1 Challenges for African Agriculture

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Motivation

Needs

Sub-Saharan Africa faces critical challenges.[1] More than 40 percent of all Africans live on less than US$1 per day, and a staggering one out of three is undernourished (Table 1.1). Yet 70 percent of the continent's poor work in agriculture.[2] Clearly, Africa's agriculture has underperformed. Under "business-as-usual" projections for agriculture, Africa will increasingly depend on food imports to meet its basic consumption requirements. Only in Africa, among all developing regions, are the numbers of malnourished children projected to increase over the next two decades (Rosegrant et al. 2001, 2005).

Although many factors contribute to Africa's persistent hunger and poverty, poor agricultural performance lies at the heart of the problem. On average, agriculture accounts for 65 percent of full-time employment in Africa, 25–30 percent of gross domestic product (GDP), and over half of total export earnings (IFPRI 2004; World Bank 2007b).[3] It underpins the livelihoods of over two-thirds of Africa's poor and assumes even greater importance in the continent's poorest countries, such as Burundi, Ethiopia, Malawi, and Tanzania. Yet Africa's agricultural performance over the past 45 years has ranked worst in the world according to most conventional measures. Given low levels of land and labor productivity, African farmers produce output per capita valued at only half

1. For brevity, the discussion hereafter will use *Africa* when referring to Sub-Saharan Africa.

2. Complete data on the sectoral composition of poor households' income do not exist for all of Sub-Saharan Africa. This estimate relies on work by Ravallion, Chen, and Sangraula (2007), who project the percentage of poor households residing in rural and urban parts of Sub-Saharan Africa; by Valdés et al. (2009), who provide breakdowns of the sectoral composition of income among poor rural households; and Garret (2004) and others, who provide evidence on the prevalence of urban agriculture among poor African households.

3. Weighting by GDP for all countries outside of South Africa (which alone accounts for 40 percent of Sub-Saharan Africa's aggregate GDP) produces an agricultural share of 25 percent. Weighting by population produces an agricultural GDP share of 30 percent.

TABLE 1.1 Indicators of agricultural performance and welfare

	Sub-Saharan Africa	South Asia	East Asia	Latin America
Agriculture				
Cereal yields, 2005 (tons/ha)	0.9	2.8		3.0
Value of agricultural production per farm population, 2005 (US$)	$225	$446		$2,105
Food aid cereals, 2000–03 (kg/capita)	4.6	1.1		1.1
Welfare				
Poverty headcount, 2004 (% living on less than US$1 per day)	41	31	9	9
Undernourishment, 2004 (% of population)	32	21	12	10
Malnutrition, 2004 (% children under 5 underweight for age)	29	45	15	7
Per capita income, 2005 (US$)	$746	$692	$1,630	$4,045
Aid per capita, 2005 (US$)	$44	$6	$5	$11
Population				
Population growth rate, 2006 (% per year)	2.3	1.5	0.8	1.3
Population, 2005 (millions)	743	1,470	1,886	551

SOURCES: World Bank (2007b), FAOSTAT (2008).

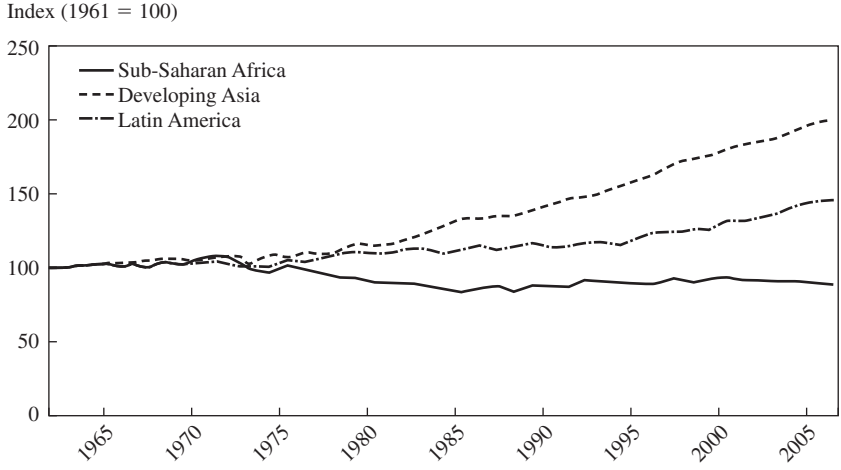
NOTE: The agricultural data for South Asia and East Asia refer to developing Asia.

the level achieved in developing Asia, while cereal yields in Africa attain only one-third of the level prevailing in developing Asia and Latin America (see Table 1.1). Africa likewise remains the only developing region where per capita agricultural production has fallen over the past four and a half decades (Figure 1.1). Today, in comparison with other developing regions of the world, Africa lays claim to the world's lowest agricultural productivity, its highest incidence of poverty, and per capita food aid quadruple that of other developing regions (see Table 1.1).

Opportunities

Increased agricultural productivity offers a potentially powerful tool for spearheading broad-based income gains among Africa's poor (see World Bank 2007a; Diao et al. 2008). On a continent where 70 percent of the poor work in

FIGURE 1.1 Trends in the value of agricultural production per capita, 1961–2006



SOURCE: FAOSTAT (2008).

agriculture, an upsurge in farm productivity contributes directly to raising rural living standards. In addition, a prosperous agriculture generates powerful growth linkages to the rest of the economy, providing cheap food, raw materials, and a growing demand for nascent processing and service industries (Mellor 1976; Haggblade, Hazell, and Brown 1989; Haggblade, Hazell, and Dorosh 2007). Even the urban poor, who spend the majority of their income on food, see their real incomes rise when growing agricultural productivity and output enable reductions in staple food prices. Likewise, the many rural households that remain net purchasers of food—a majority in many locations—benefit from rising farm productivity and falling food prices (Jayne, Mather, and Mghenyi 2006). Consequently, growing agricultural productivity attacks poverty from three different directions. It increases the productivity and incomes of the majority of Africa's poor, who work primarily in agriculture. It reduces food prices, which govern real incomes and poverty in urban areas. And it generates important spillovers to the rest of the economy.

Despite Africa's weak past performance, many agricultural specialists see significant potential for agricultural growth in Africa.[4] The continent is blessed with abundant natural resources, 12 times the land area of India with only two-thirds as many people to feed. Growing urbanization, from currently low levels, coupled with high rates of overall population growth, portends rapidly growing domestic and regional food markets. With few exceptions, African

4. See, for example, InterAcademy Council (2004), FAO (2005), and World Bank (2009).

land distribution is still equitable by international standards (Valdés et al. 2009). Small farms, efficient but poor, dominate the continent. Agricultural proponents likewise take heart from recent improvements in Africa's policy environment. The structural adjustment programs of the 1980s and 1990s have removed the worst of the previous biases against agriculture and have improved incentives for agricultural investments (Binswanger-Mkhize and McCalla 2008; Anderson and Masters 2009). Agricultural specialists similarly see opportunities for raising Africa's currently low yields through technological change. Some of the required technologies are already available, and modern science is opening up new opportunities to increase agricultural productivity, even in countries and regions that have not benefited significantly from new technologies in the past. The recent surge in world food prices, at least partly sustained by the biofuels policies of the United States and the European Union, seems likely to create new market opportunities for African farmers while at the same time adding urgency to the imperative for more rapid agricultural growth.

Recognizing these potential gains, a growing contingent of African leaders and technical specialists has become convinced that enhanced agricultural performance will constitute a necessary centerpiece for broad-based poverty reduction efforts. African leaders, through the African Union's (AU's) New Partnership for Africa's Development (NEPAD), have highlighted the critical importance of accelerating agricultural growth in Africa. In 2003 they launched a Comprehensive African Agricultural Development Programme (CAADP) to spearhead agricultural development efforts at a continental level (AU/NEPAD 2003a). Many donors and Africa specialists, likewise, consider agriculture fundamental to broad-based economic growth and poverty reduction in Africa.[5]

Impediments

But past lackluster performance in African agriculture has discouraged some professionals, even those who remain convinced of agriculture's potential importance as a poverty fighter. They question whether African agriculture can grow as rapidly as required, given a variety of historical, geographic, epidemiological, political, and world market handicaps.[6]

Geography and natural resource endowments give rise to a series of concerns. Africa's old and weathered soils, primarily kaolinitic clay, provide poor nutrient and water retention capacity. Its tropical climate precludes freezing winter temperatures that in temperate latitudes help to control pests and fracture soil clods and plow pans to facilitate plant root development (Lowe 1986;

5. Borlaug (1996), Partnership to Cut Hunger (2002), AU/NEPAD (2003a), InterAcademy Council (2004), FAO (2005), Valdés and Foster (2005), World Bank (2007a, 2009), Alliance for a Green Revolution in Africa (AGRA 2009).

6. See, for example, Bloom and Sachs (1998), Diamond (1998), Maxwell, Urey, and Ashley (2001), and Ellis (2005).

Masters and McMillan 2001). Endowed with a paucity of domesticable plant and animal species, African farmers operated for many millennia with a restricted agricultural genetic base (Diamond 1998). Given the continent's limited irrigation potential, most farmers depend on rainfed cultivation under difficult climatic conditions. Endemic diseases such as malaria, yellow fever, and HIV/AIDS have weakened Africa's labor force, while debilitating livestock diseases such as trypanosomiasis have severely limited livestock rearing, animal traction, and mixed cropping in the tropical zones (Bloom and Sachs 1998; Sachs 2001). Africa's land surplus and its consequently low population density have limited incentives for agricultural intensification, raised transport costs, and made it more difficult for viable input, output, and credit markets to emerge (Hyami and Platteau 1997).

Small countries pose problems of scale and market access. With a welter of political boundaries, many delineated in Berlin in 1885, independent Africa inherited a continent of nearly 50 independent states yet a population two-thirds the size of India's. For agricultural research and technology development, small countries imply high fixed costs. Africa, with the same cultivable area as the United States, operates eight times as many public agricultural research institutes. The resulting small size of Africa's nearly 400 public research agencies limits prospects for achieving economies of scale and spillovers in agricultural research (Pardey et al. 2007). A constellation of small countries, coupled with disease-ridden coasts and temperate inland plateaus, has led to an unusually high concentration of inland population and landlocked countries in Africa (Collier and Gunning 1999). This spatial configuration results in long distances to world markets and high transport costs. Yet coastal countries have limited incentives to invest in the road and transit infrastructure needed to serve their inland neighbors (Bloom and Sachs 1998; Chigunta, Herbert, and Mkandawire 2003; Collier 2007).

Weak institutions, poor governance, and bad policies also give pause. Skeptics highlight Africa's weak rural development institutions and poor rural infrastructure, with road densities today even lower than in India during the 1950s (Spencer 1994). Weak states, regional conflicts, and poor governance compromise the efficiency of public interventions in agriculture as well as in other sectors of the economy (Chigunta, Herbert, and Mkandawire 2003; Collier 2007).

The skeptics likewise point to volatile and generally falling commodity prices for Africa's major agricultural exports. Until the world commodity boom of 2007 and 2008, they note that slumping international prices posed long-term disincentives for African farmers. They further argue that Africa's low agricultural productivity, coupled with high transport costs and growing world market liberalization, make it increasingly difficult for African farmers to compete in global markets. Instead of focusing on what they see as slow-growth, low-return agriculture, some development specialists see urban-based manufacturing and services as more likely to stimulate broad-based economic growth in

many African settings (Maxwell 2003; Ellis 2005; Collier 2009). In short, the skeptics see attempts to develop African agriculture as too expensive and too late. They consider the prospects for success to be bleak.

Objectives

These concerns, coupled with the substantial benefits anticipated should agricultural growth accelerate, motivate interest in exploring the conditions under which African agricultural performance might improve. To do so, the following chapters examine a series of instances in which African policymakers and farmers have succeeded in sustaining agricultural growth over long periods of time.

This book explores the conditions under which Africa can successfully accelerate agricultural growth and thereby contribute to broad-based economic expansion and poverty reduction. A welter of past reviews has focused on Africa's failures and asked why African agriculture has performed poorly.[7] This book asks the opposite question. Instead of cataloging failures and constraints, it identifies episodes of successful agricultural growth, a series of region- and commodity-specific booms, many of which have lasted for decades. By examining a series of instances in which important advances have occurred in the past in African agriculture, this book aims to identify promising avenues for achieving success more consistently in the future.

Past Performance

Early Developments

Agricultural production across the continent has changed considerably since the beginning of domesticated agriculture in Africa 7,000 years ago. Today, imported plant species—such as maize, cassava, groundnuts, bananas, cocoa, potatoes, sweet potatoes, tea, and imported varieties of cotton and rice—account for over two-thirds of the value of Africa's gross agricultural output (Gabre-Madhin and Haggblade 2003). Even more striking, the continent's 600 million head of livestock and 700 million head of poultry descend almost exclusively from imported species, with the lone exception of the guinea fowl (Diamond 1998). Despite a virtual absence of indigenous domesticable livestock species, and with a limited range of indigenous plants, African farmers have built up diverse agricultural systems based largely on imported plant and animal species. This transformation has taken place in spite of the formidable ecological constraints imposed by Africa's old and weathered soils, limited irrigation potential, and debilitating endemic diseases such as malaria, tapeworm, and yellow fever. Livestock diseases, such as trypanosomiasis, have likewise severely limited livestock rearing, animal traction, and mixed cropping in the tropical zones (Bloom and Sachs 1998).

7. Berg (1981), World Bank (1989, 2000), Bloom and Sachs (1998).

The first half of the 20th century brought with it profound changes in smallholder agriculture all across Africa. Migrant smallholder farmers spread cocoa across much of West Africa (Hill 1963). Others introduced cassava to replace cocoyams, receiving important assistance from rural artisans who developed the necessary processing equipment along the way (Nweke 2004). Maize, cassava, and sweet potatoes gradually replaced sorghum and millets, leading to productivity gains across much of Africa (Jones 1957; Miracle 1966; McCann 2005). Tree crops and growing population pressure led farmers to abandon shifting cultivation and reduce fallow periods. Outside the endemic trypanosomiasis zones of Central Africa, ox plowing took root among many small farmers and commercial settler farmers. As Carr (2001, 331) has observed, "A striking feature of these developments was the speed at which many of these major innovations were adopted by large numbers of smallholders."

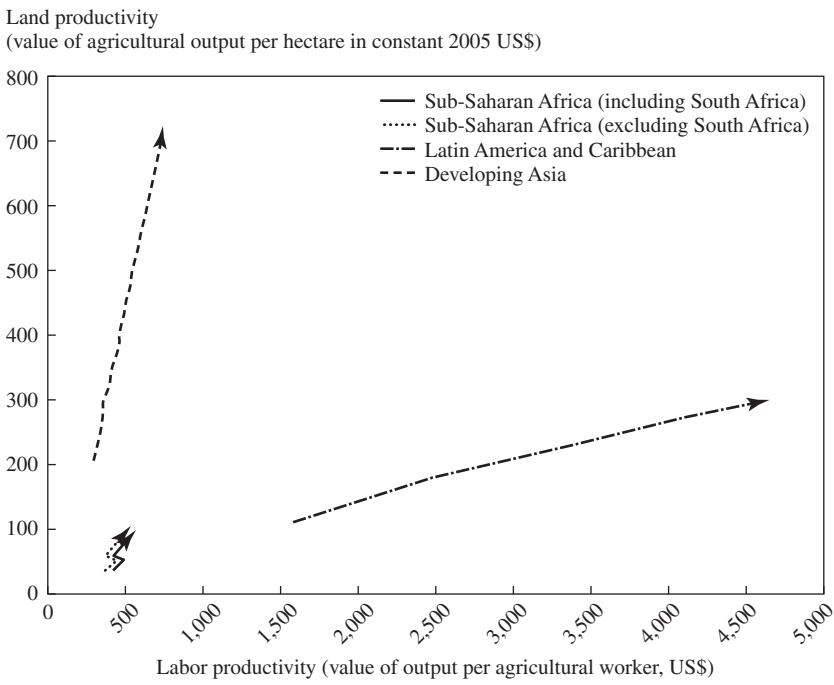
Sluggish Recent Performance

Since the middle of the 20th century, however, aggregate performance in Africa has lagged behind that of other developing regions. Over the past 45 years, the value of aggregate agricultural output has increased by 2.4 percent annually in Sub-Saharan Africa compared to 2.8 percent in Latin America and 3.6 percent in developing Asia (FAOSTAT 2008). Both labor and land productivity have stagnated, remaining far below levels achieved in other developing regions (Figure 1.2). African farmers apply an average of 8 kilograms of fertilizer per hectare compared to between 80 and 100 kilograms in developing Asia and Latin America (Morris et al. 2007). Given stagnant productivity, Africa's meager output gains have come mainly from area expansion. This extensification, coupled with shortened fallow periods and minimal input use, has led to nutrient mining and declining soil fertility (Cleaver and Schreiber 1994; Smaling, Nandwa, and Janssen 1997). In international markets, Africa has lost market share in all of its traditional export crops (World Bank 2007a; Hazell and Wood 2008). Since 1960, Africa's share of the value of world agricultural commodity exports has fallen from 5.0 percent to 1.3 percent (FAOSTAT 2008).

Africa's aggregate performance has lagged at the same time it confronts the most daunting demographic challenge of any developing region. Since 1960, Africa has contended with population growth rates of 2.6 percent per year, 0.5–0.7 percent greater than in Latin America and developing Asia (FAOSTAT 2008). Consequently, comparisons of per capita production performance across continents over the past 45 years reveal deteriorating agricultural performance in Africa alone (see Figure 1.1). As per capita food production has fallen, Africa has turned from a food exporter to a net food importer.

Equally worrisome are signs of decapitalization of Africa's key agricultural resources—its soils, human talent, and support institutions. Nearly half of Africa's farmland suffers from erosion and nutrient depletion (Cleaver and Schreiber 1994; AU/NEPAD 2003a). HIV/AIDS, with over 70 percent of known

FIGURE 1.2 Trends in agricultural factor productivity, 1961–2003



SOURCE: FAOSTAT (2008).
NOTE: The arrows at the tip of each time series indicate the value in 2003.

cases concentrated in Africa, has likewise extracted a heavy toll on Africa's human capital. Eroding civil service salaries and anemic recurrent budgets have immobilized agricultural extension and research staff, diminished staff incentives, and fueled an exodus of senior scientists from public research institutions (Pardey, Roseboom, and Beintema 1997; InterAcademy Council 2004). These disconcerting trends place Africa's natural, human, and institutional capital under pressure and threaten Africa's capacity to sustain agricultural productivity growth in the future.

Bright Spots

This bleak aggregate picture contrasts with periodic bursts of more promising region- and commodity-specific performance. A review of 26 village studies in Africa documents a series of impressive achievements, a collection of "small and not so small booms in production of food crops for the national and subnational markets" (Wiggins 2000, 635). Since 2000, half a dozen different groups have set out to identify and explore instances of superior performance

in African agriculture.[8] Several wonder aloud if a green revolution is already taking place in various parts of Africa (Wiggins 2007; Zachary 2008).

Indeed, African farmers and agricultural policymakers have achieved a series of substantial successes in agricultural development, although in recent decades these have proven inadequate in number and scale to counter Sub-Saharan Africa's heavy demographic pressure. Despite their temporal and regional dispersion, many have endured for decades, as the following thumbnail sketches suggest.

BANANAS IN AFRICA'S CENTRAL HIGHLANDS. For over 800 years, beginning about A.D. 500, farmers in the Great Lakes region experimented intensively with imported bananas. Through assiduous selection of cultivars, farmers bred a wide range of varieties suitable for human consumption, launching an extraordinary agricultural and demographic revolution in the Central African Highlands, a region that today supports one of the highest population densities in Africa (Schoenbrun 1993; de Langhe, Swennen and Vuysteke 1996; Reader 1997).

MAIZE IN EAST AND SOUTHERN AFRICA. The development and diffusion of modern, high-yielding varieties of maize have transformed this imported cereal from a minor crop in the early 1900s into the continent's major source of calories today. Maize breeding in Zimbabwe and Kenya launched the first major breakthroughs during the 1960s, when Africa's breeders produced the first commercially grown single-cross hybrids in the world. These breeding breakthroughs have improved the productivity of millions of small and large farms throughout Africa while moderating food prices for tens of millions of urban consumers (Smale and Jayne 2003).

CASSAVA. Cassava breeding and pest control efforts over the past three decades have triggered broad productivity gains for producers of Africa's number-two staple food. A stream of improved cassava varieties—the Tropical Manioc Selection series released beginning in 1977—has invigorated breeding programs across Africa, increasing on-farm yield gains by over 40 percent without purchased inputs, and permitting rapid responses to recurring viral attacks. Given the improved cassava's high productivity, low purchased input requirements, and well-recognized drought tolerance, Nweke, Spencer, and Lynam (2002) have dubbed this cassava transformation "Africa's best-kept secret."

COTTON IN WEST AFRICA. Since independence in the 1960s, West African cotton production and exports have both grown rapidly, at a compound annual rate of over 8 percent per year over the ensuing four and a half decades. As a result, francophone Africa's share in world exports has grown from near zero

8. In addition to Wiggins (2000), see the recent reviews by Pretty and Hine (2001), Reij and Waters-Bayer (2001), Gabre-Madhin and Haggblade (2004), Noble et al. (2004), FAO (2005), and Reij and Smaling (2007), as well as earlier work by Leonard (1991).

to 14 percent, making it the world's third-largest cotton-exporting block after the United States and the former Soviet Union (Tefft 2003).

HORTICULTURE EXPORTS FROM EAST AFRICA. From the early 1970s onward, Kenya's private traders have steadily expanded high-value exports of fruits and vegetables from Kenya. Over the past 30 years, horticultural exports have increased fivefold in real terms to become the country's third-largest source of foreign exchange after tourism and tea (Minot and Ngigi 2003).

DAIRY PRODUCTION IN KENYA. In recent decades, Kenya's dairy production has grown rapidly, resulting in per capita production double the levels found elsewhere on the continent. Today 600,000 small farmers operating with one to three dairy cows each produce 80 percent of Kenya's milk. By the year 2000, nearly 70 percent of Kenyan smallholders produced milk and it had become their fastest-growing income source, with net earnings from milk averaging US$370 per year (Ahmed, Ehui, and Asseva 2003; Ngigi 2005). As a result, dairy marketing offers an important pathway out of poverty for farms of all size (Burke et al. 2007).

RICE PRODUCTION IN MALI. Policy reform in rice milling and marketing has radically altered opportunities and incentives for Mali's rice producers over the past two decades. Price deregulation, together with the dismantling of public monopolies on paddy assembly, milling, and rice marketing, led to the emergence of small private dehuller mills operating at one-fourth the milling cost of the large state mills. The subsequent 50 percent devaluation of the Communauté Financière Africaine (CFA) franc (CFAF), in January 1994, further boosted producer incentives. Producers responded rapidly to these new options and incentives. As a result, Malian rice production more than tripled after 1985, growing by 9 percent annually over the ensuing 20 years (Diarra et al. 2000; FAOSTAT 2008).

The Disconnect

Why have these impressive individual episodes not added up to rapid aggregate growth? In part, sluggish aggregate statistics may understate Africa's agricultural accomplishments, particularly in cassava, bananas, and other difficult-to-measure perennial crops. Agricultural sample frames, often geared to measuring major grain staples, prove unreliable for tracking dairy, livestock, cassava, beans, and other minor food crops. Likewise, large countries such as Nigeria weigh heavily in continental aggregations, despite the questionable reliability of their statistical projections (Jaeger 1992; Wiggins 2000).

More fundamentally, Africa's high population growth rates impose the largest demographic challenge of any developing region. Given its high fertility rates, Africa will have to run faster than the rest of the developing world just to keep pace with its growing population. Because of Africa's belated demographic transition, dependency ratios remain higher and growth of the prime age workforce more limited than elsewhere. Past successes, impressive but

episodic, have proven insufficient to keep pace with Africa's daunting demographic challenge.

Although episodes of robust agricultural performance have occurred too infrequently in the past to counter Africa's demographic pressures, their occurrence suggests a possible diagnostic for improving future performance. By examining a series of cases in which important advances have occurred in the past, it may be possible to identify promising avenues for achieving success more consistently in the future.

Learning from Past Successes

Goals

Sometimes, things go right. And when they do, we may benefit from asking why. This book summarizes efforts by the International Food Policy Research Institute (IFPRI) to systematically identify instances of superior agricultural performance in Africa, to study them, and to learn from them. In doing so, the book aims to identify processes, practices, and policies that have successfully stimulated agricultural growth in Africa.

Our goal is to learn from what has gone right in the past. We begin with the premise that performance in some periods and locations has proven superior to that in others and that by comparing them it will prove possible to identify the causes of this variation. Using a comparative case study approach, the individual case studies that follow, in Part II of this book, attempt to contrast instances of superior performance with similar cases in which results have proven lackluster. The resulting method resembles a positive deviance study, in which instances of superior agricultural performance become the role models to be understood and emulated. Historically, this work most closely resembles the detailed case studies of African agriculture assembled by de Wilde (1967) and colleagues over 40 years ago.[9]

Research Methods

To identify common ingredients and processes that underlie agricultural "success," the research team first identified episodes of strong performance in African agriculture along with contrasting instances, over time or space, in which performance had lagged. They then recruited specialists to study these contrasting cases using a common research protocol. In a final stage, the analytical team brought the individual case study results together before groups of experienced African agricultural specialists to enlist their expertise in helping

9. Methodologically, the focus on detailed case studies of positive deviance resembles the approach adopted by Leonard (1991) in his study of successful rural development managers in Kenya.

to extract cross-cutting general lessons emerging from this body of collective case study experience (Table 1.2).

To identify a broad range of successful episodes in African agriculture, the team first launched an expert survey targeting IFPRI's extensive contact list of African and Africanist agricultural specialists. A one-page questionnaire posed the following single question: "What do you consider the most successful instances of improved agricultural performance in Sub-Saharan Africa?" To encourage the respondents to think broadly, the questionnaire deliberately left the criteria for success, as well as the time and geographic scope, unconfined. For each success story nominated, the survey form asked respondents to provide both their selection criteria and the factors they considered crucial in determining the favorable outcome.

In response, the team received over 250 nominations ranging broadly in geographic and historical scope. Some highlighted recent cutting-edge technical breakthroughs, while others went back thousands of years. Table 1.3 provides an overview of the nominations received, while Gabre-Madhin and Haggblade (2003, 2004) provide greater detail on the methods and findings.

In order to select instructive case studies and to help focus the analytical work, the team required a clear definition of "success." For purposes of this work, the Successes in African Agriculture team defined "success" as "a significant, durable change in agriculture resulting in an increase in agriculturally derived aggregate income, together with reduced poverty and/or improved environmental quality" (Haggblade 2004, 4). This definition retained the three vertices of the "critical triangle"—income, equity, and sustainability. Given the importance ascribed to aggregate income growth, the definition calls for a significant increase in income coupled with improvement in either sustainability or equity, or both.

With this definition in hand, the research coordinators and an external advisory group reviewed the expert survey success nominations in order to select a dozen cases for in-depth review (Table 1.4). The resulting selection provides a series of important contrasts among private and public instigators of change, a variety of intervention points, differing levels of subsidy, a mix of food and export crops, regional diversity, and impacts of variable duration and scale. Geographically, the case studies covered 11 countries in West, Eastern, and Southern Africa (Figure 1.3). In total, the analytical team produced 11 case study reports as well as an additional half dozen background and synthesis papers. These provide the substance on which the remaining chapters of this book are based.

To provide an appropriate counterfactual comparison, the team attempted to identify paired comparisons of successful and unsuccessful efforts for each of the case study selections. This proved relatively straightforward with the dairy, horticulture, cassava, and cotton case studies.[10] The other case studies—

10. Due to a debilitating illness suffered by one of the co-authors of the cotton sector study, only the "successful" Malian case study was completed.

TABLE 1.2 The successes in African agriculture research process

Activity	Purpose	Participants	Venue	Timing
1. Identify successes				
Expert survey	Inventory African successes	Research coordinators (RCs)		June–November, 2000
Advisory group (AG) meeting	Define *success* Select case study topics	AG and RCs AG	Washington, D.C.	November 20–21, 2000
2. Scrutinize selected cases				
Recruitment of the analytical team		RCs		
Analytical team inception workshop	Develop analytical framework Design standard case study protocol	RCs Analytical team (AT)	Washington, D.C.	October 1–5, 2001
Case studies		AT		
Case study workshop	Share information Provide team feedback to all authors	RCs AT	Lusaka	June 10–12, 2002
3. Generalize across case studies				
Stakeholder input	Synthesize and generalize	African policymakers AG, RCs One AT member per case study	Pretoria	December 1–3, 2003
Validation	Validate and refine findings Gain regional perspective	African policymakers RCs	Nairobi	November 22–25, 2004
Policy summary	Summarize case studies and policy implications Explore agricultural budgeting issues with parliamentarians	African parliamentarians RCs	Somerset West, South Africa	May 15–18, 2006

NOTES: RCs—During the first half of the Successes in African Agriculture (SAA) review, Eleni Gabre-Madhin and Steven Haggblade served as IFPRI's research coordinators. During the second half of the review, Haggblade and Peter Hazell served in this role. AG—The external advisory group for the SAA review included Michel Benoit-Cattin, Josué Dione, Simeon Ehui, Carl Eicher, and Wilberforce Kisamba-Mugerwa. AT—The analytical team includes the case study authors: Mohamed A. M. Ahmed, Oluyede C. Ajayi, Yemesrach Assefa, Simeon Ehui, Steven Franzel, Steven Haggblade, Bashir Jama, Thomas Jayne, Daniel Kaboré, Freddie Kwesiga, Paramu Mafangoya, Nicholas Minot, Margaret Ngigi, Quereish Noordin, Felix Nweke, Frank Place, Chris Reij, Melinda Smale, James Tefft, Gelson Tembo, and Ballard Zulu.

TABLE 1.3 Expert survey success nominations

Category	African agricultural successes identified (%)		
	Total	Africa-wide	Region-specific[a]
Commodity-specific			
Maize	10.3	11.1	10.0
Cassava	6.7	15.3	3.3
Horticulture	6.6	1.4	8.6
Livestock	6.2	9.7	4.8
Cotton	4.5	1.4	5.7
Coffee	4.3	5.6	3.8
Dairy	3.4	0.0	4.8
Rice	3.3	5.6	2.4
Cocoa	2.5	2.8	2.4
Bananas	2.5	1.4	2.9
Beans	1.8	1.4	1.9
Other	9.5	6.9	10.5
Subtotal	**61.6**	**62.5**	**61.2**
Activity-specific			
Soil fertility enhancement[b]	7.1	5.6	7.7
Policy reform			
Agricultural markets	2.0	0.0	2.7
Macro policy	1.6	0.0	2.2
Irrigation development	2.4	1.4	2.7
Specific technology development[c]	1.6	1.4	1.6
Other	6.7	6.9	6.6
Subtotal	**21.2**	**15.3**	**23.5**
Institution building			
Agricultural research	5.5	12.5	2.7
Farmer organizations	3.1	1.4	3.8
Market institutions	2.4	1.4	2.7
Human capacity building[d]	1.6	5.6	0.0
Other institutions	3.5	1.4	4.4
Subtotal	**16.1**	**22.2**	**13.7**
Countries			
Ethiopia, 1990s	0.4		0.5
Ghana, 1990s	0.4		0.5
Ivory Coast, 1960s and 1970s	0.4		0.5
Subtotal	**1.2**		**1.6**
Total			
Share	**100.0**	**100.0**	**100.0**
Number of nominations	**253**	**71**	**182**

SOURCE: Gabre-Madhin and Haggblade (2004).

[a]Specific to East, Southern, Central, or West Africa or to a specific country.

[b]Includes improved fallows, crop rotations, conservation farming.

[c]Biotechnology applications, vaccines.

[d]Finance, management, business.

TABLE 1.4 Case study selections

Paper no.	Topic	Countries covered	Regional applicability	Authors
1	Cassava	Nigeria, Ghana	West Africa	Nweke
2	Cassava	Zambia, Malawi	Southern Africa	Haggblade and Zulu
3	Cotton	Mali	Francophone West Africa	Tefft
4	Dairy	Kenya, Uganda	East Africa	Ngigi
5	Dairy	Ethiopia	Horn of Africa	Ahmed, Ehui, and Assefa
6	Horticulture	Kenya, Côte d'Ivoire	Africa	Minot and Ngigi
7	Maize	Kenya, Malawi, Zambia, Zimbabwe	East and Southern Africa	Smale and Jayne
8	SSFM: planting basins	Burkina Faso	Semiarid Africa	Kaboure and Reij
9	SSFM: planting basins	Zambia	Semiarid Africa	Haggblade and Tembo
10	SSFM: improved fallows	Kenya	Africa	Place, Franzel, Noordin, and Jama
11	SSFM: improved fallows	Zambia	Africa	Kwesiga, Franzel, Ajayi, and Mafangoya

NOTE: SSFM, sustainable soil fertility management.

including those for maize, cotton, and sustainable soil fertility management technologies—have instead relied on temporal comparisons within the selected case study countries. In both sets of case studies, periods of sluggish performance provide a contrasting scenario against which to compare periods of rapid growth. For this reason, the turning points and the forces driving change at those junctures become central to helping us understand what instruments have proven effective in turning around agricultural performance in a variety of African settings.

Analytical Framework

Eleven case studies provide the empirical foundation for this analytical work. In order to produce comparable narratives, the analytical team developed a common framework for guiding each of the case studies. As a first step, the an-

FIGURE 1.3 Case study countries

alytical team—a group of subject-matter specialists recruited to conduct each of the case studies—convened in Washington, D.C., for one week to develop a common analytical framework and to plan the case study work.

They sought an analytical framework that would help them track sources of change in agricultural trajectories. Given the long lead times required in technology development and the ongoing continuous evolution in biological systems, the framework needed to track interactions between human and biological systems over time. In constructing such a framework, the analytical team has drawn key features from a number of different conceptual paradigms ranging across a wide spectrum of disciplines. The umbrella framework and core dynamic processes draw heavily on the co-evolution paradigm developed in the anthropological and archaeological literature to study the emergence and long-

term evolution of agriculture.[11] This literature focuses broadly on the interdependence between biological systems and the human institutions governing agriculture. To help refine and operationalize that core dynamic framework, a related body of work in the biological and social sciences has likewise proven useful.[12] Figure 1.4 summarizes the resulting analytical framework, which the analytical team refers to as the Decisionmaking Environment (DE)–Action (A)–Results (R) framework (the DE-A-R framework).

DECISIONMAKING ENVIRONMENT. Because future growth in African agriculture will depend on improved performance by millions of individual farmers, the analytical framework places farmer decisionmaking at its core (see Figure 1.4). It focuses on the decisionmaking environment that shapes incentives and opportunities available to farm households. Farmers' productive capacity, or opportunity sets, are determined at any given time by household assets as well as a set of public and collective goods, including available technology, roads, and community land management systems. Biophysical features of the agroecological zone—such as rainfall, soil fertility, and the incidence of pests and disease—also clearly affect productive capacity. The second major component of the decisionmaking environment, the existing incentive structure, depends on prevailing prices, local values and culture, and institutions governing the marketing and processing of farm products. Public actors such as governments, donors, and nongovernmental organizations (NGOs) influence the farmers' decisionmaking environment through investments in public goods, such as infrastructure and research, through support institutions and through policies that shape the incentives to which farmers respond.

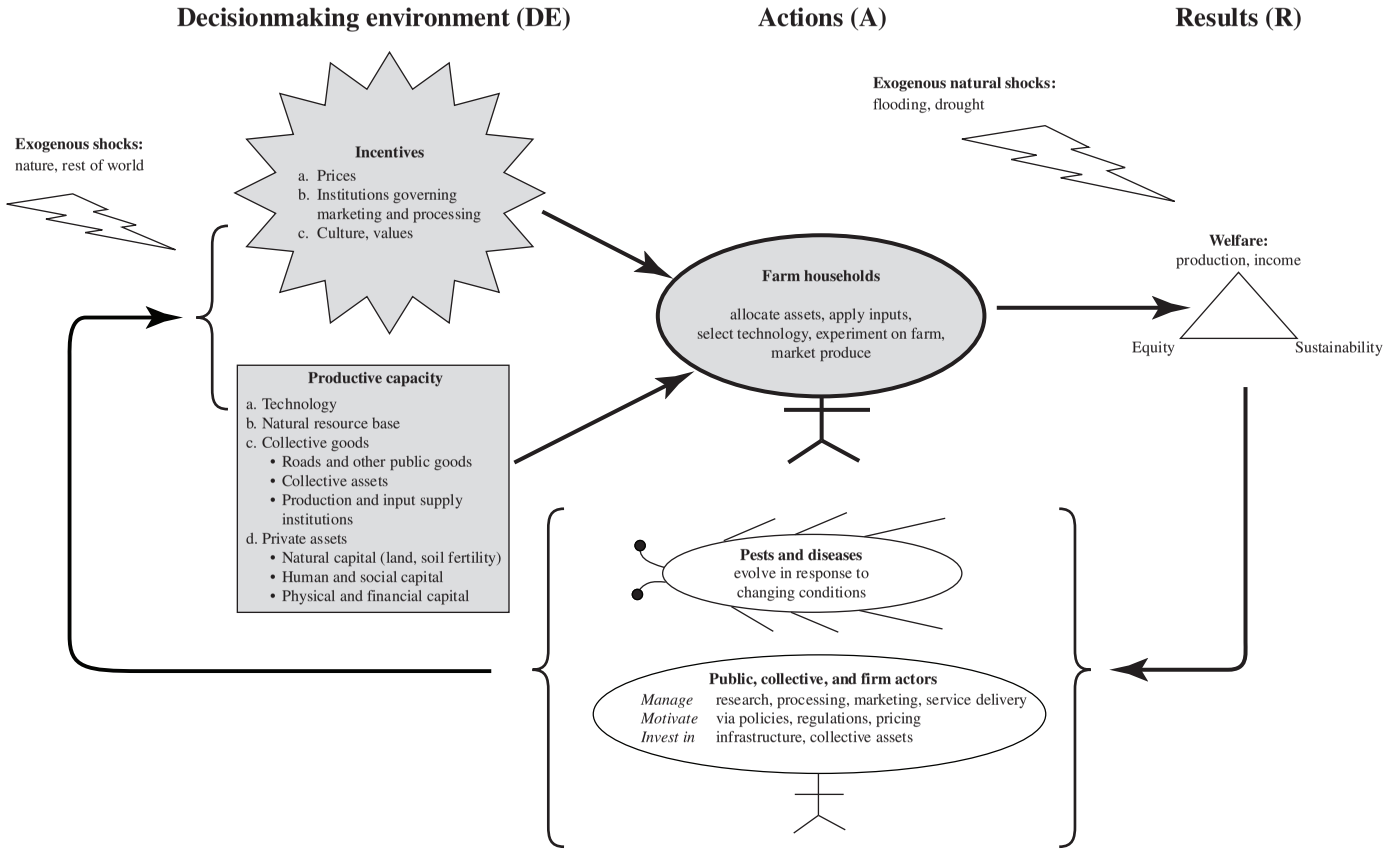
ACTIONS. Farmers act, motivated by the prevailing incentive structure and constrained by their productive capacity. They allocate land, labor, draft power, and financial capital across a portfolio of farm and nonfarm activities. Within each, they select a given technology and level of input use. They experiment, monitor, and compare outcomes. At the end of each production cycle, they decide to market some of their farm output, process a portion, and consume or store the remainder.

The natural biological environment likewise responds to changes in agricultural systems. Farm technologies and input use influence soil fertility, soil

11. See Rindos (1980, 1984) and Price and Gebauer (1995).

12. On crop evolution, see, for example, Harlan (1992, 1995), Smith (1995), Evans (1996), and Diamond (1998). On nutrient monitoring, see Stoorvogel and Smaling (1990), Smaling, Nandwa, and Janssen (1997), de Jager, Nandwa, and Okoth (1998), and van den Bosch, de Jager, and Vlaming (1998). On induced innovations, see, for example, Boserup (1965), Hyami and Ruttan (1971), and Binswanger and Ruttan (1978). On institutions and institutional innovation, see Binswanger and McIntyre (1987), Nabli and Nugent (1989), North (1990), and Hayami and Otsuka (1993). On development pathways, see Pender, Scherr, and Duron (2001) and Pender et al. (2004). For the related literature on economic livelihoods, see, for example, Ellis (2000), Pretty (2000, 2005), and Pretty and Hine (2001).

FIGURE 1.4 The DE-A-R framework



SOURCE: IFPRI (2003).

organic matter, and biotic activity. Plant and animal viruses evolve continuously as they adapt to changing agronomic practices, plant populations, input applications, and weather. Pests, diseases, and weed species change over time in response to human agricultural practices.

RESULTS. These actions, together with natural variations in weather, generate a set of results for individual households and, in aggregate, for the rural community. The results indicators adopted by the analytical team include empirical measures for each component of agricultural "success" (Table 1.5). The case study teams agreed that they would attempt to measure indicators along each dimension of success. While recognizing that this would not always be possible with available primary and secondary data, team members helped each other to identify possible sources of microdata necessary for making these calculations.

FEEDBACK AND INTERACTION. In a giant dynamic feedback loop, outcomes in each period influence both dimensions of the decisionmaking environment in the next season. Agricultural output and income influence farmers' capacity and inclination to finance productive investments. Asset accumulation in any one period increases farm households' productive capacity in the next. Marketed volumes likewise influence market price incentives as well as consumption and future production. Outcomes from one period affect soil fertility and other household assets as well as the behavior of external actors such as agribusiness firms, farm organizations, government, donors, NGOs, and nonfarm consumers. The resulting responses by these actors, external to the farm household, alter the decisionmaking environment facing farm households in the following period.

Pests, weed populations, and diseases likewise respond and adapt to changing circumstances. Over time, these adaptations lead to periodic violent

TABLE 1.5 Measuring results

Success indicator	Measure
1. Improved welfare	a. Income
	Number of households adopting change (small, medium, large)
	Increased average income per household
	b. Assets
	c. Consumption
	d. Nutrition
2. Equity	a. Smallholder participation in production growth
	b. Income change for smallholders
	c. Poverty reduction
3. Sustainability	
a. Ecological	a. Net nutrient flows
b. Financial	b. Financial viability, with and without subsidies

upsurges in pest and disease infestation. The case studies in Part II of this book routinely demonstrate the recurring difficulties posed by mutating diseases, viruses, pests, and weed populations. The case studies explore how these adaptations in the biological system trigger corresponding responses on the part of farm managers and researchers on whom farmers rely for a steady infusion of new genetic and phytosanitary material.

CASE STUDY PROTOCOL. The standard case study protocol emerging from the DE-A-R framework is described in Table 1.6. This standard protocol begins by defining the scope of the case study and explaining why agricultural specialists generally considered it a success. The team then summarizes historical dynamics in order to define key turning points and phases in each given commodity case study. Within each period, discussion and analyses focus on key shocks to the decisionmaking environment, the ensuing changes in farm household actions, and key results in terms of income, equity, and sustainability. Each case study concludes with a discussion of policy implications.

To provide some specificity and microeconomic grounding to these broad case study overviews, the analytical team agreed to prepare a series of short farmer case histories exploring how changing opportunities and incentives affected individual farm families in practice. Summarized in short boxes in the case study chapters, these profiles aim to help illustrate key dimensions of the changes under way. They likewise serve to focus attention on individual farm families, whose improved performance and welfare lie at the heart of agricultural development efforts.

Key Policy Issues

WHAT INTERVENTIONS? Two key structural features of the agricultural decisionmaking environment govern human responses at any given point in time (see Figure 1.4). First, productive capacity places bounds on the scope of

TABLE 1.6 Case study protocol

1. Scope of the case study
Commodity, time period, and location of the study
Scale and scope of the "success"
Why is this considered a success?
2. Historical turning points
Change in aggregate production trends (output, yield, area)
Identification of key turning points
Definition of key phases
3. Dynamics and drivers of change during each phase
Key shocks to the farmer decisionmaking environment
Actions and responses by farm households and others
Results: income, equity, sustainability
4. Policy implications

action available to farmers. These opportunity sets depend on the available quantity, productivity, and distribution of key productive assets such as land, labor, capital, and water; on the stock of available biological and agronomic technology; on the state of physical infrastructure; and on supporting institutions for resource management, input supply, and marketing. Second, prevailing incentive structures govern which of the available options farmers will select from within their available opportunity sets. Incentives such as enhanced food security, social solidarity, or risk reduction influence individual and household decisionmaking, while market prices affect input supply as well as the production, storage, processing, and marketing of outputs.

Levers available for initiating change thus fall into two broad categories. Interveners can elect to expand productive capacity through development of new agricultural technology, provision of public and collective goods (roads, institutions governing production and input supply), or investment in private assets such as soil fertility, human capital, and physical and financial capital. Alternatively, they can focus on improving farmer incentives. Common tools include exchange rates, tariffs, subsidies, and taxes that influence market prices as well as investment in institutions governing output marketing and processing.

WHO INTERVENES? The case studies that follow identify key actors and agents of change. Who has taken the key initiatives? Given rapidly changing agricultural technology and the privatization of gains from biotechnology and genetic engineering, private and public roles may differ in the future. Trends toward agricultural market liberalization have opened up large agricultural markets to private investment and trade. From a policy perspective, it becomes critical to determine when and where public intervention is required and, conversely, where the private sector can most usefully take the lead. Chapters 8 and 9 return to these key questions.

Generalizing across the Case Studies

To generalize from a dozen individual, historical case studies, the analytical team first compared the findings from all the case studies in order to identify general determinants of success. What, they asked, has driven past successes in African agriculture? What investments, technologies, policies, institutions, organizational structures, and processes have proven key to enabling success in each of the case studies under review? How have public and private actions shaped these opportunities? Second, they explicitly asked how the future environment facing African agriculture might differ from that of the past. What principal changes are under way—in technology, communications, world markets, and local institutions—that might influence future prospects for African farmers? Finally they asked, given these changes, how can farmers and policymakers best apply the lessons of the past going forward?

To answer each of these questions requires considerable judgment and collateral knowledge. Therefore the analytical team, in collaboration with the NEPAD Secretariat, convened a series of three groups of experienced agricul-

tural specialists and political leaders from across Africa to provide input into this synthesis effort. Participants included a broad spectrum of farmers, government officials, and private sector agribusiness operators. The first workshop, held in Pretoria in December 2003, involved roughly 70 senior African agricultural policy and technical specialists.[13] The second, focusing exclusively on East and Southern Africa, took place in Nairobi in November 2004.[14] The third, drawing African parliamentarians from all across Africa, took place in Somerset West, South Africa, in May 2006.[15] In all three settings, following brief plenary presentations by the case study teams, the participants spent the bulk of their time interacting in a series of professionally facilitated small-group working sessions.

Through the facilitated small group sessions, participants worked together to complete a series of specific tasks: (1) summarize key lessons learned from past successes in African agriculture, (2) realistically assess the domestic and international policy environment within which African decisionmakers currently operate, and (3) identify priorities for future policy action necessary to trigger sustained agricultural growth in Africa. Part III of this book, which summarizes key lessons for the future, has drawn heavily on these successive dialogues with African agricultural stakeholders and policymakers.

Organization of the Book

Part I of this book has described the objectives, methods, and analytical framework used in reviewing agricultural successes in Africa. Part II, the core of the book, reports in detail on the individual case studies selected for review. Chapter 2 begins by examining the cassava production surge that has occurred across much of Africa since the 1980s using case study material from Nigeria, Ghana, Zambia, and Malawi. Chapter 3 then reviews the causes and consequences of hybrid maize development and diffusion in eastern and southern Africa by examining four contrasting country case studies from Zimbabwe, Kenya, Malawi, and Zambia. Given the long-term investments that underpin these productivity gains, this discussion covers roughly a 100-year period, from the early 1900s to 2005. Chapter 4 details the origins and impact of francophone West Africa's long-term cotton expansion over the four and a half decades following independence, focusing on evidence and experience from Mali. Chapter 5, in turn,

13. The full conference program, proceedings, participant list, and all background papers are available at <www.ifpri.org/event/successes-african-agriculture>.

14. Titled "Agricultural Successes for the Greater Horn of Africa," these results are summarized by Haggblade (2005). A full set of conference materials is available at <www.ifpri.org/event/nepadigad-regional-conference-agricultural-successes-greater-horn-africa>.

15. The outcomes of this conference, Championing Agricultural Successes for Africa's Future: A Parliamentarians' Dialogue on NEPAD, are summarized in NEPAD (2010) and at <www.ifpri.org/sites/default/files/publications/if15.pdf>.

explores two contrasting experiences with horticultural export development, one in Kenya and the other in Côte d'Ivoire, focusing on the years since 1970. Chapter 6 reviews the East African dairy experience, contrasting the century-long expansion and modernization in Kenya with the less impressive performance in neighboring Ethiopia and Uganda. To wind up the case study reviews, Chapter 7 describes the development and impact of two pairs of sustainable soil fertility management technologies. The first pair contrasts systems of minimum-tillage planting basins developed independently in Burkina Faso and in Zambia, while the second compares the development of improved fallow systems in Western Kenya and in Eastern Zambia.

Part III of the book generalizes and looks forward. Chapter 8 begins that effort by summarizing, comparing, and contrasting the six case study chapters. In so doing, it aims to distill the general policy lessons that emerge and to separate out actionable items from idiosyncratic factors responsible for superior agricultural performance. Chapter 9 looks forward by examining several key questions. Why has Africa not experienced more frequent agricultural successes in the past? How will recent rapid changes in technology, global markets, and agricultural institutions affect future strategies for stimulating agricultural growth? What needs to change to get African agriculture growing more rapidly? The book sums up by examining how lessons from the past can help governments, farm leaders, and agribusinesses shape future strategies for successful agricultural development in Africa.