varieties and fertilizers by farmers plummeted; the maize revolution was scuttled; the countries moved from maize surplus nations to maize deficits; and food insecurity rose for many countries.

A second attempt to develop maize came from the Sasakawa Global 2000 (SG 2000) efforts in the 1990s. This was based on the assumption that if farmers could be shown the benefits of new varieties and fertilizers, African countries would see a quantum jump in cereal yields and food production. Major attempts were made to demonstrate to farmers the value of high input technologies, with improved crop varieties, fertilizers and improved agronomic practices. Supported by African presidents, the initiative succeeded in getting governments to provide free distribution of improved seeds and fertilizers to farmers in pilot areas. The effort was highly successful: most farmers in the pilot countries adopted the new crop varieties and fertilizers, and national maize yields increased from 1–1.5 t/ha to 4–5 t/ha (Smale, Byerlee, & Jayne, 2011). However, because the effort did not consider the development of markets, rapid growth in production led to price collapses across the countries. As the price of grains fell, farmers quickly abandoned the use of improved varieties and fertilizers. The approach had failed to consider several factors: development of input and output markets; and support of market institutions to assure farmers of markets and better price incentives. It

was based on the assumption that "technology would do it". It failed to consider the policies and institutions needed to support smallholder agricultural development.

A third attempt to develop maize was undertaken by the Millennium Village projects implemented by the Earth Institute at Columbia University, the United Nations Development Programme, and Millennium Promise to achieve the Millennium Development Goals in 10 countries in sub-Saharan Africa: Ethiopia, Ghana, Kenya, Malawi, Mali, Nigeria, Rwanda, Senegal, Tanzania and Uganda. This integrated rural development model provided free seeds and fertilizers for farmers; demonstration of new technologies; focused on village level interventions; and expansion of efforts into integrated rural development, including focusing on health, nutrition and education (Nziguheba et al., 2010). Farmers rapidly adopted the improved crop varieties across the Millennium villages, and crop yields rose significantly, sometimes by as much as 400%. Rural health and school attendance improved. But the Millennium Development Goal (MDG) model faced the difficulty of going to scale beyond the pilot villages. Free distribution of inputs was not sustainable and undermined the development of markets. It was again a "technology-driven model" and it did not pay attention to the development of policies and institutions that will support sustained incentives for the adoption of the improved technologies.

Three major lessons can be drawn from the earlier experiences to trigger a green revolution in Africa:

1. Technologies can open up greater space for productivity gains in African agriculture. But technologies alone are not enough. To avoid the lesson of "boom and bust" that plagued earlier efforts towards a green revolution in Africa, technical interventions need to be complemented by policies that promote the adoption of green revolution technologies.

2. It is important to avoid "pendulum approaches" for the green revolution. Neither the public sector nor the market can do it alone; complementary public and private sector investments are also needed. In particular, public policies that improve incentives for the uptake of new technologies need to also simultaneously build markets. Rather than pendulum models which flip from public to private roles, an "anchor model"—one which combines technology, policies, markets and institutions to create incentives and a supportive environment for the uptake of green revolution technologies—would be required.

3. Because of structural poverty traps, many smallholders will need subsidies so they can afford the higher expenditure needed to invest in new green revolution technologies. The challenges here include: how to do this right; how to ensure that subsidies are well-targeted to farmers who need them most; how to reduce elite capture; how to implement "smart subsidies" that directs support to the poor while building markets; how to complement with supportive infrastructure so that subsidies have greater impacts; and how to develop reasonable exit strategies.

While government must play a bigger role in launching Africa's Green Revolution, it must engage in smart ways that avoid building up unsustainable demands on the national budget.

Past attempts at a green revolution have also been hampered by lack of political leadership, a dearth of farm organizations to lobby for an agricultural agenda, and the general absence of a good institutional environment (Bingen, 1996; Eicher, 1999; van de Walle, 2001). That will need to change. Governments will actually need to deliver on the commitments they have made under the CAADP agenda and mount and sustain a disciplined long-term effort to transform their agriculture and food systems (Gemo, Eicher, & Teclemariam, 2005). Needed also are institutional innovations for Africa to develop leadership, ownership and responsibility for investing in agricultural research and the technological, institutional and policy changes to increase agricultural productivity and economic growth (Rukuni & Eicher, 1994; Rukuni, Tawonezvi, Eicher, Munyuki-Hungwe, & Matondi, 2003).

What Can We Learn From Past Successes?

Despite past policy failures, many examples exist of how African countries have been able to adapt and transform policies, institutions and processes to achieve agricultural successes, usually at commodity or regional levels. We provide a few examples here as a prelude to identifying what works, and what does not, and establishing the basis for a strategy to transform smallholder farming.

National Commodity Example—Tea and Horticulture in Kenya

Kenya has been successful in gaining global prominence in tea production. In 2017, Kenya ranked third in the world in tea production, and 90% of the tea produced was on farms less than one acre in size. Kenya's success can be attributed

to (Kidane, Maetz, & Dardel, 2006): (a) a land redistribution policy adopted at independence which subdivided large holdings and reallocated subdivisions to peasant farmers; (b) institutional support through the establishment of the Kenya Tea Development Authority (KTDA); (c) institution of favorable investment policies; (d) implementation of targeted extension services which involved insights from farmers; and (e) an institutional framework which took advantage of favorable international prices of tea. Since the early 1960s, tea productivity, incomes and export earnings have grown tremendously.

Kenya has also made remarkable progress in the area of horticulture. The success in horticulture has been attributed partly to the establishment of the Kenya Horticultural Crop Development Authority (HCDA), which focused on advisory and regulatory support, institutional and marketing arrangements, and advisory services to farmers. According to Kidane et al. (2006), Kenya's international success in tea and horticulture can be attributed to: (a) a legal and policy framework (land reform, regulatory frameworks and contractual arrangements); (b) institutional support (publically funded authorities and their leadership roles); and (c) provision of public infrastructure.

Africa-wide Commodity Example—Cassava Crop Protection and Market Development

Cassava is a major element of the diet of many Africans. Its production was threatened in the early 1970s by the cassava mealy bug and the cassava green mite infestations (Gabre-Madhin & Haggblade, 2004). The solution to these problems came from the international research community. Research institutions such as the International Center for Tropical Agriculture (CIAT) and the International Institute of Tropical Agriculture (IITA), working in collaboration with multilateral aid agencies like the International Fund for Agricultural Development (IFAD), quickly developed and propagated solutions. This effort has been credited for saving African cassava.

Having saved cassava, several nations have built on this foundation to expand cassava utilization. For example, in Nigeria, the Federal Ministry of Agriculture and Rural Development (FMARD) worked with food processors from the bakery sector to promote the substitution of cassava for wheat (an imported commodity) in bread production. In the process, it facilitated capacity building for cassava related associations, all of which have become partners in the improvement of services to farmers, processors and input suppliers and in the incorporation of cassava into several value chains. While evidence of market success of cassava bread is unclear, the following key lessons were learnt from the cassava effort: (a) research can be effective in solving major problems; (b) research collaboration is essential to successful research based interventions; and (c) a strong connection between research and outreach is important in solving problems.

Program Example—Farmer Education in Nigeria

A major problem faced in raising agricultural productivity in Africa is the low level of literacy among rural farmers. Adult education might help correct this problem. Nigeria therefore decided to experiment with an agricultural messaging-based adult literacy program, whereby adult female farmers were assisted to access and interpret information to enhance their productivity. After two decades, the program has had a measurable impact on productivity and on women's organization, including the creation of Women in Agriculture (WIA). A study by Okpachu, Okpachu and Obijesi (2014) to determine the impact of adult education on the productivity of small-scale female maize farmers in the Potiskum Local Government Area of Yobe State in Nigeria compared the outputs and incomes of female maize farmers participating in the program to those of non-participants. Regression results show that education significantly affects the agricultural productivity of small-scale female maize farmers. The study recommended that female farmers should participate in adult education schemes and that incentives and government agricultural policies should work in tandem in advancing women success.

Some Insights on What Works

Several studies have searched for key factors underlying agricultural successes. For example, Haggblade, Hazell and Kisamba-Mugerwa (2010) find, based on case studies and consultations with agricultural specialists and politicians, that successful agricultural performance requires the convergence of two conditions: agricultural research to provide more productive and sustainable technologies to farmers; and a policy framework that fosters market incentives for increasing production. The authors argue that Africa has not experienced agricultural success more frequently because these two conditions have rarely coincided. The authors conclude that agricultural growth can occur across a broad range of African settings provided technological improvements and favorable incentive systems converge. They suggest that to move forward governments need to build on the improved macro policy environment for agriculture; adopt transparent, predictable policies conducive to private sector investment in farming and agribusiness; provide public goods such as roads, water, education, health, and power; develop research and technology for self-pollinating and vegetatively propagated crops; and develop and manage systems for controlling contagious livestock and plant diseases. Several studies of the factors underlying successes in African agriculture stress

the importance of having an enabling policy environment in which technology and markets can work together (Leonard, 1991; Gabre-Madhin & Haggblade, 2004; Wiggins, 2005; Kidane et al., 2006).

In short, there are no magic technology bullets that offer a short cut to an African green revolution. African governments must embrace the broader challenge of creating a strong enabling policy environment for smallholders to adopt more productive technologies, and to encourage the private sector to invest along value chains. As we shall see, this typically requires proactive interventions to overcome market failures and inequities, adequate provision of essential public goods like agricultural research and development, extension and rural roads, and a willingness by government to engage with the private sector at all levels.

What Must Governments do Today to Transform Africa's Food Systems?

Earlier chapters noted that an "inclusive" transformation of Africa's food systems requires government policies and investments that increase smallholder productivity, facilitate the commercialization of large numbers of smallholders, promote the growth of small and medium-sized agribusinesses along value chains, and encourage the types of large-scale private agribusiness investments that can help realize rather than crowd out an inclusive transformation of the food system. This policy agenda calls for five types of government support.

First, government must provide an enabling business environment for farming and agribusiness. This is achieved through putting in place favorable macroeconomic policies including better government budget appropriations, deployment and timely release of funds; taxation; inflation control; monetary growth; exchange rates; interest rates; price intervention in agricultural inputs and output markets; and intraregional and international trade.

Second, governments also need to put in place the institutional and legal foundations governing the development and growth of efficient and effective farmer organizations; land and natural resources tenure; agricultural input (seed and fertilizer) supply; agricultural finance and insurance; agricultural machinery and farm equipment supply; agricultural output marketing; agroprocessing and small and medium-scale rural industries; and intraregional and international trade.

Third, government needs to complement policy reforms by carrying out institutional reforms in agricultural research and technology development, agricultural extension, agricultural training and higher education, agricultural technical services delivery systems, and multisectoral agricultural planning, coordination and mutual accountability.

Fourth, governments need to invest in rural infrastructure. This includes sanitation, water supply and irrigation systems, farm to market roads, railways, airports, marketplaces, storage facilities, information and communication technologies (ICT), energy, and rural electrification.

Finally, the business agenda also calls for more targeted policies and interventions aimed at commercializing more small farms and promoting the development of small and medium enterprises (SMEs) that play strategic roles along agricultural value chains. These more targeted interventions include:

- Helping to organize smallholder farms so that they can better access modern inputs, technologies and markets, for example, through farmer organizations and contract farming arrangements.
- Work with the private sector in strengthening supply chains for improved seeds, fertilizer, credit, and insurance.
- Incentivize large agribusinesses to reach out to more smallholders and to partner with SMEs.
- Provide training and encourage entrepreneurship, especially among women and young farmers, and among SMEs.
- Improve SME access to financial services.
- Help build resilient value chains in the face of climate change.

Such targeted interventions typically require meaningful partnerships between public, private and NGO players. Because many subsistence-oriented smallholders will not benefit directly from a business approach to smallholder agriculture and may be left behind, governments should also maintain adequate safety nets and social protection programs for chronically vulnerable households; provide response to and recovery after disasters; manage strategic grain reserves to protect against risk of food shortages; and strengthen smallholders' resilience to climate change and extreme weather events such as El Niño, yield and price risks.

Very little of this agenda is new, and the details, many of which are discussed in other chapters, are already well known. The real challenge is to find ways of convincing governments to actually commit to this agenda, and to undertake what many of them have already promised to do (e.g. through CAADP).

This is partly a challenge of political leadership, and of rallying and maintaining public support for the agenda, especially in more democratic countries. Institutional capability is also a problem. Many public institutions are weak, especially those that serve the agriculture sector, and they have limited capability to design, implement, monitor and evaluate government programs and projects, or to work in partnerships with private sector and NGO players. Sometimes it is not just a lack of capabilities that prevents effective partnerships, but public sector skepticism about the roles of other non-government players. The seed sector is a classic example where public institutions have tried to crowd out private breeders and dealers for decades.

There is a clear need to strengthen public institutions and their capabilities in Africa, and this will be essential for sustaining longer-term growth. It is also desirable that farmers become better organized to obtain a louder voice in public policy, so that they can promote an agricultural agenda. The good news is that there is a trend towards greater democratization in Africa, and greater decentralization to local decision makers. But Africa cannot wait for these kinds of developments to mature. Interim solutions are needed that can get agriculture moving within the constraints of the current political economy and public sector capabilities.

What Will it Take to Make it Happen?

The standard approach to getting agriculture moving is for governments and donors to develop national agricultural development strategies. These strategies are supposed to guide government policies and investments, and help integrate the roles of different players, including the donor community and the private sector. Despite a proliferation of such strategies in recent years, including those developed under the guidance of the CAADP initiative of the New Partnership for Africa's Development (NEPAD), very few have been successfully implemented (Gerrard, Argwings-Kodhek, Marouani, & Mudimu, 2016).

An important reason for the poor performance of many agricultural strategies is that they seek to move on too many fronts at the same time, and are cluttered with a broad array of economic, social, health, nutrition, resilience, and environment targets. The strategies hardly recognize the limitations of public institutions to implement change or absorb large increases in spending. The need for effective coordination across government ministries and departments, and between central and local governments; the political time frame for producing successful results before governments change or lose interest; the financial resources available, or the long gestation periods needed for some types of investments. Not all goals are win-win, despite prevailing optimism in the donor community. Sacrificing growth at an early stage to achieve quick gains on other goals can be suboptimal for long-term outcomes. For example, investing in smallholder-led growth may be a much more powerful way of achieving long-term prosperity and deep poverty reduction than direct short-term spending on the poor, but it may take longer for poverty to start falling. Or achieving sustainable farming systems or carbon capture at low levels of land productivity may look good from a short-term environmental perspective, but may not last when confronted by increasing population pressure or rising livelihood aspirations.

Where to Begin: Achieving Early Successes

Rather than trying to drive the entire agriculture sector forward in this way, there is growing interest today in more focused first mover strategies. A first mover might be a non-traditional export crop or a priority food staple that must compete with imports. The idea is to concentrate resources and effort on selected value chains and drive these hard for growth and employment creation. There can also be a regional dimension to first movers, for example, starting in high potential areas that have the best infrastructure, market access and agricultural growth potential. A first mover approach can lead to quick wins in terms of income and employment, and their visibility can also be good for developing political momentum and support for agriculture, government ministers and donors love successes. Once the first movers have been successfully launched and rural incomes and employment are rising, then attention can shift to other activities, regions and goals.

A first mover strategy is not new. It is very similar to the Asian Green Revolution strategy, where an initial thrust on import substitution for wheat and rice grown in the best irrigated areas led the successful rural transformation that followed (Rosegrant & Hazell, 2000). The strategy has also been used in Asia to drive non-traditional export crops (e.g. Vietnam used the approach to develop coffee production, moving from zero production to a major world exporter over little more than a decade). It has also been tried in Africa in the past (e.g. presidential initiatives for specific commodities, and integrated rural development projects), but with mixed success. What makes it a new and promising approach today is that it can build on embedded market liberalization policies and strong private sector roles. Also, because policy making has become more decentralized and communities and local governments have greater say, some regions are more ready for development projects than others.

National First Mover Strategies

Some countries are taking first mover approaches at a national level, through government-led, long-term growth strategies. Ethiopia, for example, established an Agricultural Transformation Agency (ATA) that has targeted several priority commodities and regions for development. The Agency is directed by a high-powered committee chaired by the Prime Minister, with the Minister of Agriculture as vice chair (Box 6.1). ATA is able to coordinate activities between government ministries and departments and across central and local governments. Nigeria launched its own version of an ATA, but which is based in the Ministry of Agriculture and has less power to coordinate activities across ministries. Rwanda has also had a focused national agricultural strategy that has had some success (Box 6.2). Similar approaches were successfully used during early transformation in Malaysia, South Korea and Taiwan. This approach is not suitable for many countries, particularly where policy decision-making is more participatory and less directed from above, and where the capabilities of public institutions are weak. It also requires strong and sustained government commitment to the agricultural development agenda. For many countries a more realistic approach is to focus sub-nationally on first movers within individual value chains, or development ready regions.

Box 6.1 • The Ethiopia Agricultural Transformation Agency (ATA) —An Example of a National First Mover Strategy

Since the early 1990s, the Government of Ethiopia has articulated several strategies to drive its agricultural transformation, beginning with the Agriculture Development Led Industrialization (ADLI) strategy. This continues to underpin all its more recent efforts. Recent manifestations include the Growth and Transformation Plans (GTPI and II); the Agricultural Sector Policy and Investment Framework (PIF); and the Agricultural Growth Program (AGP). The common themes running through all these are the recognition of the primacy of agricultural growth and small farm development for achieving an economic transformation, and a desire to raise the productivity of food staples in particular. However, dissatisfaction with the slow pace of the desired agricultural transformation led the Government in 2010 to establish the Agricultural Transformation Agency (ATA). The ATA is an autonomous federal organ accountable to the Ministry of Agriculture (MoA) and supervised by a Council of Ministers with the Prime Minister as Chair and the Minister of Agriculture as Deputy Chair.

The ATA was formed because past strategies were less successful than hoped, as they were too unfocused; failed to recognize the limitations of existing institutions and infrastructure; involved many activities that had been undertaken in a piecemeal fashion (often off-budget) with little effective coordination across the government and donors; and understated the potential role of the private sector. The ATA has taken a first mover approach, focusing on some priority commodities and high potential areas with good market access. The Agency also deploys a "business-like" approach to prioritizing activities, identifying interventions, and supporting their implementation.

The mandate of ATA is to address the systemic bottlenecks in the agriculture sector by supporting and enhancing the capability of the Ministry of Agriculture and other public, private, and non-governmental implementing partners. In doing so, the Agency aims to achieve an average annual growth rate of at least 8% in the agriculture sector. The outcome is expected to be an agricultural transformation. Its program of work has four main components:

1. **Value chain programs** for those crops and commodities that are of the greatest importance to Ethiopia's smallholder farmers, national food security and the economy at large. The first mover crops were all cereals, namely teff, wheat, and maize, with subsequent plans for work on livestock and other high-value crops such as sesame, pulses (especially chickpeas) and fruits/vegetables produced under irrigation are also planned.
2. **Systemic programs** constituting the key building blocks for all value chain programs which include seeds, soil health and fertility, cooperatives, input/output markets, research and extension, and household irrigation.
3. **Crosscutting initiatives** to ensure that the solutions identified in the value chain and systems programs consider issues that will mitigate unintended consequences, and address social, environmental and financial sustainability. Initial areas of work included gender; technology access and adoption; climate change adaptation and environmental sustainability; and monitoring, learning, and evaluation.

Box 6.1 • The Ethiopia Agricultural Transformation Agency (ATA) —An example of a national first mover strategy (continued)

4. **Special projects** to provide a platform to address issues that do not fit into any of the areas above, but can catalyze the transformation of the agriculture sector by addressing a key structural or systemic problem such as public–private partnerships and ICTs for agriculture.

The Government has backed its agricultural strategies and ATA with significant investment of its own (15% of its total budget, or about 10% if expenditures on the Productive Safety Net Program (PNSP) are excluded). The result has been an impressive rate of agricultural growth of between 6% and 8% per annum in recent years.

Box 6.2 • Rwanda's Agricultural Strategy

Rwanda has implemented a focused agricultural development strategy with some success. This package includes the high-level commitment to CAADP by the political leadership who owned the process and made sure it was implemented and adhered to. Thus, agriculture secured higher commitment than before from the Government of Rwanda as a vital ingredient of its poverty reduction (Booth & Golooba-Mutebi, 2014). In addition, Rwanda's Strategic Plan for Agricultural Transformation (PSTA) developed and transformed into PSTA II, which was aligned with the CAADP framework. To ensure funding for its programs, the government enhances development assistance and donor coordination in the Agricultural Sector Working Group (ASWG) and government–donor relation.

Other policy and regulatory reforms implemented include:

- Land policy and land laws were adopted, guaranteeing security of tenure and the possibility of a land market implemented by the Rwanda Agriculture Development Authority (RADA).
- The Crop Intensification Program overseen by RADA, focusing on distribution of improved seed and fertilizer at subsidized prices through local governments, and later graduated to the private sector.
- Land consolidation into nucleus farming blocks to maximize yields and efficiency through synchronized planting and harvesting by smallholders in service cooperatives, starting with maize and rice.
- Development inland for medium-scale irrigation of under-utilized marshlands, especially for rice.
- Promotion of sound intensification principles by district extension staff, including enforcement of the legal ban on further fragmentation of holdings, and advocacy of mulching, small-scale irrigation and renewal of terraces.
- Promotion of the one-cow-per-family initiative.
- Rice production following introduction of the NERICA variety.
- Maize production was emphasized as the major cereal and contributed to the country's achievement of food security.
- Establishing an Agriculture Guarantee Fund in 2005 to encourage bank lending to the sector.
- Privatization of the seed industry and scaling up of fertilizer distribution to increase farmers' access to inputs.
- Investment in storage facilities and commercial warehouses available to reduce post-harvest losses.
- Catalytic Financing Fund to address a gap in current financing options available to potential investors.
- Agro-dealers set up and trained to market and distribute inputs across the country to enable farmers to obtain improved seeds and fertilizers within walking distance of their locations.
- Tax waivers imported agricultural equipment, inputs, and agroprocessing machinery.

Box 6.2 · Rwanda's Agricultural Strategy (continued)

As a result, Rwanda dramatically increased government agricultural expenditure to 10.2% in 2011, thereby surpassing the CAADP target (Regional Strategic Analysis and Knowledge Support System ReSAKSS http://www.resakss.org/). The country also achieved growth in agricultural value-added exceeding population growth, and experienced a reduction in rural poverty (overall decline in poverty for the 10-year period from 2001–2011 was 23.8%). This shows that the key policy requirements for driving a successful agricultural and rural transformation include a policy-making and implementation approach that is problem-driven, iterative and learns from errors on how to manage the agriculture sector; that focuses on the policy prime movers over the long haul; and that responds to powerful incentives to demonstrate success in social and economic development.

Value Chains as a First Mover

One way to focus effort is to select a few priority commodities and invest in developing their value chains for export, import substitution, or agroprocessing. This is happening in several African countries, sometimes through projects initiated by governments, but also by market-oriented donors like the United States Agency for International Development (USAID), the UK Department for International Development (DFID), and the World Bank, and sometimes by NGOs or private sector players. Value chain analysis (Haggblade, 2007) can help identify key bottlenecks that need to be fixed along value chains, and help identify appropriate interventions. A common challenge is finding meaningful institutional mechanisms for coordinating trade along value chains, and organizing actions amongst key stakeholders, especially when no large agribusiness concern is available to take the lead. Quality control, for example, requires an adequate grading system of the final product, and also the ability to transmit the price differentials associated with different qualities back along the value chain to relevant decision makers, including farmers. This might require some coordination of the supply of desired seed varieties to farmers with appropriate advice on agronomic practices, with improved post-harvest grading and handling by farmers, traders and transporters, as well as improvements in processing plants. Getting all the relevant decision makers to agree and work in complementary ways and at the right time is not something that necessarily evolves when left to market forces alone.

The creation of marketing boards to coordinate activities along value chains has led to mixed results in Africa, sometimes succeeding, as with cocoa in Ghana and tea in Kenya, but more often leading to high costs and poor marketing performance. As an alternative to the marketing board solution, several recent attempts have explored more flexible institutional structures that can facilitate and encourage coordination and the development of non-market relationships among value chain actors, but without undermining a basic laissez-faire approach to the market. Particular attention has been given to the problem of giving smallholders access to inputs and markets (Kolavalli et al., 2015). Some programs in Ghana such as the Northern Rural Growth Project (NRGP) and the Market Oriented Agricultural Project (MoAP), enable various actors in the value chains to interact with each other by organizing value chain committees. How useful these efforts are in overcoming some of the market failures to give smallholders greater access to inputs and output markets remains to be seen.

Spatial Initiatives for Agricultural Development

Given the multifaceted nature of the agricultural development problem, and the need for a wide range of supporting activities and functions performed by a diverse set of stakeholders, one way to make quick progress is to focus on first mover regions, or spatial initiatives for agricultural development (SIAD). This seems particularly helpful as a way to coordinate and focus business support for commercializing smallholder farmers. SIAD creates platforms for such partnerships by simultaneously addressing the constraints facing smallholder farmers in an area with known agricultural potential.

SIAD provide basic infrastructure (roads, water, energy, telecommunications, etc.), proximity services (finance, quality control laboratory, transportation, maintenance and waste management services, refrigerated warehouses, etc.), knowledge, and good agricultural practices (training, research, supervision, and transfer of technology). With appropriate institutions and governance, SIAD will create a platform for sustainable development involving government, the private sector, development agencies, farmer organizations and civil society. Such an approach has the potential to fill in all the links in different value chains from upstream to downstream. Each SIAD will create a business-friendly environment that includes specialized consulting services, a mentoring service for entrepreneurs and innovation support, support services to consolidate and develop markets, access to secure financing, and intelligent

partnerships that stimulate local economic development by creating opportunities for sustainable smallholder-led agricultural development.

In the following we discuss briefly different forms of SIAD and provide an example of how to support smallholders in connecting with and benefitting from these investments through a shared value.

Agro-corridors

Africa has inherited a patchwork of political borders that frequently separate high-potential food production zones from cross-border deficit markets they would most naturally serve. Political borders separate surplus maize in South African silos from deficit markets throughout Southern and Eastern Africa; surplus millet and sorghum producers in southern Mali and Burkina Faso from deficit markets in half a dozen surrounding countries; food surplus zones of northern Mozambique and southern Tanzania from intermittent deficit markets in Malawi, Zimbabwe and eastern Zambia; surplus cowpea production in southern Niger from large markets in Nigeria; and livestock exporters in Mali, Mauritania, and Niger from coastal markets across West Africa (World Bank, 2008b; FEWSNET, 2010a, 2010b). Despite widespread smuggling, existing border controls and poor perimeter infrastructure disrupt market signals, raise transaction costs and limit market integration (World Bank 2008a; Aker, Klein, O'Connell, & Yang, 2010). Africa-wide simulations suggest that improved maize productivity, when coupled with improved transport and regional trade, results in 25% higher farmer income and lower consumer prices than when the same new technology is introduced into the current, high-transactions-cost marketing system (Diao, Headey, & Johnson, 2008).

Ultimately, achieving African food security will depend on significant, broad-based gains in agricultural productivity combined with a successful coupling of the continent's many breadbasket zones and cross-border deficit markets. Agricultural trade and development corridors offer a valuable tool for seizing these opportunities. They simultaneously stimulate agricultural investments in high-potential zones and improve food security in deficit markets.

Looking forward, continent-wide projections suggest that domestic food markets will provide the most rapidly growing agricultural markets in Africa over the coming decades (Diao & Hazell, 2004). Given the peculiar configuration of Africa's political borders, which separate many breadbasket zones from the deficit markets they could most economically serve, regional trade corridors will become increasingly important for maintaining farmer incentives in high-potential zones.

An array of African leaders and partners have begun efforts to puncture the continent's dense network of political borders with a series of strategic development corridors. "Economic corridors are development programs that foster promising economic sectors in a territory by further leveraging existing economies of scale along a physical backbone of infrastructure including roads, rail networks, canals, ports, airports" (FAO, 2017, p. 58). Corridors enhance economic activity by connecting communities, cities, regions and countries through a sustainable transport infrastructure and logistics. Applied to agricultural development, "agro-corridors" add to existing infrastructure, logistics and trade development, with a special focus on agriculture-related activities. Therefore agro-corridors have the potential to boost the agriculture and agro-industry sectors by facilitating the connection between farmers and markets and attracting investments in the agricultural value chain.

The presidents of South Africa and Mozambique launched the first of Africa's development corridors in 1995 to stimulate regional trade and investment-led economic growth along the Maputo Development Corridor (MDC). Linking Johannesburg and Maputo, this initiative modernized the commercial infrastructure and trade protocols first established by the Transvaal Republic and the Portuguese in the 1880s. Within a decade, the MDC had attracted over US$5 billion in private sector investments (Jourdan, 1998; Södrbaum & Taylor, 2008; TransFarm Africa, 2009).

Subsequently, the Southern Agricultural Growth Corridor of Tanzania (SAGCOT) was set up as an international public–private partnership. It was launched at the World Economic Forum on Africa in May 2010 in Dar es Salaam, Tanzania, and in Davos, Switzerland, in January 2011 to implement Tanzania's transformational agricultural vision, Kilimo Kwanza (The United Republic of Tanzania Prime Minister's Office, 2016). SAGCOT aims to mobilize private sector agribusiness investments amounting to US$3.5 billion by 2030 (SAGCOT, 2016). Currently, SAGCOT is facilitating 20 investments worth approximately US$1 billion and with the potential to lift approximately 50,000 farmers out of poverty by 2018.

An array of African regional organizations, foundations and donors have undertaken three dozen corridor studies across Africa (Jourdan, 2008; Buys, Deichmann, & Wheeler, 2010). Related investigations have examined early experience and design options likely to improve the distributional impact and spread effects of these regional corridors (Koch et al, 1998; Kepe, 2001; Söderbaum & Taylor, 2001, 2008; Klenynhans, 2007; Jourdan, 2008; TransFarm Africa, 2009). This evidence suggests that commercial viability generally requires anchoring infrastructural trunk lines at major mineral deposits. With the addition of feeder roads, land allocation for commercial farming clusters and associated communication

and financial services, many natural resource corridors can also serve to catalyze private investments in agriculture, agroprocessing and trade. The studies also suggest that inclusive governance and communication systems—involving provincial, private and civil society representation—and early attention to agricultural development objectives increase the potential for broad-based economic spillovers.

As a management tool, development corridors provide a means of coordinating tripartite agreements that marry together infrastructure financing (potentially funded by donors) with trade policy reforms (by national governments), and investments in agricultural production and trade (by farmers and agribusinesses). Africa will require strong leadership and a clear strategic vision to prioritize and push forward critical trunk infrastructure investments and trade agreements. These will, in turn, stimulate agribusiness investments in the many areas of the continent that have the potential to become high-potential agricultural zones.

Agro-clusters

In the literature, an economic cluster is defined as the geographic concentration of horizontally and vertically connected companies and institutions in a particular field, along with their related government, academic and private sector stakeholders (Porter, 1998). It follows that an agro-cluster is a "concentration of producers, agribusinesses and institutions that are engaged in the same agricultural or agro-industrial subsector, and interconnect and build value networks when addressing common challenges and pursuing common opportunities" (FAO, 2017, p. 90). Such geographic concentration is expected to improve firms' productivity, innovation and competitiveness. Firms operating within a cluster will benefit from positive externalities generated by the quality of firms (suppliers/consumers) on the vertical or the horizontal value chain. They will benefit from reduced transportation costs, learn new technology from other firms with lower costs, and invest in innovation to ensure competitiveness. Porter (1990) emphasizes that cluster initiatives enable industries to deal with "sophisticated and demanding consumers" since cluster firms promptly access quality inputs. Benefits of differentiation, innovation, and improved quality arise from intense rivalry triggered by competitiveness. However, good governance must be promoted to avoid the negative impact of rent-seeking or any other political capture which can lead to misallocation of resources between the provision of public goods and the "favored" industries in the clusters.

Agro-industrial Parks

"An agro-industrial park is a centrally managed, physical platform that offers high quality infrastructure, logistics and specialized facilities and services to a community of tenants, formed by agro-industries, related agribusiness firms, service providers and research and knowledge institutions" (FAO, 2017, p. xvi). Theoretically, agro-industrial parks are promoted to gain competitiveness through co-location and maximize the efficient use of natural resources across interconnected urban-rural spaces. However, relying on agro-parks as a competitiveness and value addition tool in agriculture is recent (FAO, 2017). Setting up a successful agro-park is a complex exercise; the choice of sites, dimensions, crops, among other major decisions requires a clear set of criteria and principles, and sufficient and accurate information. The role of the public sector is essential regarding major public goods investments, less attractive to the private sector. Beyond the physical aspect, institutional design should adequately fit the overall agro-park strategy. Similarly, sound management on the private and public sides (together and separately) is critical to guarantee the sustainability of the park. A participative approach, including key stakeholder groups on the design and implementation, will facilitate collaboration within the agro-park.

Agro-based Special Economic Zones

"Special economic zones are demarcated geographic areas contained within a country's national boundaries where the rules of business are different from those that prevail in the national territory. These differential rules principally deal with investment conditions, international trade and customs, taxation, and the regulatory environment; whereby the zone is given a business environment that is intended to be more liberal from a policy perspective and more effective from an administrative perspective than that of the national territory" (Farole & Akinci, 2011, p. 27).

Unlike the previous clusters, agro-parks and corridors developments that emphasize physical aspects such as infrastructures the starting point in the special economic zone (SEZ) development process is the establishment of a regulatory framework. It includes tax facilities on importations or exportations, land policy, infrastructure, specialized services, among others. SEZ is a transversal policy tool that can equally apply to most of the spatial development initiatives (clusters, agro-parks, and corridors). For example, SEZ can apply to agro-parks to the extent that agro-firms operating in the agro-park can afford SEZ status and therefore benefit from certain privileges associated with the particular set of SEZ regulatory tools. "The distinguishing factor that makes an agro-industrial park an SEZ is the legal and regulatory framework governing the fiscal conditions and regulatory

administration (particularly customs) of businesses physically located within the park" (FAO, 2017, p. 183).

The success of the SEZ is highest when its development aligns with sectoral, regional and national development plans, as part of a global long-term vision for sustainable and inclusive growth. Instruments for mitigating inefficiencies include use of ICT, empowerment delegation and outsourcing of services. Political capture, rent-seeking or any kind of "abuse" of SEZ incentives can be mitigated by setting participatory and transparent decision-making processes. Also important is a requirement that state (regional) and local government interested in smallholder farmers contribute to SEZ success by putting in place those regulatory, service and incentive contributions that will enhance performance.

The Government of DRC has used an agro-based SEZ approach with some success since 2014 (Box 6.3). The approach seems particularly well-suited for developing central places within vast land areas with poor infrastructure.

Box 6.3 • Spatial Initiatives for Agricultural Development and Smallholder Farming—Case of Cassava Value Chain

In 2014, the Government of the Democratic Republic of Congo (DRC) launched its first Agricultural Special Economic Zone (ASEZ) as part of a massive spatial initiative for agricultural development (SIAD). The initial phase started with 3 registered companies in the form of public–private partnerships with over 80,000 ha. From the beginning, the government decided to incorporate 500 smallholders into the SIAD through the "Creating Shared Value" (CSV) approach.

In their seminal article, Porter and Kramer (2011) define the concept of share value as corporate policies and practices that enhance the competitiveness of a company while simultaneously advancing social and economic conditions in the communities in which the company sells and operates. The authors predict that incorporating societal issues into strategy and operations is the next major transformation in management thinking (Moore, 2014). It is fundamentally integrating societal issues and challenges into economic value creation. In the case of the pilot DRC ASEZ, government, private sector, development agencies, farmer organizations and local leaders teamed up to assist smallholder farmers with various levels of mechanization services for plowing, planting, harvesting, and access to quality inputs, roads and markets, extension services and research and purchase of small-scale farmers' products by ASEZ companies at agreed-on prices. Key actors include:

- DRC Government: oversight, funding
- International Food Policy Research Institute (IFPRI): design and monitoring and evaluation (M&E)
- Société d'Aménagement du Parc Agro-Industriel de Bukanga Lonzo: land, security, water, and electricity
- Société d'Exploitation du Parc Agro-Industriel de Bukanga: agricultural machinery and processing of cassava flour
- Marché International de Kinshasa: distribution of cassava flour to the market
- International Institute for Tropical Agriculture (IITA): planting material and factory training
- ECOSAC (Entreprise de Consultance et des SERVICES Agricoles Communautaires): extension services and farmers coordination
- African Development Bank (AfDB): funding (cassava factory)
- Local chiefs: political and social leadership

Thanks to the project, cultivated land by smallholders increased from 50 to 500 ha; the goal is to reach 2 ha per household for a total of 1,000 ha. The yield increased from 3 to 15 tons per hectare. The processing plant on the ASEZ site opens a reliable market for smallholder farmers. Involvement of research centers such as IFPRI and IITA provides the necessary research-based knowledge to guide the decision-making processes of all actors. As the project evolves, each household will be receiving directly an amount of US$100 per week. For an average household size of 5 persons, this represents an income of US$2.8 per person per day, well above the poverty line of $1.90 per person per day. The amount distributed represents 50% of the sale value of cassava roots; the remaining 50% is divided between a social security fund (35%) and extension services (15%). Income from non-farming activities generated by the ASEZ is not included. The social fund will provide health insurance to all households and pay for

Special Purpose Funding Vehicle for Smallholder Farmers through SIAD.

Successful implementation of SIADs calls for responsible governance to reduce the burden of misconduct in the public sector and enforce major regulatory standards, while maintaining strong incentives for foreign direct investment. Contrary to traditional state-based regulation, non-binding approaches by companies, NGO-sponsored contractual regulation or multi-stakeholder governance strategies, the emergence of the responsible governance framework allows the public and private sectors to develop mutually appropriate strategies to increase foreign direct investment. More specifically, the responsible governance approach can:

- Improve public governance: for most governments, it is extremely difficult to establish, implement and enforce all regulatory measures at once. Hence, they could benefit from complementary governance mechanisms from the private sector.
- Strengthen collaboration: ensure that each representative actor abides with the laws, codes, standards and customs agreed upon. Without an instrument to force each player to conform to the same standard, the government cannot motivate even one player to voluntarily join any initiative.
- Create a new governance culture: to ensure a robust and flexible learning system that will form a culture of adaptation and continuously evaluate the strategies implemented and their effectiveness.
- Develop credibility of all institutions involved: focus on accountability and enforcement in a way that builds trust and demonstrates credibility.

One example of such responsible governance is the establishment of a special purpose funding vehicle (SPFV) for smallholder farmers through SIAD. SPFV is designed to help build an enabling environment for the corporate sector to work in partnership with the government, multilateral development banks, development organizations, donor agencies, foundations, non-government and civil society organizations, smallholder farmers, and local community organizations. The aim is to improve the competitiveness of SIAD, attract sound investors and aid-funds, thus contributing to sustainable growth and shared prosperity across Africa. The establishment of SPFV will encourage significant private investment within SIAD that balances commercial viability with social objectives. It will target new investments or established companies that want to link with smallholder farmers to build or extend competitive supply chains. Through these investor companies, the SPFV will help catalyze private investment in the SIAD that would improve the productivity and incomes of smallholder farmers by expanding and providing a commercial opportunity, such as through the purchase or distribution of their products, or initiatives that allow for the creation of agricultural infrastructure that will benefit smallholder farmers. The SPFV serves to reduce the private sector's risk associated with the development of commercial links with smallholder farmers.

Examples of projects that could be considered for SPFV focus would include: a) development of an out-grower scheme to underpin the agricultural supply to a company or organization's investment in a processing plant. Such a project would provide employment opportunities during its construction phase and have an impact on those communities surrounding the investment through employment opportunities with the project as distinct from out-grower farming; b) improvement of local assembly systems linked to a training program focused on grades and standards where a trader is seeking to increase the volume and quality of crop delivery.

Under the operating guidelines of the SPFV, capital would also be accessed to provide a range of environmental and social advisory support where projects may require these services and where it can be evidenced that the SPFV providing this assistance will contribute to the overall success of SIAD and smallholder farmers.

Many agricultural development strategies have been developed in recent years at national and regional levels for Africa, often under CAADP guidance. Country CAADP plans aim to lay out full menus of activities and investments needed to achieve a minimum 6% annual agricultural growth.

Conclusion and Recommendations

Africa needs an agricultural revolution today both as an engine of growth for its agricultural and rural transformation, to meet its future food needs, and to reduce poverty. To achieve it, African governments will need to take smallholder agriculture more seriously, and embark on a development agenda that is focused less on the standard green revolution paradigm of the past and more on developing an "inclusive" food system that can meet the growing demands of increasing urban and middle class populations for a diverse range of fresh, processed and pre-cooked foods.

To achieve this agenda, governments will need to pursue a five-pronged agricultural development strategy. They must provide fundamentals in the form of an enabling

business environment for farming and agribusiness; invest in adequate levels of basic public goods like research and development, extension, and rural infrastructure; undertake targeted interventions to help commercialize many more smallholders and promote the development of SMEs along food chains; and they must maintain adequate safety nets and social protection programs for the rural poor.

Implementing the agenda will be a challenge; few governments seem able to marshal the levels of support needed for successful agricultural transformation. Smallholders have a limited voice in the political arena, and few political leaders seem ready to prioritize agriculture when it comes to resource allocation. Bolder political action will be necessary. Another challenge is weak public sector capabilities to design and implement a coherent program of policies and investments, or to partner effectively with the private sector and other key players in the food system. Within this context, the comprehensive agriculture sector-wide strategies favored by development agencies and planning departments have limited impact. They attempt to do too many things at the same time without considering the weak capabilities of many public institutions, the prevailing financial constraints, the long gestation periods required for some investments, or the political time frame available to produce successful results before governments change or lose interest.

A more practical approach is for governments to concentrate on a few first movers, which may be priority commodities or regions, and to drive these for early successes in terms of growth and employment. Establishing quick success helps build momentum and political support for further agricultural investments. It also opens up new growth opportunities elsewhere in the sector. Several first mover approaches are being tried in Africa, ranging from national agricultural transformation agendas in Ethiopia and Nigeria which prioritize specific commodities and regions; to the targeted development of specific value chains in many countries; to spatial initiatives like agro-corridors, agro-clusters, agro-industrial parks, and agro-based SEZ. These approaches provide platforms that enable relevant public and private sector players to come together to better serve groups of smallholder farmers, while enabling public and private investments in infrastructure and supporting services to achieve critical levels.

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CHAPTER 7

Conclusions and Recommendations

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Introduction

As chapters in this report have argued, the prospects for African agriculture look very favorable over the decades ahead. Demand for food continues to grow strongly, and is projected to more than double by 2050. National diets are shifting away from food staples like grains towards horticultural and livestock products, and processed and pre-cooked foods, all of which add value within the agri-food system. Imports of raw and processed foods have increased to about US$35 billion per year, and are estimated to rise to about US$110 billion by 2025, and many of these could be produced at home.

These dynamics have already created many new growth opportunities in Africa's food system. Agricultural growth has averaged about 7% per annum since 2005, and a great deal of value addition and employment are being created along value chains in the form of agricultural trade, farm servicing, agroprocessing, urban retailing and food services. Already, it is estimated that 40–70% of the food costs to urban Africans are incurred in the post-farm gate segments of the supply chain (Reardon et al., 2014). The World Bank estimates the share of all agribusiness and food-related business in national gross domestic product (GDP) is typically around 20% (World Bank, 2013).

These changes have been very beneficial to many of Africa's smallholder farmers and small and medium enterprises (SMEs) operating in the agri-food system. But given many access constraints to key inputs, finance and markets, and the more stringent health and quality credence requirements of more urbanized and consumer driven markets, there is a real danger that many other smallholders and SMEs will be left behind, while larger commercial farms and large agribusinesses reap more of the benefits. To ensure a more equitable outcome appropriate to Africa's current low to middle-income status, this report recommends that African governments become more proactive in promoting an "inclusive" transformation of their agri-food systems, based on promoting small farms and SMEs on a commercial basis.

Chapters in this report find that an inclusive transformation has the potential to help:

- Make Africa more food secure by 2050
- Create many more productive jobs in agriculture and the food system more widely, helping to avoid a premature exit of workers from agriculture to low productivity jobs in urban centers
- Create the types of jobs that are attractive to Africa's growing population of young workers
- Reduce poverty by improving the incomes of smallholders and wage workers, and keeping food prices down
- Provide consumers with more nutritious foods

To seize these new opportunities, Africa's smallholder farmers need to grow as businesses, and for this they need business rather than welfare support. They will need access to improved technologies and natural resource management practices, knowledge, modern inputs (like seeds, fertilizers and machinery), financial services, and markets, and secure access to land and water. Many smallholders will also require help acquiring the necessary knowledge and skills to become successful farm business entrepreneurs, especially women and young farmers. Managing market and climate risk is also a growing challenge for many small farms and, in addition to insurance and access to safety nets, they need to develop resilient farming systems. If SMEs are to prosper along value chains, then they too may need support. In addition to access to good roads and transport systems, they need an enabling business and regulatory environment, reliable supplies of energy and water, secure rights over land for building, access to financial services, and often training in relevant technical and managerial skills.

Governments have key roles to play in supporting the transformation agenda, but much of the direct support farmers need must come from agribusiness. Agribusiness must take the lead in developing supply chains for modern farm inputs like certified seeds, fertilizers, and mechanization; developing marketing channels, especially for export and high value products; developing market information and farm advisory systems using the latest information and communication technologies (ICT); and investing in value addition activities like agroprocessing. In all cases, agribusiness needs to be encouraged to reach out to more smallholder farmers. Private sector lending institutions and insurers also need to be encouraged to expand their services along agricultural value chains, and especially to service more smallholder farmers.

Encouraging greater private sector involvement in agriculture requires an enabling business environment, often institutional support in organizing smallholder farmers into cooperative or marketing associations, and innovative public–private partnerships to overcome market failure and set-up problems in linking more smallholder farmers into modern value chains on a financially sustainable basis. Together, agribusiness and farmers with government support could create a trillion-dollar food market by 2030, as well as provide consumers with more nutritious foods (World Bank, 2013). The World

Bank report on Growing Africa: Unlocking the Potential of Agribusiness calls on governments to work side-by-side with agribusinesses, to link farmers with consumers in an increasingly urbanized Africa. Improving prospects for tomorrow's farmers entails more profitable management of existing farms, with enhanced access to technology, markets, finance, information and infrastructure—creating the environment in which they and other actors can prosper (Fan, Brzeska, Keyzer, & Halsema, 2013).

Chapters in this report have explored the desired role of governments in supporting the transformation agenda in detail. Below we provide a summary of the key recommendations.

Enabling Policies and Investments

Recommendation 1: Improve the business environment for the agri-food system

Most macroeconomic, trade, and agriculture sector policy distortions were successfully pared back as part of the structural adjustment programs in the 1980s and 1990s. Yet Africa still lags on its business environment for the private sector, and further reforms are still needed. For the agribusiness system this includes reforming regulations and licensing requirements that impede the establishment or expansion of new enterprises; improving contract law and enforcement processes; improving regulations for financial and insurance services; improving land policies so that farmers have secure access to their land and agribusinesses can acquire land for building purposes; regulating input markets (e.g., seeds, fertilizers, pesticides and veterinary medicines) to ensure minimum quality and safety standards; and regulating agricultural and food markets to ensure minimum food safety and quality standards.

Recommendation 2: Strengthen the public institutions that serve the agri-food system

The ability to design, implement and evaluate policy reforms and public sector investments and interventions hinges critically on the capabilities of the many public institutions that serve the agri-food system. The capabilities of many of these institutions are still weak in many African countries, and they need to be strengthened as a matter of some urgency. This includes institutional reforms in agricultural research and technology development, agricultural extension, agricultural training and higher education, agricultural technical services delivery systems, and in the agencies that undertake multisectoral agricultural planning, coordination and mutual accountability.

Recommendation 3: Free up regional trade in agricultural products

The domestic agricultural markets of most African countries are too small to absorb any rapid and sustained increase in agricultural output, and greater freedom to trade regionally would help maintain farm gate prices. Regional trade can also be an important buffer to offset production shortfalls in any one country, helping stabilize prices for consumers. However, more open regional trade can be a mixed blessing if not supported by stable and predictable rules-based policies for handling national food crises.

Recommendation 4: Governments need to increase their investments in agriculture and rural infrastructure in line with their 10% commitment to CAADP

On average, African countries are still only about half way to achieving their Comprehensive Africa Agriculture Development Programme (CAADP) goal of investing 10% of their total budgets in agriculture. Cost–benefit studies show that most countries are seriously underinvesting in irrigation systems, farm to market roads, storage facilities, ICT, rural electrification, and agricultural research and development (R&D) and extension for small farms. Priority should also be given to infrastructure investment that favors linkages between rural areas and secondary cities and towns, including improved wholesale markets in those cities and towns linked by information flows to improved rural assembly markets.

Engaging with the Private Sector

Recommendation 5: Smallholder farmers need to be better organized to link to modern value chains

If smallholders are going to be integrated into modern value chains at scale, then they need to be organized into producer organizations that have the technical, commercial and financial resources necessary to position their members as credible business partners to agribusinesses. While cooperatives have attempted to play similar intermediary roles in the past, new types of producer organizations and business models will be required. This will require better and more coordinated support from the public and private sectors, particularly in building up appropriate technical, commercial and organizational skills.

Recommendation 6: Government should engage in innovative partnerships with the private sector to commercialize more smallholders and SMEs

Given the constraints holding back many small farms and SMEs from commercial success, there is need for more innovative and targeted interventions to help them. These might include public–private partnerships to help deliver financial services and insurance to small farms, and organizing small farms into groups for marketing purposes. Some non-governmental organizations (NGOs) are very effective at assisting by playing intermediary roles, but their costs need to be covered in what is essentially a "setting-up" subsidy. SMEs also need support as many have trouble accessing credit, and lack business management skills. These constraints can be overcome through setting up investment funds and training programs to support networks of SMEs. Special emphasis should be given to training and encouraging entrepreneurship among women and young people.

Recommendation 7: Recognize the diversity of smallholder farmers and target different kinds of assistance to those who are not going to prosper as commercial farmers

Africa's small farms are diverse and face varying livelihood prospects depending on their own assets and aspirations, as well as their regional and country contexts. Few "one-size-fits-all" policies exist for assisting small farms, and hence this diversity cannot be ignored. Agricultural assistance aimed at commercializing more small farms needs to be targeted to those farm households that have viable farm business prospects and capabilities. Alternative types of assistance are needed for the others if resources are not to be wasted, or farm households misled into unsustainable livelihood strategies. The ability to segment small farms and identify them on the ground for targeting purposes has become important. Therefore new lines of research using recently available farm household panel data sets, and spatially referenced data and geographic information system (GIS) techniques can facilitate targeting in small farm assistance programs and projects.

Finance

Recommendation 8: Governments need to support the finance sector to fill an important gap in meeting the financial needs of commercially-oriented small farms

As with recommendation 7, the diversity of small farms needs to be recognized because different types of farm households need different types of financial services, and they are likely to be provided by different types of financial institutions. There is an important gap in the financial services available to commercially-oriented smallholder farms, which needs to be filled as part of the inclusive transformation agenda. In addition to enabling regulations and policies for the finance sector, targeted interventions like credit guarantees, matching grant schemes, agricultural insurance, warehouse finance, etc. can help leverage financial services for commercial farms, either directly or through value chain financing.

Recommendation 9: Establish consistent and clear standards and guidelines to support the growth of digital finance and its further application in the agriculture sector

Digital finance has shown great potential for promoting financial inclusion and agricultural finance by providing a wide spectrum of financial services, ranging from credit, saving, insurance and value chain finance through digital initiatives. Regulatory frameworks need to support continuous innovation of the market without imposing overly restrictive entry and operations requirements, while at the same time managing potential risks to ensure customer protection.

Recommendation 10: Develop information systems that can facilitate the design and provision of agriculture financial services

Critical information includes climate data for agricultural insurance and information on business transactions between producers and buyers for value chain financing. In view of increasing demand for high value and processed food products, basic data on agribusiness SMEs could also help financial institutions to analyze them and provide suitable financial services and products. The establishment of agro-climatic information systems assists financial institutions, insurance companies, policy makers, agribusinesses and farmers to better assess risks, design the right products to address them, and make the necessary investments to promote improved resilience of agriculture to climate risks.

Resilience

Recommendation 11: Governments should invest in and scale up technologies and policies that contribute to sustainable intensification practices and resilient farming systems

Commercializing smallholder farms and linking them to modern value chains can help increase their incomes and assets, and hence strengthen their reserves for coping with risk. But it also exposes them to new financial, production, and marketing risks. There are many things farmers can do to add greater resilience to their livelihoods, such as crop and income diversification, making risk-reducing investments like irrigation, and adopting climate smart farming practices. Policy makers can assist by investing in R&D on climate smart agriculture, promoting the development of weather-based agricultural insurance, facilitating the more widespread availability of rural credit and other financial services, and maintaining adequate rural safety nets.

Recommendation 12: Governments need to support the transformation of the agri-food system with policies that can help manage climate and market induced shocks

Production shocks have repercussions along value chains, affecting the supply and prices of foods, the viability of many SMEs, and the welfare of many poor people. To build greater resilience into national food systems, governments should also consider policies that can help stabilize national food supplies and prices, such as maintaining an adequate national food reserve for emergencies, freeing up food markets to greater regional and international trade, and buying up surplus food in low price years for school feeding programs.

Implementation

Recommendation 13: In implementing agricultural strategies, focus on some initial first movers as an entry point to gain early traction and impact

Given the practical realties of weak public institutions and sparse infrastructure in many countries, a first mover strategy that prioritizes specific segments of the agri-food system for early development can make a lot of sense. These might range from a carefully prioritized national agricultural transformation agenda (as in Ethiopia and Rwanda), to the targeted development of specific value chains, to spatial initiatives like agro-corridors, agro-clusters, agro-industrial parks, and agro-based special economic zones. First mover approaches provide platforms that enable relevant public and private sector players to come together to better serve groups of smallholder farms, while enabling public and private investments in infrastructure and supporting services to achieve critical levels.

Last word

While the way forward seems clear, a real challenge is to find ways of convincing more African governments to actually commit to an inclusive transformation agenda built around smallholders and SMEs. The past is not too encouraging. Africa missed a huge opportunity for inclusive growth by not doing more to increase the productivity of its smallholder-dominated food staples. Most African governments simply underinvested in agriculture. On average, some have never spent much more than 5% of their total budgets on agriculture, compared to 15–20% in Asian countries at the time of their Green Revolution, and compared to the 10% goal set through the CAADP process. Even when a smallholder development agenda has been pursued, there has been a tendency for governments to rely too much on new technologies while ignoring the enabling policy environment that is required if farmers are to have incentive to adopt those technologies (Haggblade, Hazell, & Kisamba-Mugerwa, 2010).

Some countries have benefited from high-level political leadership to drive successful agricultural transformations, as is happening in Rwanda and Ethiopia today. But more generally, there has been little political voice to rally and sustain public support for agricultural development, especially in more democratic countries. Smallholder farmers are simply not organized to have much voice in the political agenda.

Is there a basis for hope in the future? The CAADP process is helping bring some political pressure on governments, and its peer review process is an encouraging step in motivating countries to do more. Several key donor agencies are also backing agricultural development again after a long respite. A focus on first mover strategies that lead to quick and visible successes might also help develop greater political momentum in support of agriculture. But perhaps the best hope lies in the ongoing changes in Africa's food system that are creating a wealth of new opportunities not only for farmers, but also for a growing agribusiness sector. The sheer size of these opportunities (estimated by the World Bank to reach a trillion dollars a year by 2030) may be large enough to spark a new political dynamic built on complementary public and private sector interests, leading to new investments and partnerships and supporting policies.

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Agricultural Data

Technical notes

The following conventions are used in the Tables:

0 or 0.0 = nil or negligible
.. or () data not available or missing

Sources of data as follows:

Population, total (millions)
Source: World Development Indicators, World Bank

Rural Population (% of total population)
Source: World Development Indicators, World Bank

Urban population (% of total)
Source: World Development Indicators, World Bank

GDP per Capita (current US$)
Source: World Development Indicators, World Bank

Agriculture Value Added (annual % growth)
Source: World Development Indicators, World Bank

Spending, Total (As a Share of Agriculture GDP %)
Source: ASTI (Agricultural Science and Technology Indicators) http://www.asti.cgiar.org/

Cereal Yield (kg per hectare)
Source: World Development Indicators, World Bank

Crop Production Index (2004-2006 = 100)
Source: World Development Indicators, World Bank

Fertilizer Consumption (kg per hectare of arable land)
Source: World Development Indicators, World Bank

Agriculture Value Added per Hectare of Agricultural Land
Source: Regional Strategic Analysis and Knowledge Support System (ReSAKSS)

Government Agriculture Expenditure (% of Agriculture Value Added)
Source: Regional Strategic Analysis and Knowledge Support System (ReSAKSS)

Researchers Government (FTEs)
Source: ASTI (Agricultural Science and Technology Indicators) http://www.asti.cgiar.org/

Agriculture Expenditure (% Share of Total Expenditure)
Source:Regional Strategic Analysis and Knowledge Support System (ReSAKSS)

Population, Total (in millions)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Angola	17.0	17.6	18.2	18.9	19.6	20.3	21.0	21.8	22.5	23.4	24.2	25.1	26.0	26.9	27.9	28.8
Benin	7.1	7.3	7.5	7.8	8.0	8.2	8.5	8.7	8.9	9.2	9.5	9.7	10.0	10.3	10.6	10.9
Botswana	1.8	1.8	1.8	1.8	1.9	1.9	1.9	1.9	2.0	2.0	2.1	2.1	2.1	2.2	2.2	2.3
Burkina Faso	11.9	12.3	12.7	13.0	13.4	13.8	14.3	14.7	15.1	15.6	16.1	16.6	17.1	17.6	18.1	18.6
Burundi	6.6	6.7	7.0	7.2	7.4	7.7	7.9	8.2	8.5	8.8	9.0	9.3	9.6	9.9	10.2	10.5
Cabo Verde	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cameroon	15.7	16.1	16.5	17.0	17.4	17.9	18.4	18.9	19.4	20.0	20.5	21.1	21.7	22.2	22.8	23.4
Central African Republic	3.8	3.9	4.0	4.1	4.1	4.2	4.3	4.3	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.6
Chad	8.7	9.0	9.4	9.7	10.1	10.4	10.8	11.1	11.5	11.9	12.3	12.7	13.1	13.6	14.0	14.5
Comoros	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8
Congo, Dem. Rep.	48.4	49.8	51.4	53.0	54.8	56.5	58.4	60.4	62.4	64.5	66.7	69.0	71.3	73.7	76.2	78.7
Congo, Rep.	3.3	3.4	3.5	3.6	3.7	3.8	4.0	4.1	4.3	4.4	4.5	4.6	4.8	4.9	5.0	5.1
Cote d'Ivoire	17.0	17.4	17.7	18.0	18.3	18.7	19.1	19.5	19.9	20.4	20.9	21.4	22.0	22.5	23.1	23.7
Equatorial Guinea	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.2	1.2
Eritrea	3.5	3.6	3.7	3.9	4.0	4.1	4.2	4.2	4.3	4.4	4.5	..	..	..	..	..
Ethiopia	68.5	70.5	72.5	74.6	76.7	78.9	81.0	83.2	85.4	87.7	90.0	92.4	94.9	97.4	99.9	102.4
Gabon	1.3	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.6	1.6	1.7	1.8	1.8	1.9	1.9	2.0
Gambia, The	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.6	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.0
Ghana	19.4	19.9	20.4	21.0	21.5	22.1	22.7	23.3	23.9	24.5	25.1	25.7	26.3	27.0	27.6	28.2
Guinea	9.0	9.1	9.3	9.5	9.7	9.9	10.1	10.3	10.6	10.8	11.0	11.3	11.5	11.8	12.1	12.4
Guinea-Bissau	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.8	1.8
Kenya	32.3	33.2	34.1	35.1	36.0	37.1	38.1	39.1	40.2	41.4	42.5	43.6	44.8	46.0	47.2	48.5
Lesotho	1.9	1.9	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.2	2.2
Liberia	3.0	3.1	3.1	3.2	3.3	3.4	3.5	3.7	3.8	3.9	4.1	4.2	4.3	4.4	4.5	4.6

Madagascar	16.3	16.8	17.3	17.8	18.3	18.9	19.4	20.0	20.6	21.2	21.7	22.3	23.0	23.6	24.2	24.9
Malawi	11.7	12.0	12.3	12.7	13.0	13.4	13.8	14.3	14.7	15.2	15.6	16.1	16.6	17.1	17.6	18.1
Mali	11.3	11.6	12.0	12.4	12.8	13.2	13.7	14.1	14.6	15.1	15.5	16.0	16.5	17.0	17.5	18.0
Mauritania	2.8	2.9	3.0	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.1	4.2	4.3
Mauritius	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Mozambique	18.6	19.1	19.7	20.3	20.9	21.5	22.2	22.8	23.5	24.2	24.9	25.7	26.4	27.2	28.0	28.8
Namibia	1.9	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.2	2.2	2.3	2.3	2.4	2.4	2.5
Niger	11.8	12.2	12.7	13.1	13.6	14.1	14.7	15.2	15.8	16.4	17.1	17.7	18.4	19.1	19.9	20.7
Nigeria	125.5	128.7	132.0	135.4	138.9	142.6	146.4	150.3	154.4	158.6	162.9	167.3	171.8	176.5	181.2	186.0
Rwanda	8.3	8.5	8.7	8.8	9.0	9.2	9.4	9.7	10.0	10.2	10.5	10.8	11.1	11.3	11.6	11.9
Sao Tome and Principe	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Senegal	10.1	10.4	10.7	11.0	11.3	11.6	11.9	12.2	12.6	12.9	13.3	13.7	14.1	14.5	15.0	15.4
Seychelles	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Sierra Leone	4.7	5.0	5.2	5.4	5.7	5.8	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4
Somalia	9.3	9.6	9.8	10.1	10.4	10.7	11.0	11.4	11.7	12.1	12.4	12.8	13.1	13.5	13.9	14.3
South Africa	45.3	45.9	46.4	47.0	47.6	48.2	48.9	49.6	50.3	51.0	51.7	52.5	53.3	54.1	55.0	55.9
South Sudan	7.0	7.2	7.5	7.8	8.1	8.5	8.9	9.3	9.7	10.1	10.4	10.8	11.2	11.5	11.9	12.2
Sudan	27.9	28.7	29.4	30.2	30.9	31.6	32.3	33.0	33.7	34.4	35.2	36.0	36.8	37.7	38.6	39.6
Swaziland	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3
Tanzania	35.1	36.1	37.1	38.2	39.4	40.6	41.9	43.3	44.7	46.1	47.6	49.1	50.6	52.2	53.9	55.6
Togo	5.1	5.3	5.4	5.5	5.7	5.8	6.0	6.2	6.3	6.5	6.7	6.9	7.0	7.2	7.4	7.6
Uganda	24.9	25.7	26.6	27.6	28.5	29.6	30.6	31.7	32.8	33.9	35.1	36.3	37.6	38.8	40.1	41.5
Zambia	10.8	11.1	11.4	11.7	12.1	12.4	12.7	13.1	13.5	13.9	14.3	14.7	15.2	15.6	16.1	16.6
Zimbabwe	12.4	12.5	12.6	12.8	12.9	13.1	13.3	13.6	13.8	14.1	14.4	14.7	15.1	15.4	15.8	16.2

Source: World Development Indicators

Rural Population (% of Rural Population)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sub-Saharan Africa	68.8	68.4	68.0	67.6	67.1	66.7	66.2	65.7	65.3	64.8	64.3	63.8	63.3	62.8	62.2	61.7
Angola	66.8	66.1	65.4	64.6	63.8	63.1	62.3	61.5	60.7	59.9	59.1	58.3	57.5	56.7	56.0	55.2
Benin	61.4	61.0	60.7	60.4	60.0	59.7	59.3	58.9	58.5	58.1	57.7	57.3	56.9	56.5	56.1	55.6
Botswana	45.9	45.6	45.4	45.2	44.9	44.7	44.5	44.2	44.0	43.8	43.5	43.3	43.1	42.8	42.6	42.3
Burkina Faso	81.5	80.7	80.0	79.2	78.5	77.7	76.8	76.0	75.2	74.3	73.5	72.7	71.8	71.0	70.1	69.3
Burundi	91.5	91.3	91.1	90.9	90.6	90.4	90.1	89.9	89.6	89.4	89.1	88.8	88.5	88.2	87.9	87.6
Cabo Verde	45.7	44.9	44.0	43.2	42.3	41.5	40.6	39.8	39.0	38.2	37.4	36.6	35.9	35.2	34.5	33.8
Cameroon	53.9	53.3	52.7	52.1	51.5	50.9	50.3	49.7	49.1	48.5	47.9	47.3	46.8	46.2	45.6	45.1
Central African Republic	62.3	62.2	62.1	62.0	61.9	61.8	61.7	61.5	61.4	61.2	61.0	60.7	60.5	60.2	60.0	59.7
Chad	78.3	78.3	78.3	78.2	78.2	78.2	78.1	78.1	78.1	78.0	78.0	77.9	77.8	77.7	77.5	77.4
Comoros	72.0	72.0	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.0	72.0	71.9	71.8	71.7	71.6
Congo, Dem. Rep.	64.4	63.9	63.5	63.0	62.5	62.0	61.6	61.1	60.6	60.1	59.6	59.1	58.5	58.0	57.5	57.0
Congo, Rep.	40.8	40.4	39.9	39.5	39.0	38.6	38.1	37.7	37.2	36.8	36.3	35.9	35.5	35.0	34.6	34.2
Cote d'Ivoire	55.8	55.1	54.5	53.8	53.2	52.5	51.7	51.0	50.2	49.4	48.7	48.0	47.2	46.5	45.8	45.1
Equatorial Guinea	61.2	61.2	61.2	61.2	61.1	61.1	61.0	61.0	60.9	60.8	60.7	60.5	60.4	60.2	60.1	59.9
Eritrea	82.2	82.0	81.7	81.4	81.1	80.8	80.5	80.1	79.8	79.4	79.0	..	..	..	..	..
Ethiopia	85.1	84.9	84.7	84.5	84.3	84.1	83.9	83.5	83.1	82.7	82.3	81.8	81.4	81.0	80.5	80.1
Gabon	19.2	18.4	17.8	17.2	16.6	16.0	15.6	15.1	14.7	14.3	14.0	13.6	13.3	13.1	12.8	12.6
Gambia, The	51.2	50.3	49.4	48.5	47.7	46.8	46.0	45.2	44.4	43.7	43.0	42.3	41.6	41.0	40.4	39.8
Ghana	55.4	54.7	54.0	53.4	52.7	52.0	51.3	50.6	50.0	49.3	48.6	47.9	47.3	46.6	46.0	45.3
Guinea	68.6	68.3	67.9	67.6	67.2	66.8	66.4	66.0	65.6	65.1	64.7	64.3	63.8	63.3	62.8	62.3
Guinea-Bissau	62.5	61.7	60.8	60.0	59.1	58.3	57.4	56.5	55.7	54.8	53.9	53.1	52.3	51.5	50.7	49.9
Kenya	79.8	79.4	79.1	78.7	78.3	78.0	77.6	77.2	76.8	76.4	76.0	75.6	75.2	74.8	74.4	73.9
Lesotho	79.9	79.4	78.9	78.3	77.8	77.2	76.7	76.2	75.7	75.2	74.7	74.2	73.7	73.2	72.7	72.2

Liberia	55.3	55.0	54.6	54.3	53.9	53.6	53.3	52.9	52.6	52.2	51.8	51.5	51.1	50.7	50.3	49.9
Madagascar	72.6	72.3	72.1	71.8	71.2	70.6	70.0	69.3	68.7	68.1	67.4	66.8	66.2	65.5	64.9	64.3
Malawi	85.3	85.2	85.1	85.0	84.9	84.9	84.8	84.7	84.6	84.5	84.3	84.2	84.1	83.9	83.7	83.5
Mali	70.9	70.2	69.5	68.7	67.9	67.2	66.4	65.6	64.8	64.0	63.2	62.4	61.6	60.9	60.1	59.3
Mauritania	50.0	49.2	48.4	47.6	46.9	46.1	45.4	44.7	44.0	43.3	42.7	42.0	41.4	40.7	40.1	39.6
Mauritius	57.5	57.8	58.0	58.2	58.4	58.6	58.8	59.0	59.2	59.4	59.6	59.8	60.0	60.2	60.3	60.5
Mozambique	70.7	70.5	70.4	70.2	70.0	69.8	69.6	69.5	69.3	69.0	68.8	68.6	68.3	68.1	67.8	67.5
Namibia	67.1	66.2	65.3	64.3	63.4	62.4	61.4	60.4	59.4	58.4	57.4	56.3	55.3	54.3	53.3	52.4
Niger	83.7	83.6	83.5	83.4	83.3	83.1	83.0	82.8	82.6	82.4	82.2	82.0	81.8	81.5	81.3	81.0
Nigeria	64.3	63.5	62.6	61.8	60.9	60.1	59.2	58.3	57.4	56.5	55.6	54.8	53.9	53.1	52.2	51.4
Rwanda	84.2	83.2	82.4	81.6	80.7	79.8	78.9	78.0	77.0	76.0	75.1	74.1	73.1	72.2	71.2	70.2
Sao Tome and Principe	45.6	44.7	43.8	42.9	42.0	41.2	40.3	39.6	38.8	38.1	37.4	36.7	36.1	35.5	34.9	34.4
Senegal	59.5	59.4	59.2	59.1	58.9	58.7	58.5	58.3	58.0	57.8	57.5	57.2	56.9	56.6	56.3	55.9
Seychelles	49.7	49.5	49.4	49.2	48.9	48.7	48.5	48.2	48.0	47.7	47.4	47.1	46.8	46.4	46.1	45.8
Sierra Leone	64.1	63.9	63.6	63.4	63.2	62.9	62.6	62.4	62.1	61.8	61.4	61.1	60.8	60.4	60.1	59.7
Somalia	66.4	66.0	65.6	65.2	64.8	64.4	64.0	63.6	63.2	62.7	62.3	61.8	61.4	60.9	60.4	60.0
South Africa	42.6	42.1	41.6	41.0	40.5	39.9	39.4	38.8	38.3	37.8	37.3	36.7	36.2	35.7	35.2	34.7
South Sudan	83.4	83.2	83.1	83.0	82.8	82.7	82.6	82.4	82.3	82.1	82.0	81.8	81.6	81.4	81.2	81.0
Sudan	67.5	67.4	67.3	67.3	67.2	67.2	67.1	67.1	67.0	66.9	66.8	66.7	66.5	66.4	66.2	66.0
Swaziland	77.4	77.6	77.7	77.8	78.0	78.1	78.2	78.3	78.4	78.5	78.6	78.6	78.7	78.7	78.7	78.7
Tanzania	77.3	77.0	76.4	75.8	75.2	74.5	73.9	73.2	72.6	71.9	71.2	70.5	69.8	69.1	68.4	67.7
Togo	66.6	66.2	65.7	65.3	64.8	64.4	63.9	63.4	62.9	62.5	62.0	61.5	61.0	60.5	60.0	59.5
Uganda	87.8	87.7	87.5	87.2	87.0	86.7	86.4	86.1	85.8	85.5	85.2	84.9	84.6	84.2	83.9	83.6
Zambia	65.0	64.6	64.2	63.8	63.4	63.0	62.5	62.1	61.7	61.3	60.8	60.4	60.0	59.5	59.1	58.6
Zimbabwe	65.8	65.4	65.5	65.7	65.9	66.1	66.3	66.4	66.6	66.8	67.0	67.2	67.3	67.5	67.6	67.7

Source: World Development Indicators, World Bank

Urban population (% of total)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sub-Saharan Africa	31.2	31.6	32.0	32.4	32.9	33.3	33.8	34.3	34.7	35.2	35.7	36.2	36.7	37.2	37.8	38.3
Angola	33.2	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.1	40.9	41.7	42.5	43.3	44.1	44.8
Benin	38.7	39.0	39.3	39.6	40.0	40.3	40.7	41.1	41.5	41.9	42.3	42.7	43.1	43.5	44.0	44.4
Botswana	54.1	54.4	54.6	54.8	55.1	55.3	55.5	55.8	56.0	56.2	56.5	56.7	56.9	57.2	57.4	57.7
Burkina Faso	18.5	19.3	20.0	20.8	21.5	22.3	23.2	24.0	24.8	25.7	26.5	27.3	28.2	29.0	29.9	30.7
Burundi	8.5	8.7	8.9	9.1	9.4	9.6	9.9	10.1	10.4	10.6	10.9	11.2	11.5	11.8	12.1	12.4
Cabo Verde	54.3	55.1	56.0	56.8	57.7	58.5	59.4	60.2	61.0	61.8	62.6	63.4	64.1	64.8	65.5	66.2
Cameroon	46.1	46.7	47.3	47.9	48.5	49.1	49.7	50.3	50.9	51.5	52.1	52.7	53.3	53.8	54.4	54.9
Central African Republic	37.7	37.8	37.9	38.0	38.1	38.2	38.3	38.5	38.6	38.8	39.0	39.3	39.5	39.8	40.0	40.3
Chad	21.7	21.7	21.7	21.8	21.8	21.8	21.9	21.9	21.9	22.0	22.0	22.1	22.2	22.3	22.5	22.6
Comoros	28.0	28.0	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	28.0	28.0	28.1	28.2	28.3	28.4
Congo, Dem. Rep.	35.6	36.1	36.5	37.0	37.5	38.0	38.4	38.9	39.4	39.9	40.4	41.0	41.5	42.0	42.5	43.0
Congo, Rep.	59.2	59.6	60.1	60.5	61.0	61.4	61.9	62.3	62.8	63.2	63.7	64.1	64.5	65.0	65.4	65.8
Cote d'Ivoire	44.2	44.9	45.5	46.2	46.8	47.5	48.3	49.0	49.8	50.6	51.3	52.0	52.8	53.5	54.2	54.9
Equatorial Guinea	38.8	38.8	38.8	38.8	38.9	38.9	39.0	39.0	39.1	39.2	39.3	39.5	39.6	39.8	39.9	40.1
Eritrea	17.8	18.0	18.3	18.6	18.9	19.2	19.5	19.9	20.2	20.6	21.0	..	..	..	..	..
Ethiopia	14.9	15.1	15.3	15.5	15.7	15.9	16.1	16.5	16.9	17.3	17.7	18.2	18.6	19.0	19.5	19.9
Gabon	80.9	81.6	82.2	82.8	83.4	84.0	84.4	84.9	85.3	85.7	86.0	86.4	86.7	86.9	87.2	87.4
Gambia, The	48.8	49.7	50.6	51.5	52.3	53.2	54.0	54.8	55.6	56.3	57.0	57.7	58.4	59.0	59.6	60.2
Ghana	44.6	45.3	46.0	46.6	47.3	48.0	48.7	49.4	50.0	50.7	51.4	52.1	52.7	53.4	54.0	54.7
Guinea	31.4	31.7	32.1	32.4	32.8	33.2	33.6	34.0	34.4	34.9	35.3	35.7	36.2	36.7	37.2	37.7
Guinea-Bissau	37.5	38.3	39.2	40.0	40.9	41.7	42.6	43.5	44.3	45.2	46.1	46.9	47.7	48.6	49.3	50.1
Kenya	20.2	20.6	20.9	21.3	21.7	22.0	22.4	22.8	23.2	23.6	24.0	24.4	24.8	25.2	25.6	26.1
Lesotho	20.1	20.6	21.1	21.7	22.2	22.8	23.3	23.8	24.3	24.8	25.3	25.8	26.3	26.8	27.3	27.8

Liberia	44.7	45.0	45.4	45.7	46.1	46.4	46.7	47.1	47.4	47.8	48.2	48.5	48.9	49.3	49.7	50.1
Madagascar	27.4	27.7	27.9	28.2	28.8	29.4	30.0	30.7	31.3	31.9	32.6	33.2	33.8	34.5	35.1	35.7
Malawi	14.7	14.8	14.9	15.0	15.1	15.1	15.2	15.3	15.4	15.5	15.7	15.8	15.9	16.1	16.3	16.5
Mali	29.1	29.8	30.5	31.3	32.1	32.8	33.6	34.4	35.2	36.0	36.8	37.6	38.4	39.1	39.9	40.7
Mauritania	50.0	50.8	51.6	52.4	53.1	53.9	54.6	55.3	56.0	56.7	57.3	58.0	58.6	59.3	59.9	60.4
Mauritius	42.5	42.3	42.0	41.8	41.6	41.4	41.2	41.0	40.8	40.6	40.4	40.2	40.0	39.8	39.7	39.5
Mozambique	29.3	29.5	29.6	29.8	30.0	30.2	30.4	30.5	30.7	31.0	31.2	31.4	31.7	31.9	32.2	32.5
Namibia	32.9	33.8	34.7	35.7	36.6	37.6	38.6	39.6	40.6	41.6	42.6	43.7	44.7	45.7	46.7	47.6
Niger	16.3	16.4	16.5	16.6	16.7	16.9	17.0	17.2	17.4	17.6	17.8	18.0	18.2	18.5	18.7	19.0
Nigeria	35.7	36.5	37.4	38.2	39.1	39.9	40.8	41.7	42.6	43.5	44.4	45.2	46.1	46.9	47.8	48.6
Rwanda	15.8	16.8	17.6	18.4	19.3	20.2	21.1	22.0	23.0	24.0	24.9	25.9	26.9	27.8	28.8	29.8
Sao Tome and Principe	54.4	55.3	56.3	57.1	58.0	58.8	59.7	60.4	61.2	61.9	62.6	63.3	63.9	64.5	65.1	65.6
Senegal	40.5	40.6	40.8	40.9	41.1	41.3	41.5	41.7	42.0	42.2	42.5	42.8	43.1	43.4	43.7	44.1
Seychelles	50.3	50.5	50.6	50.8	51.1	51.3	51.5	51.8	52.0	52.3	52.6	52.9	53.2	53.6	53.9	54.2
Sierra Leone	35.9	36.1	36.4	36.6	36.8	37.1	37.4	37.6	37.9	38.2	38.6	38.9	39.2	39.6	39.9	40.3
Somalia	33.6	34.0	34.4	34.8	35.2	35.6	36.0	36.4	36.8	37.3	37.7	38.2	38.6	39.1	39.6	40.0
South Africa	57.4	57.9	58.4	59.0	59.5	60.1	60.6	61.2	61.7	62.2	62.7	63.3	63.8	64.3	64.8	65.3
South Sudan	16.6	16.8	16.9	17.0	17.2	17.3	17.4	17.6	17.7	17.9	18.0	18.2	18.4	18.6	18.8	19.0
Sudan	32.5	32.6	32.7	32.7	32.8	32.8	32.9	32.9	33.0	33.1	33.2	33.3	33.5	33.6	33.8	34.0
Swaziland	22.6	22.4	22.3	22.2	22.0	21.9	21.8	21.7	21.6	21.5	21.4	21.4	21.3	21.3	21.3	21.3
Tanzania	22.7	23.0	23.6	24.2	24.8	25.5	26.1	26.8	27.4	28.1	28.8	29.5	30.2	30.9	31.6	32.3
Togo	33.4	33.8	34.3	34.7	35.2	35.6	36.1	36.6	37.1	37.5	38.0	38.5	39.0	39.5	40.0	40.5
Uganda	12.2	12.3	12.5	12.8	13.0	13.3	13.6	13.9	14.2	14.5	14.8	15.1	15.4	15.8	16.1	16.4
Zambia	35.0	35.4	35.8	36.2	36.6	37.0	37.5	37.9	38.3	38.7	39.2	39.6	40.0	40.5	40.9	41.4
Zimbabwe	34.2	34.6	34.5	34.3	34.1	33.9	33.7	33.6	33.4	33.2	33.0	32.8	32.7	32.5	32.4	32.3

Source: World Development Indicators, World Bank

GDP per capita (current US$)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sub-Saharan Africa	498	520	647	783	897	1.020	1.154	1.283	1.198	1.552	1.700	1.735	1.778	1.814	1.592	1.450
Angola	526	711	779	1.041	1.444	2.062	2.879	3.869	3.348	3.529	4.299	4.598	4.805	4.709	3.696	3.111
Benin	379	419	519	583	602	626	706	820	793	758	826	838	915	944	784	789
Botswana	3.128	3.056	4.163	4.897	5.351	5.375	5.714	5.623	5.186	6.346	7.645	7.029	7.008	7.498	6.532	6.788
Burkina Faso	235	261	332	371	407	423	475	570	553	575	667	674	699	705	616	650
Burundi	134	122	113	127	151	166	171	196	205	231	260	265	283	313	304	286
Cabo Verde	1.269	1.374	1.769	1.976	2.048	2.304	3.112	3.639	3.445	3.313	3.670	3.408	3.559	3.530	2.954	2.998
Cameroon	615	676	825	930	952	1.003	1.111	1.234	1.203	1.183	1.296	1.256	1.365	1.441	1.244	1.033
Central African Republic	243	254	286	313	327	348	397	457	450	446	494	486	337	377	348	382
Chad	197	221	293	455	660	712	802	930	804	897	989	973	986	1.026	777	664
Comoros	396	433	545	616	622	648	721	796	779	769	830	789	834	853	728	775
Congo, Dem. Rep.	154	175	174	194	219	253	280	318	293	318	357	398	421	462	475	445
Congo, Rep.	843	886	998	1.289	1.637	2.012	2.111	2.882	2.255	2.737	3.197	2.952	2.965	2.911	1.712	1.528
Cote d'Ivoire	657	711	866	920	932	952	1.066	1.242	1.218	1.220	1.215	1.262	1.424	1.570	1.421	1.526
Equatorial Guinea	2.284	2.711	3.577	6.085	10.851	12.732	15.762	22.742	16.530	17.136	21.452	21.558	20.247	19.003	10.347	8.333
Eritrea	215	202	233	287	277	298	317	326	431	482	583	..	..	..	..	..
Ethiopia	120	111	119	136	162	194	243	325	380	341	355	469	502	571	645	707
Gabon	3.976	4.103	4.892	5.686	6.741	7.028	8.353	10.094	7.604	8.754	10.716	9.774	9.680	9.692	7.389	7.179
Gambia, The	541	441	360	414	432	439	519	608	549	563	518	506	486	443	475	473
Ghana	274	309	373	423	498	923	1.091	1.224	1.087	1.313	1.575	1.630	1.814	1.432	1.361	1.513
Guinea	316	323	370	386	303	297	409	437	437	439	459	502	540	561	554	508
Guinea-Bissau	309	321	361	393	425	419	481	584	544	544	693	608	611	643	597	620
Kenya	402	396	437	459	520	697	839	917	920	967	987	1.155	1.229	1.335	1.350	1.455
Lesotho	438	408	604	782	863	916	918	934	923	1.173	1.352	1.282	1.196	1.175	1.074	998
Liberia	174	177	133	149	169	179	210	232	303	327	380	415	454	458	452	455

Madagascar	279	262	317	245	275	292	378	471	416	413	455	444	462	452	402	401
Malawi	147	291	260	274	280	298	320	373	421	459	512	375	333	355	363	301
Mali	307	334	392	439	488	522	596	690	697	708	835	777	778	826	730	781
Mauritania	464	461	529	603	698	944	1.013	1.168	1.047	1.203	1.393	1.364	1.451	1.327	1.158	1.078
Mauritius	3.792	3.958	4.623	5.230	5.116	5.696	6.575	8.030	7.318	8.000	9.197	9.291	9.637	10.154	9.252	9.628
Mozambique	256	263	284	336	369	386	422	503	464	419	527	566	606	623	528	382
Namibia	1.834	1.713	2.482	3.288	3.573	3.881	4.203	4.029	4.153	5.192	5.601	5.749	5.488	5.421	4.738	4.140
Niger	165	178	216	233	250	258	293	355	341	348	376	392	416	431	359	363
Nigeria	352	459	513	649	808	1.020	1.137	1.384	1.098	2.327	2.528	2.755	2.997	3.222	2.655	2.178
Rwanda	201	197	213	237	287	342	405	501	539	563	617	678	689	707	710	703
Sao Tome and Principe	510	556	649	693	811	844	894	1.126	1.100	1.130	1.304	1.381	1.620	1.822	1.625	1.756
Senegal	481	513	643	733	774	810	950	1.100	1.021	1.002	1.080	1.036	1.049	1.052	909	958
Seychelles	7.663	8.331	8.525	10.177	11.093	12.014	12.155	11.123	9.707	10.805	12.189	12.845	15.687	15.571	15.390	15.076
Sierra Leone	228	250	264	263	288	322	359	406	395	405	445	562	711	708	588	496
Somalia	..	..	..	..	..	..	..	..	..	..	..	..	408	418	426	434
South Africa	2.682	2.518	3.776	4.864	5.415	5.632	6.125	5.787	5.889	7.363	8.050	7.548	6.877	6.480	5.770	5.274
South Sudan	..	..	..	..	..	..	..	1.679	1.265	1.562	1.706	958	1.186	1.152	759	..
Sudan	378	412	478	565	680	894	1.116	1.292	1.227	1.476	1.667	1.893	1.956	2.177	2.514	2.415
Swaziland	1.438	1.325	2.021	2.530	2.874	2.937	3.047	2.842	3.033	3.690	3.934	3.852	3.599	3.464	3.137	2.775
Tanzania	304	308	323	345	442	472	528	651	659	702	733	820	902	950	872	879
Togo	261	281	310	350	372	377	421	513	500	488	562	564	579	620	551	578
Uganda	235	240	238	288	316	336	402	450	647	595	584	648	662	719	694	615
Zambia	378	377	429	530	691	1.030	1.105	1.369	1.139	1.463	1.645	1.735	1.851	1.738	1.314	1.178
Zimbabwe	548	507	453	454	445	415	397	326	606	714	839	956	1.011	1.027	1.019	1.009

Source: World Development Indicators, World Bank

Agriculture, value added (annual % growth)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sub-Saharan Africa	4.2	16.5	3.1	3.9	5.5	5.0	4.2	5.3	3.1	4.7	3.0	6.0	3.0	4.2	3.2	2.8
Angola	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Benin	6.1	5.0	2.4	8.6	-0.2	6.4	4.8	2.0	4.7	-1.9	2.0	3.1	4.8	5.4	-7.2	4.4
Botswana	11.2	-20.5	20.1	0.5	-2.5	13.3	12.2	2.0	6.4	5.8	0.2	-8.5	1.3	-0.4	0.3	..
Burkina Faso	11.0	5.8	7.4	-3.4	10.5	4.0	-4.3	19.6	-9.3	11.5	-3.2	7.8	2.8	2.1	-0.9	4.9
Burundi	-3.4	4.2	-3.5	-0.2	-6.6	3.1	-8.8	-2.1	3.0	3.9	4.4	5.4	1.0	3.3	5.5	-10.7
Cabo Verde	-8.3	-3.3	2.0	6.1	-3.8	0.3	41.8	2.6	7.6	-4.1	4.1	6.8	-13.7	-0.2	2.8	7.3
Cameroon	3.7	3.7	3.5	4.4	2.7	3.0	5.9	5.2	2.9	6.0	3.1	2.7	3.7	4.7	5.3	..
Central African Republic	10.3	2.2	-1.0	6.8	-3.4	4.3	2.4	1.9	-0.9	2.0	6.5	2.7	-45.4	-6.2	3.5	5.7
Chad	..	..	..	..	..	..	..	-4.9	-3.1	16.1	-7.6	11.8	-2.1	6.4	10.1	-6.0
Comoros	5.3	2.7	2.9	2.7	3.0	2.6	2.3	8.3	-3.1	-0.7	4.1	4.1	4.1	2.0	..	..
Congo, Dem. Rep.	-1.5	-3.6	0.7	1.6	0.5	5.6	2.8	2.8	2.8	3.0	3.0	3.0	3.2	5.8	4.7	3.3
Congo, Rep.	8.0	8.6	6.3	4.8	4.4	5.4	5.0	5.6	-3.2	6.3	8.4	5.6	8.0	8.1	5.2	5.4
Cote d'Ivoire	..	..	..	..	..	..	..	..	-2.9	-4.1	7.2	-2.7	6.9	13.2	2.8	0.8
Equatorial Guinea	..	..	..	..	..	..	6.6	-21.1	-8.7	18.5	11.6	8.1	7.8	6.3	5.9	2.6
Eritrea	29.1	-7.5	-11.9	-3.2	69.6	8.8	1.3	-43.5	3.6	..	..	..	..	..	..	..
Ethiopia	9.6	-1.9	-10.5	16.9	13.5	10.9	9.4	7.5	6.4	5.1	9.0	4.9	7.1	5.4	6.4	2.3
Gabon	3.0	-3.6	1.2	-0.5	4.5	11.5	5.6	-6.8	-7.0	-5.2	2.3	4.7	4.5	9.7	8.2	11.9
Gambia, The	8.6	-18.1	19.5	6.7	-2.3	-14.6	-1.8	26.0	11.7	11.2	-24.2	6.2	-1.8	-7.1	7.0	-12.2
Ghana	..	..	..	..	..	..	-1.7	7.4	7.2	5.3	0.8	2.3	5.7	4.6	2.5	3.6
Guinea	5.9	4.2	3.5	3.2	1.3	3.9	2.8	3.6	3.2	3.2	4.7	4.3	7.4	2.1	0.6	4.0
Guinea-Bissau	1.6	-0.3	4.4	-1.7	12.4	-1.1	2.5	3.9	3.6	0.7	9.6	-0.1	3.0	..	..	..
Kenya	11.7	-3.5	2.4	1.7	6.9	1.7	5.1	-5.0	-2.3	10.1	2.4	3.1	5.4	4.3	5.5	4.0
Lesotho	12.9	-29.4	3.4	-0.9	1.4	-10.3	-0.9	19.4	5.4	-5.3	5.3	-3.4	21.6	-4.8	-7.2	..

Liberia	5.5	-2.0	-29.8	-14.9	3.1	4.2	7.3	10.5	5.3	3.6	3.9	1.9	2.6	-0.6	0.1	-1.4
Madagascar	4.0	-1.3	1.3	3.1	2.5	2.1	2.2	2.9	8.5	-3.4	0.7	1.5	-6.1	3.3	-0.9	1.6
Malawi	-6.0	5.9	3.3	3.6	-9.3	-4.6	7.4	3.5	4.0	6.8	4.3	-0.1	6.6	5.9	-2.0	-2.3
Mali	11.4	-3.7	14.6	-2.3	7.6	4.2	3.4	11.4	3.1	10.5	-1.3	8.2	-2.1	8.8	6.9	2.1
Mauritania	0.9	-3.1	4.3	-3.2	8.2	-0.0	9.7	8.0	1.3	5.2	-2.2	7.5	-1.0	2.2	5.9	3.5
Mauritius	7.0	-16.3	1.6	8.1	-5.4	15.5	-2.2	2.7	10.2	-0.4	3.5	1.1	0.5	3.7	-0.3	..
Mozambique	10.1	11.6	5.4	5.0	6.8	10.5	8.5	7.0	5.1	5.2	4.2	2.0	1.9	3.7	3.1	2.6
Namibia	-6.6	9.4	4.5	0.6	4.6	-1.1	-14.0	-15.9	17.7	4.9	-1.3	2.0	-11.4	5.5	-7.4	..
Niger	..	..	..	..	..	..	4.6	16.2	-9.5	15.8	-3.0	14.9	-0.5	9.0	3.3	..
Nigeria	3.9	55.2	7.0	6.3	7.1	7.4	7.2	6.3	5.9	5.8	2.9	6.7	2.9	4.3	3.7	4.1
Rwanda	8.9	16.9	-3.1	1.8	6.5	2.7	2.6	6.5	7.7	5.0	4.7	6.5	3.3	6.6	5.0	3.9
Sao Tome and Principe	..	0.0	2.5	3.7	1.6	5.9	2.7	8.6	3.8	0.7	3.0	1.6	-0.4	4.0	2.2	..
Senegal	1.3	-22.2	17.8	2.4	11.0	-8.4	-5.8	19.5	13.0	5.8	-14.8	8.9	1.8	2.4	18.2	9.0
Seychelles	-2.3	1.2	-5.9	-2.9	7.7	-5.4	0.8	4.6	-16.5	-6.2	3.5	-1.0	22.4	-5.6	..	..
Sierra Leone	-37.5	31.7	9.5	8.8	6.8	6.0	13.3	6.7	4.0	3.5	4.9	3.8	4.6	0.8	3.5	3.8
Somalia	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
South Africa	-3.3	6.5	0.7	0.9	2.8	-5.5	3.0	19.4	-1.9	-0.3	2.0	1.8	4.5	6.9	-6.1	-7.8
South Sudan	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sudan	4.6	3.0	-0.2	-2.5	2.2	8.7	-1.4	3.3	-3.0	0.7	7.0	18.2	4.0	-4.1	2.8	5.2
Swaziland	-1.8	3.4	8.5	-12.9	20.1	-3.6	-3.1	9.0	8.2	-12.3	5.8	6.0	12.1	3.4	4.1	-41.0
Tanzania	4.9	5.0	3.2	5.9	7.7	2.4	2.4	7.5	5.1	2.7	3.5	3.2	3.2	3.4	2.3	2.1
Togo	5.6	0.3	-1.6	3.4	10.0	-5.3	2.1	16.3	-26.4	1.4	5.0	10.1	-0.0	14.3	-1.0	8.8
Uganda	7.9	7.1	2.1	1.6	2.0	0.5	0.1	1.3	3.1	2.9	3.3	0.7	2.0	3.0	2.3	3.2
Zambia	-4.1	-3.5	2.8	1.6	-3.6	-1.4	-3.8	-2.7	0.6	-6.0	7.8	3.4	-3.8	1.1	-7.7	..
Zimbabwe	14.0	-24.0	-15.0	-9.0	-5.0	-4.0	-7.0	-39.3	22.0	7.2	1.4	7.8	-2.6	23.0	-5.2	-3.6

Source: World Development Indicators, World Bank

Spending, total (as a share of AgGDP. %)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Benin	0.4	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.4	0.5	0.6	0.4	0.4	0.4
Botswana	5.0	4.4	3.9	4.4	7.4	6.2	5.3	3.8	3.7	3.5	2.9	2.5	3.0	2.9
Burkina Faso	0.6	1.5	1.0	1.3	0.7	0.7	0.8	0.5	0.7	0.7	0.8	0.7	0.9	1.0
Burundi	0.4	0.4	0.5	0.5	0.6	0.7	0.9	0.7	0.8	0.6	0.6	0.5	0.4	0.5
Cabo Verde									1.0	1.1	1.1	1.1	0.9	1.0
Cameroon												0.3	0.3	0.3
Central African Rep.									0.1	0.1	0.2			
Chad									0.1	0.1	0.1	0.1	0.1	0.1
Congo, Dem. Rep.									0.2	0.2	0.2	0.3	0.3	0.3
Congo, Rep.	0.5	0.6	0.6	0.7	0.9	0.9	0.9	1.1	1.0	0.9	1.0	0.6	0.6	0.4
Cote d'Ivoire	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.6	0.6	0.5	0.5	0.6	0.5	0.5
Eritrea	1.4	1.4	1.4	1.1	0.4	0.5	0.4	0.6	0.4	0.4	0.3			
Ethiopia	0.5	0.6	0.6	0.5	0.4	0.3	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.2
Gabon	0.2	0.3	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
Gambia, The	0.9	0.9	1.0	1.1	1.0	1.1	0.9	0.6	0.5	0.3	0.8	1.0	0.7	0.8
Ghana	0.6	0.5	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9	1.0
Guinea	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.4	0.3	0.3
Guinea-Bissau									0.0	0.0	0.0			
Kenya	1.4	1.2	1.1	1.1	1.2	1.4	1.3	1.2	1.1	1.0	0.9	0.9	0.8	0.8

Lesotho	0.7	1.0	1.0	1.1	1.2	1.4	1.4	1.3	1.3	0.9	1.0	1.0	1.2	0.9
Liberia									0.4	0.5	0.5			
Madagascar	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Malawi	1.0	0.6	0.5	0.5	0.6	0.5	0.6	0.5	0.7	0.7	0.7	0.8	0.7	0.5
Mali	1.0	0.9	0.6	1.0	0.7	0.6	0.7	0.5	0.6	0.6	0.6	0.4	0.4	0.4
Mauritania	0.4	0.9	0.7	0.7	0.6	0.8	0.8	0.4	0.5	0.6	0.5	0.5	0.5	0.5
Mauritius	3.6	4.3	4.0	4.1	4.1	3.8	3.9	4.0	4.9	5.8	4.8	5.5	6.2	5.9
Mozambique				0.6	0.7	0.5	0.4	0.3	0.4	0.4	0.3	0.4	0.3	0.4
Namibia	3.1	3.2	3.2	2.6	3.5	2.5	2.1	2.8	2.2	1.9	2.4	1.9	2.4	3.1
Niger	0.2	0.2	0.2	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nigeria	0.5	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.3	0.2	0.3	0.2	0.2	0.2
Rwanda					0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7
Senegal	0.9	1.2	1.1	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.6	0.9	1.1
Sierra Leone	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2
Swaziland									1.9	2.0	1.5	0.7	0.9	0.9
Tanzania	0.3	0.4	0.5	0.4	0.2	0.3	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
Togo	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.4	0.3	0.4	0.4	0.2	0.2	0.2
Uganda	0.6	0.9	1.2	1.3	1.1	0.9	1.1	1.2	0.8	0.9	0.9	0.7	0.8	1.0
Zambia	0.5	0.5	0.4	0.4	0.3	0.3	0.4	0.4	0.3	0.4	0.4	0.4	0.5	0.5
Zimbabwe	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.5	0.4	0.7	0.9	1.3	1.7	1.4

Source: ASTI (Agricultural Science and Technology Indicators). ASTI database. International Food Policy Research Institute (IFPRI). http://www.asti.cgiar.org/

Cereal yield (kg per hectare)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sub-Saharan Africa	1.129	1.135	1.112	1.175	1.166	1.237	1.217	1.299	1.308	1.385	1.293	1.413	1.345	1.452	..	..
Angola	585	627	646	492	583	446	464	653	571	629	662	552	814	888	..	..
Benin	1.069	945	1.149	1.147	1.136	1.126	1.014	1.248	1.271	1.201	1.518	1.373	1.399	1.460	..	..
Botswana	554	358	1.215	275	439	373	639	362	364	372	452	367	218	304	..	..
Burkina Faso	968	943	996	941	1.127	1.204	936	1.040	1.002	1.063	995	1.203	1.157	1.226	..	..
Burundi	1.284	1.309	1.288	1.328	1.344	1.277	1.299	1.281	1.296	1.223	1.164	1.107	1.178	1.332	..	..
Cabo Verde	637	149	379	385	243	141	110	337	231	220	178	196	182	202	..	..
Cameroon	1.709	1.683	1.620	1.563	1.670	1.700	1.676	1.679	1.723	1.643	1.713	1.592	1.676	1.681	..	..
Central African Republic	1.033	1.048	1.010	1.019	1.023	1.000	951	947	948	1.447	1.516	1.676	1.582	1.480	..	..
Chad	635	671	791	671	762	750	799	812	598	763	632	932	823	856	..	..
Comoros	1.310	1.308	1.310	1.311	1.311	1.279	1.337	1.288	1.323	1.362	1.355	1.320	1.384	1.370	..	..
Congo, Dem. Rep.	787	772	772	772	772	772	772	772	772	772	771	771	773	772	..	..
Congo, Rep.	775	772	781	777	771	778	764	771	791	785	794	810	831	824	..	..
Cote d'Ivoire	1.720	1.751	1.827	1.854	1.836	1.828	1.569	1.735	1.712	2.271	1.884	2.081	2.169	2.139	..	..
Equatorial Guinea	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eritrea	637	158	261	275	758	799	939	252	500	512	576	591	659	600	..	..
Ethiopia	1.198	1.354	1.123	1.163	1.361	1.563	1.439	1.446	1.683	1.833	1.962	2.047	2.193	2.325	..	..
Gabon	1.542	1.450	1.539	1.561	1.571	1.581	1.667	1.611	1.591	1.598	1.600	1.605	1.605	1.605	..	..
Gambia, The	1.284	960	1.201	1.171	1.040	1.026	800	977	1.052	1.129	869	910	960	747	..	..
Ghana	1.186	1.349	1.396	1.373	1.432	1.335	1.317	1.598	1.660	1.814	1.594	1.768	1.689	1.703	..	..
Guinea	1.483	1.487	1.485	1.491	1.496	1.502	1.514	1.465	1.484	1.185	1.227	1.153	1.190	1.246	..	..
Guinea-Bissau	1.005	1.067	1.101	1.288	1.534	1.661	1.346	1.490	1.627	1.652	1.538	1.467	1.334	1.322	..	..
Kenya	1.640	1.488	1.594	1.806	1.646	1.646	1.773	1.418	1.243	1.710	1.515	1.745	1.662	1.628	..	..
Lesotho	996	736	609	596	687	523	436	390	421	909	663	238	764	637	..	..

Liberia	1.115	917	833	917	1.290	1.262	1.449	1.553	1.184	1.179	1.195	1.298	1.309	1.322	..	..
Madagascar	2.021	1.968	2.202	2.354	2.515	2.566	2.621	2.812	3.184	3.272	3.341	3.400	3.505	3.682	..	..
Malawi	1.176	1.046	1.209	1.021	778	1.445	2.467	1.599	2.124	1.907	2.094	2.087	2.069	1.591	..	..
Mali	986	792	979	864	1.090	1.125	1.101	1.398	1.675	1.716	996	1.527	1.567	1.551	..	..
Mauritania	639	1.012	851	638	841	661	706	766	713	956	1.375	1.035	1.198	1.679	..	..
Mauritius	7.204	7.763	6.556	6.474	7.540	7.793	9.454	5.850	3.815	4.298	3.902	3.390	3.219	3.765	..	..
Mozambique	880	697	818	774	529	782	885	763	884	1.028	1.041	630	670	703	..	..
Namibia	387	413	328	418	466	619	481	496	365	464	535	550	594	589	..	..
Niger	401	412	442	347	437	451	426	488	380	489	378	514	407	448	..	..
Nigeria	1.234	1.255	1.309	1.373	1.422	1.508	1.400	1.598	1.531	1.528	1.335	1.400	1.235	1.592	..	..
Rwanda	913	1.028	944	959	1.184	1.138	1.015	1.276	1.738	1.919	2.087	2.144	2.144	1.981	..	..
Sao Tome and Principe	2.174	2.107	2.131	2.146	2.228	2.455	2.308	2.154	1.539	1.582	2.103	2.104	2.102	2.100	..	..
Senegal	887	651	1.090	973	1.200	879	722	1.172	1.134	1.196	966	1.229	1.123	1.110	..	..
Seychelles	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sierra Leone	998	996	1.012	1.000	1.118	1.348	1.290	1.350	1.645	1.746	1.750	1.538	1.777	1.842	..	..
Somalia	813	770	688	581	658	493	606	567	416	575	457	1.190	964	761	..	..
South Africa	2.423	2.772	2.537	2.778	3.309	3.141	2.790	4.063	4.405	4.149	4.014	4.239	4.041	4.894	..	..
South Sudan	..	..	..	..	..	..	..	..	..	..	..	692	766	1.254	..	..
Sudan	626	487	644	657	506	645	730	567	587	452	564	537	593	683	..	..
Swaziland	1.417	995	1.022	1.244	1.314	1.418	561	995	1.284	1.199	1.336	1.329	1.360	936	..	..
Tanzania	2.044	1.900	858	1.371	1.102	1.327	1.427	1.334	1.110	1.648	1.390	1.315	1.418	1.678	..	..
Togo	1.150	1.131	1.155	1.095	1.133	1.131	1.122	1.144	1.243	1.187	1.226	1.112	1.090	1.153	..	..
Uganda	1.641	1.639	1.678	1.468	1.574	1.523	1.526	2.056	2.038	1.978	2.078	2.029	1.998	2.019	..	..
Zambia	1.402	1.419	1.702	1.814	1.899	1.816	2.253	2.180	2.066	2.534	2.731	2.689	2.532	2.755	..	..
Zimbabwe	1.160	547	803	1.075	588	847	745	310	452	735	593	689	669	541	..	..

Source: World Development Indicators, World Bank

Crop production index (2004-2006 = 100)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sub-Saharan Africa	84.946	88.163	91.578	95.549	100.478	103.974	101.247	108.701	107.334	117.190	116.515	123.553	128.294	..	..	..
Angola	62.98	74.35	81.78	93.29	101.68	105.03	120.64	129.78	171.56	181.5	201.1	158.44	227.3	193.96	..	..
Benin	89.81	98.75	101.71	106.85	101.75	91.4	95.3	114.55	112.94	116.98	129.06	135.93	146.35	169.8	..	..
Botswana	101.08	105.65	110.56	108.82	99.98	91.19	77.68	85.7	87.13	94.92	110.82	88.67	80.8	94.93	..	..
Burkina Faso	83.5	86.3	97.12	85.39	105.57	109.04	79.74	122.7	102.88	123.91	105.33	131.92	145.61	148.47	..	..
Burundi	93.84	106.23	94.92	107.37	91.14	101.49	93.05	101.09	98.73	107.39	100.36	86.26	128.08	108.35	..	..
Cabo Verde	106.67	98.02	103.18	102.43	98.73	98.84	105.17	102.79	94.74	86.58	106.6	112.46	117.92	123.24	..	..
Cameroon	78.58	80.61	83.34	85.96	103.61	110.43	117.2	121.03	131.44	145.34	149.17	158.81	162.67	170.12	..	..
Central African Republic	102.43	100.2	94.81	98.26	100	101.74	106.29	108.5	112.87	111.25	115.66	117.79	120.76	126.17	..	..
Chad	98.64	88.51	99.57	86.5	111.6	101.9	107.38	110.04	97.33	177.41	108.6	191.52	163.85	169.19	..	..
Comoros	97.98	97.67	99.36	100.21	95.63	104.15	107.87	107.98	105.95	105.39	104.97	100.27	105.83	108.4	..	..
Congo, Dem. Rep.	100.06	98.08	98.77	99.47	100.04	100.49	101.53	102.34	103.16	104.33	109.08	110.27	108.84	111.7	..	..
Congo, Rep.	88.07	89.44	91.15	95.71	100.25	104.05	107.32	112.58	116.77	114.45	116.33	120.98	123.91	124.87	..	..
Cote d'Ivoire	93.46	94.67	94.38	95.83	99.85	104.32	99.24	105.6	98.88	106	109.65	119.5	123.37	135.29	..	..
Equatorial Guinea	93.99	91.92	95.75	97.39	100.55	102.06	106.3	107.64	106.27	109.73	111.27	113.86	115.08	116.79	..	..
Eritrea	90.01	56.55	66.89	68.62	119.14	112.25	129.5	59.44	82.52	86.18	93.25	92.64	98.07	95.71	..	..
Ethiopia	80.7	78.95	81.86	89.11	105.2	105.69	107.5	112.65	126.77	136.76	144.86	157.38	168.34	185.49	..	..
Gabon	96.2	98.42	98.97	97.93	99.81	102.26	105.31	110.52	109.63	112.81	118.37	116.98	121.32	123.63	..	..
Gambia, The	112.56	64.52	85.18	109.6	91.82	98.58	65.12	101.13	124.5	144.95	85.17	107.78	96.69	85.2	..	..
Ghana	81.1	90.19	93.63	97.44	99.72	102.83	100.04	112.15	121.73	124.44	131.89	139.51	144.06	148.66	..	..
Guinea	85.2	89.2	93.27	97.02	100.56	102.42	106.5	111.3	110.74	118.06	124.04	126.84	131.53	131.52	..	..
Guinea-Bissau	90.63	90.92	90	94.62	100.76	104.62	104.9	121.21	124.42	130.7	126.73	134.53	141.89	141.29	..	..
Kenya	86.54	87.26	88.02	86.3	104.73	108.97	109.36	108.66	112.62	125.14	113.76	126.86	133.35	136.94	..	..
Lesotho	150.12	110.89	101.22	100.97	99.14	99.89	93.11	93.35	88.94	131.37	110.98	83.25	111.02	114.43	..	..

Liberia	98.12	96.33	95.58	99.47	102.65	97.88	113.83	107.26	98.17	99.93	102.35	109.63	105.81	104.87	..	..
Madagascar	86.33	84.13	87.06	91.2	103.02	105.78	108.18	112.22	121.05	124.24	123.11	129.74	114.77	121.74	..	..
Malawi	106.15	82	94.41	98.58	84.26	117.16	133.9	135.95	158.76	156.5	163.8	170.76	181.38	148.25	..	..
Mali	89.77	84.17	107.72	95.63	103.67	100.7	103.56	114.52	135.12	138.48	141	154.54	146.26	176.72	..	..
Mauritania	87.83	92.58	106.33	93.45	104.6	101.96	108.38	110.16	101.96	143.85	130.23	169.27	167.09	205.31	..	..
Mauritius	115.56	97.06	103.71	105.6	98.81	95.59	86.29	90.58	95.06	90.27	87.94	84.15	81.5	84.93	..	..
Mozambique	84.51	89.75	96.77	99.93	93.44	106.63	110.88	110.31	122.43	161.64	173.09	129.57	130.38	143.75	..	..
Namibia	78.67	80.5	83.14	96.38	95.27	108.35	102.29	100.07	100.1	105.87	107.09	115.35	106.2	117.92	..	..
Niger	82.31	93.24	102.3	82.22	102.92	114.86	121.91	161.08	118.88	181.27	155.45	175.46	183.36	205.57	..	..
Nigeria	79.5	83.44	87.87	93.73	99.43	106.84	97.53	104.33	90.1	104.49	96.23	107.46	104.36	117.89	..	..
Rwanda	79.91	102.61	94.37	93.77	101	105.23	105.47	114.48	135.83	141.59	154.28	165.25	169.88	143.07	..	..
Sao Tome and Principe	101.92	102.04	103.35	97.66	100.59	101.76	102.93	102.03	103.82	107.2	99.94	101.58	111.38	120.51	..	..
Senegal	103.68	60.96	95.33	94.95	113.94	91.11	81.08	136.89	149.73	165.13	103.93	126.44	119.22	130.4	..	..
Seychelles	112.34	110.63	104.09	105.02	96.47	98.52	94.7	92.8	87.77	87.07	90.73	97.25	96.25	94.65	..	..
Sierra Leone	49.62	59.56	84.31	93.03	92.16	114.8	98.22	104.27	128.69	145.41	154.9	160.35	169.35	173.8	..	..
Somalia	99.85	105.23	104.01	103.85	101.44	94.7	89.54	92.45	92.77	104.98	85.98	109.27	108.34	100.38	..	..
South Africa	93.97	102.54	99.01	100.66	105.53	93.81	93.11	113.15	109.08	107.72	107.46	112.36	116.52	123.82	..	..
South Sudan	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sudan	85.12	82.98	98.04	93.9	101.15	104.95	102.45	99.06	105.35	91.05	108.26	..	..	..	..	..
Swaziland	87.53	94.82	94.34	98.55	103.15	98.3	96.76	98.88	100.35	105.52	108.69	111.42	114.4	114.88	..	..
Tanzania	73.79	94.52	79.53	96.07	97.24	106.68	109.06	109.57	111.63	130.36	140.35	149.73	173.88	189.24	..	..
Togo	99.42	100.32	101.36	104.16	95.77	100.07	103.16	110.98	119.5	121.88	136.47	135.2	122.1	147.74	..	..
Uganda	98.36	102.05	102.23	101.55	100.35	98.09	101.16	100.38	102.26	96.97	90.72	83.53	84.36	86.47	..	..
Zambia	70.25	70.88	87.15	93.9	99.11	106.98	103.4	114.13	143.98	163.97	178.11	183.55	169.38	184.47	..	..
Zimbabwe	136.96	91.26	101.94	114.93	88.98	96.09	104.55	94.55	90.86	101.75	100.85	101.07	94.64	104.91	..	..

Source: World Development Indicators, World Bank

Fertilizer consumption (kilograms per hectare of arable land)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sub-Saharan Africa	..	11.8	11.0	12.8	10.9	13.1	12.5	12.2	12.4	15.0	14.2	16.1	17.2	16.0	..	..
Angola	..	1.7	1.8	4.5	2.3	3.7	3.3	8.3	5.5	8.4	12.0	13.6	14.4	7.0	..	..
Benin	..	16.4	0.8	0.1	0.5	0.0	0.2	0.3	6.7	9.0	4.3	9.9	4.8	12.2	..	..
Botswana	..	..	..	..	..	..	..	..	48.6	83.1	29.7	54.8	81.4	58.3	..	..
Burkina Faso	..	0.4	10.4	12.5	15.2	13.4	10.1	9.5	9.5	9.4	10.7	11.0	15.3	15.8	..	..
Burundi	..	1.3	0.3	1.1	3.5	3.3	2.0	2.2	1.9	3.6	5.6	5.7	7.4	10.9	..	..
Cabo Verde	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cameroon	..	9.8	8.2	11.1	8.0	9.0	8.6	6.6	7.0	9.2	11.0	10.0	6.7	9.3	..	..
Central African Republic	..	..	..	..	..	..	..	..	..	..	0.4	0.3	0.3	0.3	..	..
Chad	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Comoros	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Congo, Dem. Rep.	..	0.0	0.3	0.2	0.1	0.5	0.6	0.9	0.8	1.1	1.0	0.7	1.2	2.6	..	..
Congo, Rep.	..	0.0	0.0	2.7	0.1	0.1	0.4	0.7	4.6	0.5	1.3	2.7	3.7	1.9	..	..
Cote d'Ivoire	..	31.0	29.3	27.2	17.8	22.8	24.0	18.2	15.3	32.1	19.4	25.5	36.1	40.2	..	..
Equatorial Guinea	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eritrea	..	6.2	1.6	0.0	2.3	0.0	3.5	0.0	2.8	0.4	0.8	1.3	0.8	0.7	..	..
Ethiopia	..	17.0	5.7	10.3	10.9	11.1	16.0	17.2	17.7	21.8	20.8	23.8	19.2	26.0	..	..
Gabon	..	5.6	3.6	5.1	8.3	8.5	9.1	10.5	12.0	3.2	5.6	9.9	10.1	11.4	..	..
Gambia, The	..	0.0	9.4	8.1	9.8	10.8	9.0	4.3	6.3	7.3	10.3	6.0	0.6	5.6	..	..
Ghana	..	3.7	6.8	13.2	6.0	20.1	17.8	14.5	19.0	18.7	13.2	34.8	25.3	15.7	..	..
Guinea	..	1.0	0.8	1.0	0.9	0.9	1.2	1.3	0.6	0.9	3.6	2.5	1.3	1.0	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kenya	..	27.3	33.1	27.7	34.3	33.2	36.4	33.3	31.9	30.3	43.6	42.1	52.5	11.3	..	..
Lesotho	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Liberia	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Madagascar	..	2.1	2.1	2.2	5.5	2.5	3.2	4.1	2.3	2.4	3.2	2.4	2.8	5.5	..	..
Malawi	..	29.7	31.1	34.4	30.5	36.8	41.7	34.9	30.8	35.4	29.5	39.9	45.6	36.5	..	..
Mali	..	0.0	0.0	52.0	15.7	17.5	31.1	22.5	6.1	19.6	22.0	26.0	31.5	29.1	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius	..	318.4	299.5	307.7	352.2	257.9	282.2	228.8	228.0	163.2	243.2	224.2	192.0	211.7	..	..
Mozambique	..	6.0	0.7	2.3	1.4	4.6	2.7	11.4	4.0	8.2	7.4	6.0	10.6	14.9	..	..
Namibia	..	3.9	1.4	3.2	1.9	2.8	2.5	0.3	1.6	4.4	6.6	6.1	3.8	2.2	..	..
Niger	..	0.6	0.3	0.2	0.4	0.5	0.4	0.2	0.4	0.5	0.5	0.9	0.7	1.1	..	..
Nigeria	..	4.5	6.1	4.5	7.2	10.0	4.2	5.9	5.3	12.2	6.6	11.4	16.2	10.9	..	..
Rwanda	..	0.0	2.2	1.8	3.1	3.5	7.9	9.6	1.3	0.1	0.1	4.1	10.1	11.8	..	..
Sao Tome and Principe	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Senegal	..	11.8	10.9	12.7	9.9	2.3	2.1	2.3	6.4	8.2	6.8	11.5	8.7	6.7	..	..
Seychelles	..	0.0	24.0	11.0	34.0	11.0	30.0	34.0	52.0	32.2	562.5	1112.5	1837.5	575.0	..	..
Sierra Leone	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Somalia	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
South Africa	..	61.2	55.2	60.3	47.3	62.3	61.0	56.3	60.2	53.8	60.3	59.5	57.7	60.6	..	..
South Sudan	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sudan	..	3.5	3.5	4.6	2.7	2.6	3.6	3.8	8.0	10.2	8.1	11.2	11.1	11.1	..	..
Swaziland	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tanzania	..	3.7	4.5	5.3	5.8	5.4	5.1	4.7	7.5	8.8	8.6	7.7	4.7	8.4	..	..
Togo	..	5.2	7.5	3.4	9.7	5.5	6.3	0.0	6.2	9.0	10.2	5.0	12.0	9.2	..	..
Uganda	..	1.3	1.6	1.5	1.0	1.3	1.2	2.9	2.1	1.7	1.8	1.8	2.3	1.7	..	..
Zambia	..	26.1	26.2	29.9	28.0	25.7	32.3	38.7	25.8	29.2	46.1	33.9	42.3	46.2	..	..
Zimbabwe	..	35.7	40.0	22.7	21.8	32.4	27.0	22.0	28.8	34.1	26.5	20.8	28.6	29.4	..	..

Source: World Development Indicators, World Bank

Agriculture value added per hectare of agricultural land (constant 2010 USD)

Country / Region	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Angola	51.0	63.0	58.0	62.0	68.0	74.0	93.0	90.0	140.0	139.0	135.0	110.0	163.0	203.0	215.0
Burundi	353.0	368.0	360.0	366.0	365.0	391.0	356.0	394.0	394.0	409.0	414.0	421.0	410.0	412.0	430.0
Benin	353.0	373.0	358.0	394.0	405.0	454.0	462.0	464.0	484.0	461.0	464.0	455.0	455.0	463.0	471.0
Burkina Faso	171.0	181.0	181.0	182.0	215.0	223.0	205.0	247.0	228.0	242.0	250.0	265.0	269.0	278.0	279.0
Botswana	9.0	9.0	10.0	9.0	7.0	9.0	10.0	12.0	13.0	12.0	13.0	14.0	14.0	13.0	13.0
Central African Republic	162.0	167.0	167.0	171.0	170.0	179.0	182.0	191.0	188.0	197.0	210.0	213.0	117.0	120.0	124.0
Côte d'Ivoire	295.0	305.0	318.0	259.0	249.0	252.0	246.0	260.0	251.0	296.0	308.0	288.0	308.0	339.0	389.0
Cameroon	398.0	414.0	424.0	412.0	423.0	444.0	500.0	524.0	532.0	528.0	549.0	565.0	589.0	594.0	669.0
Congo, Dem. Rep. of	164.0	136.0	141.0	138.0	132.0	138.0	151.0	169.0	180.0	177.0	192.0	196.0	205.0	214.0	220.0
Congo, Republic of	44.0	49.0	50.0	45.0	40.0	37.0	40.0	36.0	47.0	43.0	40.0	48.0	55.0	65.0	99.0
Comoros	1.321.0	1.358.0	1.387.0	1.414.0	1.480.0	1.510.0	1.517.0	1.605.0	1.649.0	1.578.0	1.582.0	1.571.0	1.576.0	1.544.0	1.529.0
Cape Verde	1.516.0	1.428.0	1.457.0	1.541.0	1.503.0	1.480.0	1.746.0	1.651.0	1.749.0	1.705.0	1.740.0	1.759.0	1.780.0	1.660.0	1.656.0
Djibouti	15.0	15.0	15.0	16.0	17.0	18.0	21.0	21.0	22.0	22.0	23.0	23.0	23.0	24.0	24.0
Algeria	276.0	278.0	317.0	308.0	265.0	265.0	274.0	244.0	351.0	330.0	325.0	363.0	419.0	455.0	550.0
Egypt	6.494.0	6.503.0	6.689.0	6.371.0	6.438.0	6.494.0	7.040.0	7.091.0	7.335.0	7.955.0	8.538.0	7.022.0	7.034.0	7.202.0	7.330.0
Eritrea	42.0	39.0	33.0	30.0	66.0	71.0	71.0	44.0	39.0						
Ethiopia	196.0	182.0	166.0	187.0	219.0	246.0	266.0	320.0	349.0	348.0	378.0	439.0	455.0	463.0	493.0
Gabon	152.0	142.0	151.0	139.0	127.0	125.0	133.0	110.0	131.0	109.0	102.0	105.0	110.0	125.0	155.0
Ghana	464.0	479.0	517.0	557.0	582.0	472.0	462.0	536.0	592.0	578.0	552.0	565.0	594.0	584.0	549.0
Guinea	61.0	63.0	61.0	69.0	67.0	68.0	73.0	75.0	77.0	67.0	70.0	65.0	70.0	66.0	62.0
Gambia, The	326.0	312.0	377.0	399.0	389.0	338.0	328.0	383.0	389.0	448.0	330.0	356.0	357.0	317.0	298.0
Guinea-Bissau	156.0	174.0	178.0	180.0	198.0	192.0	203.0	226.0	220.0	233.0	253.0	250.0	217.0	209.0	206.0
Kenya	282.0	264.0	270.0	273.0	281.0	253.0	271.0	293.0	316.0	364.0	404.0	418.0	448.0	486.0	562.0
Liberia	342.0	366.0	234.0	216.0	230.0	241.0	271.0	296.0	267.0	218.0	229.0	216.0	226.0	218.0	212.0
Libya		157.0	140.0	120.0	101.0	95.0	99.0	86.0							

Lesotho	79.0	63.0	64.0	63.0	60.0	56.0	56.0	61.0	61.0	71.0	74.0	69.0	78.0	80.0	84.0
Morocco	268.0	277.0	304.0	310.0	288.0	357.0	295.0	344.0	390.0	402.0	428.0	410.0	468.0	414.0	422.0
Madagascar	45.0	46.0	45.0	47.0	48.0	49.0	48.0	49.0	56.0	54.0	56.0	57.0	55.0	54.0	54.0
Mali	43.0	45.0	46.0	44.0	52.0	53.0	61.0	70.0	75.0	86.0	95.0	117.0	122.0	133.0	142.0
Mozambique	21.0	28.0	30.0	31.0	34.0	39.0	42.0	48.0	53.0	56.0	57.0	59.0	60.0	62.0	66.0
Mauritania	23.0	23.0	26.0	26.0	24.0	22.0	25.0	25.0	25.0	22.0	20.0	22.0	23.0	25.0	26.0
Mauritius	4.390.0	3.892.0	4.038.0	4.401.0	4.292.0	3.848.0	3.620.0	3.525.0	3.466.0	3.369.0	3.601.0	3.655.0	3.552.0	3.687.0	3.513.0
Malawi	304.0	340.0	325.0	329.0	309.0	298.0	308.0	332.0	361.0	363.0	376.0	367.0	387.0	405.0	391.0
Namibia	18.0	19.0	21.0	20.0	24.0	24.0	23.0	21.0	23.0	25.0	25.0	26.0	22.0	24.0	23.0
Niger	41.0	42.0	44.0	42.0	43.0	47.0	45.0	52.0	47.0	53.0	50.0	56.0	55.0	60.0	61.0
Nigeria	482.0	737.0	776.0	824.0	871.0	928.0	989.0	1.066.0	1.189.0	1.240.0	1.258.0	1.324.0	1.386.0	1.445.0	1.498.0
Rwanda	620.0	637.0	709.0	759.0	824.0	911.0	874.0	904.0	994.0	1.029.0	1.094.0	1.231.0	1.268.0	1.341.0	1.411.0
Sudan	113.0	117.0	113.0	103.0	105.0	106.0	105.0	110.0	115.0	112.0	144.0	156.0	169.0	186.0	195.0
Senegal	168.0	142.0	170.0	162.0	181.0	170.0	162.0	182.0	198.0	211.0	199.0	223.0	219.0	234.0	259.0
Sierra Leone	196.0	235.0	234.0	246.0	259.0	260.0	324.0	343.0	356.0	347.0	372.0	416.0	465.0	524.0	449.0
São Tomé and Príncipe	491.0	542.0	527.0	568.0	554.0	598.0	631.0	672.0	875.0	927.0	989.0	976.0	1.039.0	1.110.0	1.160.0
Swaziland	201.0	202.0	186.0	173.0	177.0	152.0	162.0	164.0	169.0	182.0	190.0	182.0	185.0	189.0	213.0
Seychelles	5.484.0	5.668.0	4.874.0	6.208.0	6.371.0	6.384.0	8.661.0	7.926.0	7.124.0	8.772.0	16.370.0	15.350.0	20.069.0	22.323.0	26.195.0
Chad	35.0	38.0	50.0	47.0	44.0	46.0	42.0	46.0	56.0	69.0	44.0	51.0	53.0	57.0	
Togo	273.0	272.0	270.0	281.0	328.0	308.0	296.0	338.0	279.0	269.0	279.0	386.0	377.0	416.0	421.0
Tunisia	300.0	261.0	305.0	343.0	329.0	351.0	349.0	328.0	361.0	331.0	365.0	397.0	384.0	395.0	406.0
Tanzania	157.0	166.0	177.0	190.0	189.0	201.0	200.0	218.0	239.0	251.0	260.0	279.0	301.0	293.0	299.0
Uganda	230.0	207.0	226.0	211.0	259.0	271.0	268.0	275.0	353.0	371.0	360.0	300.0	294.0	294.0	290.0
South Africa	90.0	98.0	91.0	87.0	79.0	82.0	98.0	109.0	102.0	92.0	91.0	88.0	87.0	95.0	90.0
Zambia	72.0	74.0	79.0	85.0	86.0	83.0	82.0	83.0	90.0	85.0	88.0	94.0	94.0	96.0	98.0
Zimbabwe	159.0	115.0	111.0	125.0	111.0	119.0	127.0	92.0	66.0	71.0	72.0	80.0	76.0	94.0	85.0

Source: ReSAKSS (Regional Strategic Analysis and Knowledge Support System) http://www.resakss.org/

Government agriculture expenditure (% of agriculture value added)

Country / Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Angola	6.0	8.0	2.0	4.0	4.0	7.0	9.0	14.0	13.0	8.0	6.0	5.0	6.0	6.0	4.0	2.0
Burundi	1.0	1.0	1.0	1.0	2.0	2.0	4.0	4.0	2.0	2.0	2.0	4.0	3.0	2.0	2.0	
Benin	6.0	4.0	4.0	5.0	4.0	4.0	4.0	5.0	6.0	8.0	7.0	4.0	5.0	6.0	7.0	
Burkina Faso	8.0	5.0	6.0	6.0	7.0	6.0	7.0	12.0	7.0	9.0	7.0	8.0	8.0	7.0	7.0	6.0
Botswana	55.0	68.0	77.0	63.0	57.0	85.0	60.0	56.0	41.0	40.0	59.0	43.0	43.0	33.0	31.0	32.0
Central African Republic	2.0	1.0	1.0	1.0	1.0	1.0	1.0			1.0	1.0	1.0	2.0	3.0		
Côte d'Ivoire	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0	2.0	2.0	6.0	5.0	5.0	4.0
Cameroon	2.0	3.0	3.0	3.0	3.0	3.0	3.0									
Congo, Dem. Rep. of				1.0		1.0	1.0	2.0	1.0	1.0						
Congo, Republic of	2.0	3.0	4.0	4.0	7.0	9.0	10.0	10.0	10.0	7.0	10.0	18.0	13.0			
Cape Verde	13.0	12.0	13.0	13.0	13.0	14.0	14.0	11.0	12.0	14.0	16.0					
Djibouti			8.0	9.0	9.0	9.0	9.0	8.0	8.0	8.0	8.0	12.0	12.0	12.0	12.0	
Algeria	10.0	10.0	12.0	12.0	13.0	15.0	17.0	17.0	19.0	16.0						
Egypt	11.0	12.0	9.0	8.0	8.0	7.0	7.0	6.0	5.0	4.0	4.0	4.0	4.0	5.0	5.0	
Eritrea	32.0															
Ethiopia	3.0	5.0	7.0	9.0	8.0	9.0	9.0	8.0	6.0	5.0	5.0	4.0	4.0	4.0	4.0	
Ghana	2.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	3.0	2.0	3.0	3.0	4.0			
Guinea				8.0	6.0	5.0	6.0	7.0	7.0	6.0	6.0	8.0	9.0	7.0	8.0	6.0
Gambia, The	5.0	4.0	5.0	4.0	3.0	3.0	4.0	5.0	5.0	5.0	5.0	11.0	4.0			
Guinea-Bissau																
Kenya	3.0	3.0	4.0	4.0	4.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	5.0	3.0	3.0	3.0
Liberia	1.0							1.0	1.0	7.0	11.0	8.0	14.0	16.0		
Lesotho	18.0	21.0	21.0	23.0	22.0	23.0	24.0	21.0	17.0	17.0	15.0	11.0	13.0	12.0	10.0	8.0
Morocco	8.0	7.0	8.0	6.0	5.0	6.0	5.0	5.0								
Madagascar	3.0	3.0	2.0	2.0	3.0	4.0	3.0	3.0	11.0	12.0	5.0	5.0	4.0	4.0	2.0	1.0

Mali	6.0	8.0	6.0	7.0	9.0	11.0	8.0	8.0	8.0	7.0	7.0	4.0	3.0	2.0	3.0	
Mozambique	3.0	3.0	6.0	5.0	6.0	7.0	5.0	5.0	5.0	4.0	5.0	4.0	4.0	13.0	16.0	8.0
Mauritania			8.0	6.0	6.0	6.0	7.0									
Mauritius	18.0	15.0	16.0	13.0	15.0	15.0	16.0	12.0	13.0	28.0	31.0	19.0	20.0	24.0	25.0	21.0
Malawi	4.0	4.0	2.0	2.0	2.0	5.0	8.0	13.0	16.0	19.0	13.0	15.0	11.0	11.0	15.0	16.0
Namibia	16.0	18.0	17.0	16.0	13.0	16.0	13.0	15.0	15.0	13.0	27.0	31.0	23.0	20.0	25.0	
Niger	6.0	7.0	8.0	8.0	12.0	10.0	7.0	10.0	4.0	3.0	5.0	11.0	6.0	8.0	11.0	8.0
Nigeria	4.0	5.0	3.0	1.0	3.0	3.0	3.0	3.0	3.0	4.0	2.0	1.0	2.0	1.0		
Rwanda							2.0	2.0	3.0	2.0	3.0	7.0	7.0	7.0		
Sudan	2.0	2.0	2.0	2.0	5.0	5.0	5.0	7.0	4.0	3.0	3.0					
Senegal	8.0	6.0	10.0	10.0	8.0	13.0	15.0	20.0	12.0	17.0	14.0	15.0	19.0	17.0	18.0	19.0
Sierra Leone	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	3.0	5.0	6.0	3.0	3.0	3.0		
São Tomé and Príncipe				12.0	6.0	7.0	8.0	13.0								
Swaziland	10.0	13.0	13.0	17.0	20.0	18.0	15.0	14.0	13.0	14.0	19.0	8.0	11.0	20.0	19.0	16.0
Seychelles	27.0	27.0	27.0	29.0	24.0	22.0	18.0	16.0	14.0	13.0	17.0	29.0	18.0	21.0		
Chad		1.0	1.0	1.0	1.0	1.0		1.0								
Togo	3.0	1.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	4.0	5.0	5.0	4.0	5.0	4.0	4.0
Tunisia	22.0	25.0	28.0	22.0	18.0	17.0	16.0	16.0	16.0	16.0	17.0					
Tanzania	4.0	3.0	3.0	4.0	6.0	4.0	3.0	2.0	3.0	4.0	4.0	4.0	2.0	3.0	2.0	
Uganda	4.0	4.0	5.0	4.0	2.0	2.0	3.0	3.0	4.0	3.0	2.0	3.0	3.0	4.0	3.0	3.0
South Africa	12.0	13.0	13.0	16.0	17.0	23.0	24.0	25.0	20.0	20.0	22.0	23.0	25.0	23.0	21.0	22.0
Zambia	7.0	7.0	6.0	8.0	8.0	10.0	12.0	18.0	23.0	16.0	20.0	11.0	13.0	15.0	27.0	26.0
Zimbabwe										8.0	26.0	19.0	9.0	14.0	23.0	
Africa wide	6.5	7.0	5.9	5.6	5.9	6.3	6.4	6.8	6.4	6.3	5.6	5.4	5.5	5.5	5.5	7.6

Source: ReSAKSS (Regional Strategic Analysis and Knowledge Support System). http://www.resakss.org/

Researchers. government (FTEs)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Benin	83.0	77.9	72.8	67.7	64.2	65.8	64.9	64.9	86.0	88.0	89.0	105.0	105.0	97.0
Botswana	48.4	52.2	57.8	59.6	64.3	66.5	82.8	68.6	78.4	85.7	94.1	96.7	100.8	100.2
Burkina Faso	186.8	193.9	202.4	209.7	218.3	225.8	217.4	215.3	188.9	185.9	179.5	189.8	204.2	275.4
Burundi	57.5	58.6	45.6	50.8	55.4	62.8	72.8	78.1	59.6	67.6	74.8	77.5	82.9	83.5
Cabo Verde									23.0	23.0	21.0	20.0	19.0	21.0
Cameroon												209.4	200.1	193.8
Central African Rep.									81.8	81.8	94.8			
Chad									39.5	50.6	60.3	64.5	73.4	80.9
Congo, Dem. Rep.									229.5	263.5	299.5	301.4	317.5	323.2
Congo, Rep.	91.7	88.3	83.2	79.4	77.0	77.3	73.4	73.4	69.6	74.4	76.8	72.3	69.7	73.4
Cote d'Ivoire	128.0	117.2	113.5	112.1	114.4	116.3	119.8	122.0	122.1	129.7	122.3	115.8	124.5	157.3
Eritrea	58.6	65.7	55.8	52.9	72.6	81.8	87.8	80.5	80.1	74.1	78.4			
Ethiopia	799.2	922.9	1.009.9	1.035.6	1.067.7	1.114.7	1.241.6	1.215.8	1.273.4	1.479.1	1.720.5	1.878.7	2.296.8	2.482.9
Gabon	27.4	28.5	32.6	35.3	38.2	41.0	40.6	48.1	48.6	42.8	33.9	34.7	34.7	35.3
Gambia, The	36.1	35.1	35.3	35.5	34.7	33.9	34.2	34.4	39.2	45.0	50.1	51.6	55.6	49.4
Ghana	353.7	314.0	325.0	341.0	344.8	344.6	354.8	374.4	378.9	390.5	428.0	420.5	406.4	407.6
Guinea	189.2	191.0	183.9	182.4	177.5	184.6	193.9	187.1	212.2	214.6	215.6	221.0	222.8	224.9
Guinea-Bissau									11.0	11.0	9.0			
Kenya	646.7	706.1	690.6	718.3	724.9	727.9	726.8	738.4	813.2	811.7	831.8	811.6	810.0	789.0

Lesotho	23.9	25.2	26.6	27.9	29.3	30.9	32.6	33.1	33.6	35.6	33.6	37.0	35.0	36.0
Liberia									9.0	20.0	32.0			
Madagascar	163.2	152.8	151.9	148.3	144.3	148.0	147.9	144.4	137.8	140.2	139.9	137.8	148.2	154.1
Malawi	95.5	89.3	84.3	80.3	77.4	75.8	73.4	70.9	81.7	99.7	101.9	72.8	84.3	87.8
Mali	172.5	177.8	178.1	151.4	153.6	155.9	158.2	192.5	214.1	224.7	233.4	226.6	233.6	239.0
Mauritania	55.1	57.2	57.6	59.7	63.2	65.9	68.7	63.2	40.3	44.9	52.0	64.9	69.9	75.2
Mauritius	59.9	67.7	69.3	70.4	86.8	87.8	86.0	87.2	93.9	89.9	94.1	103.3	107.5	111.3
Mozambique				125.0	150.0	174.0	195.0	208.0	214.0	220.0	248.0	208.0	233.0	243.0
Namibia	61.2	56.5	48.9	63.1	49.6	53.6	55.0	58.5	60.1	60.7	59.1	65.0	62.9	69.8
Niger	91.6	87.0	83.8	82.8	83.6	77.8	78.4	78.2	95.8	93.7	98.0	113.8	114.9	141.5
Nigeria	822.8	820.9	851.2	885.9	963.4	989.7	1.048.6	1.212.3	1.303.2	1.330.0	1.477.8	1.416.9	1.456.6	1.502.4
Rwanda					78.0	80.0	84.0	80.0	85.0	98.0	111.0	126.0	156.0	104.0
Senegal	120.0	115.5	118.0	135.5	129.0	119.0	115.0	108.5	87.0	76.5	86.5	86.0	86.5	89.0
Sierra Leone	36.0	37.0	39.0	32.0	32.0	32.0	36.0	40.0	65.0	68.0	67.0	101.0	114.0	109.0
Swaziland									10.5	9.8	9.1	6.8	8.0	7.2
Tanzania	503.3	513.7	524.0	538.3	539.7	538.1	531.9	517.2	494.6	497.2	603.9	617.2	605.6	602.6
Togo	63.5	56.4	55.4	55.4	53.4	50.4	55.4	41.3	52.7	72.1	83.1	82.8	83.9	82.7
Uganda	172.2	156.6	160.0	148.5	158.9	191.3	190.8	198.2	215.6	207.0	233.5	280.9	284.0	273.2
Zambia	117.6	120.8	120.3	114.6	117.1	115.4	142.3	174.8	182.9	188.8	184.7	161.6	174.2	188.4
Zimbabwe	119.9	112.2	104.4	101.2	96.3	90.4	82.5	104.9	124.7	115.6	122.3	103.0	113.4	120.0

Source: ASTI (Agricultural Science and Technology Indicators). ASTI database. International Food Policy Research Institute (IFPRI). http://www.asti.cgiar.org/

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