PART 1

Overview of Evolution, Current Status, and Future Goals
As in any other part of the world, agriculture in Africa is dependent on constraints and limitations imposed by the natural resource base. Foremost among these constraints are those related to land availability, land fertility, and access to water. Traditionally, African countries have faced fewer land constraints because of their comparatively low population density, but many rural areas may be facing rapidly rising population density (Jayne, Chamberlin, and Muyanga 2012). Water constraints similarly limit production in many areas. Almost all agricultural production in Africa is rainfed. Barely 4 percent of the cultivated area in Africa south of the Sahara (SSA) was equipped for irrigation in 2005, compared with 18 percent globally (Svendsen, Ewing, and Msangi 2009). Rainfall, which varies dramatically across Africa, often limits agricultural production during dry seasons and droughts (Xie et al. 2014). Soil degradation is another constraint that tends to worsen with increasing population density and associated shortened fallow periods in many areas. Country-level estimates of yearly productivity losses resulting from land degradation, summarized in Bojo (1996), ranged from less than 1 percent of agricultural gross domestic product (AgGDP) to more than 15 percent.

For many decades, African countries have lagged behind other developing regions in terms of economic performance in general and agricultural performance in particular. It is now widely accepted that African economies are undergoing a remarkable recovery. Although the recent acceleration in growth is welcome and impressive, the gap is still significant, and enormous work remains to be done to sustain the recovery and build on recent progress toward reducing poverty. African countries are showing greater willingness and intention to increase agricultural investments, but most countries still appear to be underinvesting in agricultural research and development (R&D), hindering their ability to generate the technological innovations needed for agricultural productivity growth. Future progress by African countries in spurring agricultural growth and reducing poverty...
requires adequate strategies to promote technical change and raise factor productivity—especially labor productivity—among the rural poor. The key is a policy and institutional framework that supports agricultural innovation and competitiveness by helping African countries successfully address the resource limitations and constraints they are facing.

This chapter reviews the performance of African countries in terms of agricultural growth, productivity, and poverty reduction. After several decades of economic and agricultural stagnation, and even decline, agricultural growth and productivity have increased impressively in the past one to two decades. This chapter analyzes the magnitude and nature of the changes that have taken place in order to draw lessons for future policies and programs focusing on technological innovation. It then assesses current efforts by African countries to sustain the recent recovery under the Comprehensive Africa Agriculture Development Programme (CAADP) of the New Partnership for Africa’s Development (NEPAD). A large number of countries have put ambitious national agricultural investment plans in place under CAADP that would significantly increase agricultural growth and reduce poverty, if the stated goals can be achieved. Key questions raised include to what degree countries are making the necessary investments to foster agricultural productivity growth, what gaps remain to be filled, and what the implications are for innovation policies and programs. The discussion in this chapter provides a backdrop for subsequent chapters in this volume that examine various aspects of the science and technology (S&T) agenda in Africa, including the effectiveness and impact of national agricultural research systems (NARSs), the role and reach of investments in human and institutional resources to promote innovation and raise productivity, and goals and targets designed to guide future strategies.

**Agricultural Growth: From Decline to Recovery**

African countries entered the postcolonial era with strong overall economic growth performance. On average, gross domestic product (GDP) grew at 4.7 percent per year from 1960 to 1970, surpassing South Asia’s rate of 4.0 percent.\(^1\) Growth performance began to deteriorate rapidly in the following decade, reaching crisis proportions in the 1980s. Average GDP growth in African countries fell from 3.4 percent per year in the 1970s to 1.4 percent per

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1 Growth rates refer to SSA and were calculated from World Bank (2014b).
year in the 1980s. Per capita GDP grew at 2.1 percent per year during the 1960s, compared with 1.7 percent in South Asia, but slowed thereafter. By the 1980s, Africa entered a period of negative per capita GDP growth: –1.4 percent per year in the 1980s and –0.4 percent per year in the 1990s.

The pace of agricultural growth followed the same declining trends. During the 1970s, the average rate of agricultural growth was a mere 2.5 percent per year, representing a low point in Africa's post-independence performance. Growth increased to 3.2 percent per year in the 1990s, accelerating in the following decades to reverse the negative trends of the 1970s and 1980s. In the new millennium, growth increased to reach 4.6 percent per year between 2002 and 2010. During the food and financial crises that devastated the global economy in 2008–2009, Africa managed to maintain relatively healthy positive growth. Agricultural growth continued to accelerate into the current decade at an average rate of 5.1 percent—nearly twice the rate of population growth of 2.7 percent. Over the past 15 years, African countries have experienced the longest period of sustained economic and agricultural growth since independence. More strikingly, growth has not only accelerated, but also spread broadly across all the major subregions (Figure 1.1).

The aggregated GDP and agricultural growth trends discussed above mask significant subregional and national differences that, notably, are the levels at which actual policies and programs are designed and implemented (Figure 1.2). For most countries, both GDP and agricultural growth generally move in the same direction, the exception being mineral-rich countries like Guinea and Zambia. This fact is not new, but is also not likely to change in the foreseeable future. However, as seen in the ensuing discussion, it has significant implications for future growth and development strategies, and particularly for the agricultural S&T agenda. A number of countries are still facing considerable growth challenges (Figure 1.2). With the exception of West Africa, the majority of countries in all the other subregions exhibit agricultural growth rates that are still markedly below the 6 percent target set under CAADP.

Consequently, while the current recovery is encouraging, and growth is moving in the right direction, significant efforts are still needed in many countries to sustain and further accelerate the recovery process. This becomes even clearer when looking beyond the absolute rates of growth to trends in per capita agricultural production over the past five decades. The rapid growth in the past 15 years has at best allowed countries to make up for the lost decades of the 1970s and 1980s (Figure 1.3). With the notable exception of West Africa, average regional per capita production is still well below the levels of the 1960s.
Figure 1.1 Agricultural GDP growth recovery among African countries, 1990–2000 and 2000–2013

a. Average agricultural GDP growth (%), 1990–2000

b. Average agricultural GDP growth (%), 2000–2013

Source: Calculated by authors based on UNSD (2013).

Note: The lighter/darker a country's shading, the lower/higher its growth rate; the contrast between the two maps signals the extent to which growth has not only accelerated, but also spread geographically.
FIGURE 1.2 GDP and AgGDP growth by subregion, 1995–2003 and 2003–2010 averages

**Source:** ReSAKSS (2013b).

**Notes:** AgGDP = agricultural gross domestic product; CAADP = Comprehensive Africa Agriculture Development Programme; GDP = gross domestic product.
The difficulty in raising the pace of agricultural growth above that of population growth has led to a rapid increase in agricultural import expenditures by African countries. The total value of agricultural imports rose tenfold between 2001 and 2011 to nearly US$80 billion. While African countries have quadrupled the value of agricultural exports during the same period to more than $40 billion, the agricultural trade deficit has widened significantly, and is about to reach the same value as overall agricultural exports (Badiane, Makombe, and Bahiigwa 2014). Faster income growth and rapid urbanization have contributed to the rapid increase in food demand, in general, and food imports, in particular. In the face of limited scope to raise agricultural output in other major world regions significantly, failure to further accelerate and sustain growth in the agricultural sector would have two major negative consequences for African countries. On one hand, they stand to miss the opportunity to capture a larger share of the steadily expanding demand on African

2 All currency is in US dollars, unless specifically noted otherwise.
and global agricultural markets and, hence, the opportunity to create wealth in Africa and earn foreign exchange. On the other hand, greater dependency on food imports makes African countries more vulnerable to (temporary) shortages in global food markets and, hence, to greater volatility in food prices.

It is clear from the above that the lost decades leading to and just following the structural adjustment era not only caused very slow progress in reducing poverty for most African countries, but also altered the role of African countries in the global food and agricultural economy. As a result, the recent growth performance, and its strategic implications, must be assessed in the context of the progress that has been, and still needs to be, realized in terms of the role of agriculture in African economies and its implications for reducing poverty. This is dealt with in the next section.

**Growth Performance and Poverty Outcomes**

Africa’s overall economic and agricultural growth performance over the past five decades is mirrored in changes in poverty levels over the same timeframe. Although Africa had poverty rates lower than those of East Asia and Pacific and South Asia in the 1980s, rates began to rise in Africa while they declined in the other two regions (World Bank 2014a). In 1981, 51.5 percent of Africa’s population lived below the $1.25 a day international poverty line compared with 77.2 percent in East Asia and Pacific and 61.1 percent in South Asia. During 1981–1993, the proportion of people living below the international poverty line increased by 7.9 percentage points in Africa, whereas it decreased by 26.5 and 9.4 percentage points in East Asia and Pacific and South Asia, respectively. As Africa’s economic growth began showing signs of improvement in the mid-1990s, poverty rates also began trending downward. In particular, between 1993 and 2010, Africa’s poverty rate fell by 10.9 percentage points to 48.5 percent in 2010. Meanwhile, poverty fell more rapidly in other developing regions—by 38.2 and 20.7 percentage points to 12.5 and 31.0 percent in 2010 in East Asia and Pacific and South Asia, respectively.

Although the proportion of poor people has trended downward, Africa is the only developing region of the world where the absolute number of poor people living below $1.25 a day continued to rise, from 330.0 million in 1993 to 413.7 million in 2010. Meanwhile, over the same period, the numbers of poor people fell drastically in East Asia and Pacific, by 71.2 percent to 250.9 million people, and in South Asia, by 19.8 percent to 506.8 million people.

The challenges of increasing growth and reducing poverty are best appreciated by looking at progress toward the Millennium Development Goal
(MDG) of halving poverty by 2015. While poverty levels have fallen across the board—in particular in the 2000s, with the exception of Central Africa—none of Africa’s subregions is on track to meet the poverty goal (Figure 1.4). More important, the remaining gap suggests that considerably more efforts are needed if the goal is to be achieved soon. The slow progress in eliminating poverty is an effect of agricultural growth trends. The stagnation and decline in the agricultural sector during most of the post-independence era has led to a *stunting* of the sector. In other words, poor agricultural performance over decades has led to a rapid decline in the sector’s share of GDP in most African economies. As a result, agriculture plays a less significant role in African economies than should have been the case, based on their current levels of development.

To measure the extent of the stunting of the agricultural sector, the relationship between per capita income and the relative size of the sector was estimated and used to compare actual and “expected” shares among African countries (Figure 1.5). AgGDP shares have declined much faster in African countries than would be expected considering the slow income growth. Observed average
FIGURE 1.5 Expected versus actual average AgGDP shares, selected African countries, 2000–2008

Source: Based on Badiane (2011).

Note: AgGDP = agricultural gross domestic product.
shares are around 30 percent, or nearly 20 percentage points, below projected levels. The extent of the stunting of the agricultural sector can also be seen by comparing sectoral shares among African countries with those of other developing regions. Results presented in Badiane (2011) show that agriculture’s average share of GDP among African countries is significantly smaller than among South Asian countries of similar income levels. The African average share is barely larger than the average share among countries in East Asia and the Middle East and North Africa, which have per capita incomes three times higher.

The relatively rapid decline of the agricultural sector could not have occurred without having serious effects on regional poverty levels (Figure 1.6). Countries with higher levels of discrepancy between actual and expected AgGDP shares also have higher poverty levels. Achieving greater progress toward poverty reduction requires a reversal of past trends. The real battle is not only to achieve growth, but also to raise productivity levels in the agricultural sector, which is the most effective way of eliminating poverty in the near future (Diao et al. 2012).
Raising productivity must include closing yield gaps for major commodities, which remain substantial in most of Africa’s subregions (Table 1.1). Yield levels in the countries of West and Central Africa are a mere fraction of the realizable potential (Table 1.1, column 2). In some cases, the yield gaps for other subregions are equally large (Table 1.1, columns 3 and 4). As is demonstrated by the widespread existence of large yield gaps, the recent uptick in productivity has not been sufficient to make up for ground lost in the 20–30 years after independence. It appears that countries will need to perform far better than indicated by the recent recovery to make up for the gap in productivity. This stresses the critical importance of technological and institutional innovations in pursuit of continued agricultural growth.

### TABLE 1.1 Yield gaps for selected commodities

<table>
<thead>
<tr>
<th>Crop</th>
<th>Nin-Pratt et al. 2011</th>
<th>Hengsdijk and Langeveld 2009</th>
<th>FAO 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>36.5</td>
<td>16.5–29.5</td>
<td>10–25</td>
</tr>
<tr>
<td>Rice</td>
<td>53.6</td>
<td>14.8</td>
<td>10–40</td>
</tr>
<tr>
<td>Millet</td>
<td>29.6</td>
<td>9.2–15.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10–40</td>
</tr>
<tr>
<td>Sorghum</td>
<td>30.5</td>
<td>9.2–15.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0–25</td>
</tr>
<tr>
<td>Cassava</td>
<td>65.4</td>
<td>24.2</td>
<td>25–85&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Potatoes</td>
<td>21.5</td>
<td></td>
<td>10–25</td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>56.7</td>
<td></td>
<td>10–25</td>
</tr>
<tr>
<td>Beans</td>
<td>47.4</td>
<td>9.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10–25&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>61.5</td>
<td>24.1</td>
<td>10–40</td>
</tr>
<tr>
<td>Soybeans</td>
<td>52.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bananas</td>
<td>22.2</td>
<td>25–85&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Cotton lint</td>
<td>33.8</td>
<td>60.6</td>
<td>10–25</td>
</tr>
</tbody>
</table>

**Source:** Compiled by authors from Nin-Pratt et al. (2011), Hengsdijk and Langeveld (2009), and FAO (2013).

**Notes:** The Nin-Pratt study covered the member countries of the West and Central African Council for Agricultural Research; the Hengsdijk and Langeveld and FAO studies covered various regions. <sup>a</sup>Data refer to tropical cereals. <sup>b</sup>Data refer to dry beans. <sup>c</sup>Data refer to cassava, yams, plantains, and other roots and tubers. <sup>d</sup>Data refer to pulses.

### Trends in Agricultural Productivity

Over the past 50 years, trends in overall agricultural productivity exhibit patterns of decline and recovery that are similar to observed sectoral growth trends. The findings from studies of agricultural productivity by several authors all point to faster rates of productivity growth in later periods. Authors may disagree about the exact periods of growth or decline and the exact magnitude of the rate of productivity growth in later periods compared with stagnating or
falling productivity levels in earlier periods, but they all agree that the pace of productivity growth has picked up in the past decade or two (Fulginiti, Perrin, and Yu 2004; Ludena et al. 2007; Nin-Pratt and Yu 2008; Alene 2010; Block 2010; Benin et al. 2011). Several of the authors concluded that, although total factor productivity (TFP) has risen in past decades, it has not recovered to the levels recorded in the early 1960s (Box 1.1).

Both wealth creation and competitiveness, and thus long-term growth and poverty reduction, are driven by increases in productivity, which in turn are determined by the pace of technical change. This highlights the critical importance of investments in policies to promote technological and institutional innovations in the agricultural sector. Many of the studies that have looked at changes in agricultural productivity among African countries have also studied the determining factors. While a number of factors are identified by the different authors, many of the findings stress the critical importance of investment in R&D systems.

For example, according to Fuglie and Rada (2013), international and national agricultural research, economic policy reform (increasing the nominal rate of assistance to agriculture), irrigation, reduction in armed conflict, and increased farmer schooling are the main drivers of the change in TFP. Alene (2010) finds that increased R&D expenditures, increased rainfall, and increased trade (a proxy for economic policy reforms) had positive impacts on TFP growth. Alene (2010, 223) finds a 10-year lag between agricultural R&D expenditure growth and agricultural productivity growth: “While a strong R&D expenditure growth of about 2 percent per year in the 1970s led to strong productivity growth after the mid-1980s, stagnation of R&D expenditure in the 1980s and early 1990s led to slower productivity growth in the 2000s.” Results reported by Block (2010) suggest that agricultural R&D expenditures had the highest impact on TFP growth: 10-year lagged R&D expenditures could explain 75 percent of TFP growth from 1981 to 2000.

The next-largest effect was that of policy distortions, measured by the black market premium for foreign currency and changes in the relative rate of assistance: policy reforms lessening discrimination against agriculture increased TFP growth. Civil wars decreased TFP growth. In contrast, Fulginiti, Perrin, and Yu (2004) stress the importance of institutional variables. They find that countries with greater political rights and civil liberties performed better, whereas wars and conflicts had negative impacts on TFP. Nin-Pratt and Yu (2008), on the other hand, attribute the recovery of TFP to economic policy reforms that improved incentives to farmers, such as the economic reforms that began in Ghana and Nigeria and later spread to many
Of greater importance from the point of view of poverty reduction are changes in agricultural productivity associated with rising labor productivity as opposed to land productivity. In line with the broad agricultural growth recovery documented above, land and labor productivity have risen considerably in the past couple of decades (Table 1.2). Both land and labor productivity grew at around 3.5 percent per year during 2000–2011, having accelerated considerably from the preceding two decades. Slow or even negative growth in

other countries, or the devaluation of the CFA (Communauté Financière africaine) franc in 1994, which helped many West African countries increase their exports and improve their agricultural sectors.

### BOX 1.1 Total factor productivity

Total factor productivity (TFP) is used to measure changes in the quantity of output that can be produced with a given level of inputs. TFP is expressed as an index, representing changes in productivity relative to a base year.

Unlike partial productivity measures, which estimate the additional output resulting from an increase in one input, such as land or labor, TFP is a measure of total output produced by all inputs. Mathematically, TFP is a ratio of an output index to an input index; each of these indexes measures changes over time in outputs or inputs, meaning that TFP measures changes in the relationship between levels of inputs and outputs. An increase in TFP means that the same level of inputs can be used to produce a greater level of outputs than previously. Increased productivity—this ability to produce more with the same inputs—can result from increasing efficiency or from introducing technical change (or from a combination of both, which is often the case). The scope to increase productivity by increasing efficiency is limited, and researchers agree that technical change through research and development is the only sustainable source of continued productivity growth.

Differences in estimates of TFP result from a number of factors. As the ratio of changes in total output to changes in total inputs, estimating TFP requires methods to aggregate and compare different types of inputs and outputs across time and space. Several methods exist, each deriving somewhat different results and offering different advantages and challenges in terms of the data required, the computational burden, and the assumptions made. The authors cited in this chapter also measure changes over different time periods, use different datasets for input and output variables, and look at different sets of countries, from the whole continent to Africa south of the Sahara, with and without South Africa.

Source: Authors.
labor productivity from 1980 to 2000 in most subregions gave way to healthier growth rates in the current decade in all subregions, but it is West Africa’s rapid labor productivity growth of nearly 6 percent per year that brings the total for SSA to 3.5 percent. West Africa’s growth rate, in turn, is strongly influenced by Nigeria, the largest agricultural economy in Africa. Nigeria’s high labor productivity growth brought up the subregion’s average in both periods, particularly in 2000–2011, when Nigeria’s yearly growth rate of 9.25 percent exceeded those of all other West African countries.

Land productivity growth rates of around 1.5 to 2.3 percent (for West Africa) from 1980 to 2000 (with the exception of Southern Africa’s rate of less than 1 percent) accelerated in most subregions in the following decade, but dropped by nearly half in East Africa. As with labor productivity, high land productivity growth rates in West Africa reflect Nigeria’s influence, particularly in 2000–2011, when Nigeria registered the highest yearly growth rate in the subregion: 7.29 percent. In 2000–2011, East Africa had the lowest land and labor productivity growth rates of all subregions, and West Africa had the highest, with both land and labor productivity growing at more than 5 percent per year. The overall acceleration of land and labor productivity growth is encouraging, but improvement has not been across the board and reflects the need for continued investments to raise productivity.

Area expansion continues to play an important role in output growth in all subregions. During 1980–2000, growth in arable land (or nonpermanent cropland and pasture) generally exceeded growth in labor productivity, with the exception of West Africa. This was reversed in the following decade, with labor productivity growing more than twice as fast as the expansion of arable land in all subregions except East Africa. During this time, East Africa had the fastest arable land growth but the lowest labor and land productivity

<table>
<thead>
<tr>
<th>Subregion</th>
<th>Arable Land</th>
<th>Land productivity</th>
<th>Labor productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Africa</td>
<td>0.61</td>
<td>2.25</td>
<td>1.51</td>
</tr>
<tr>
<td>West Africa</td>
<td>1.20</td>
<td>1.78</td>
<td>2.27</td>
</tr>
<tr>
<td>Central Africa</td>
<td>0.19</td>
<td>0.54</td>
<td>2.14</td>
</tr>
<tr>
<td>Southern Africa</td>
<td>0.95</td>
<td>0.85</td>
<td>0.82</td>
</tr>
<tr>
<td>Total</td>
<td>0.85</td>
<td>1.62</td>
<td>1.71</td>
</tr>
</tbody>
</table>

Source: Data for arable land are from World Bank (2014b); data for land productivity (agricultural value-added per hectare of arable land) and labor productivity (agricultural value-added per agricultural worker) are from ReSAKSS (no date).
growth of all subregions. Land productivity has also generally grown faster than arable land, with the exceptions of Southern Africa, during 1980–2000, and East Africa, during 2000–2011. Arable land expansion in Nigeria was slower than the West African subregional average in 1980–2000, and was fairly close to the subregional average in 2000–2011.

The broader trends discussed above further highlight the imperative to promote agricultural S&T and invest in R&D to ensure continued productivity growth. As can be inferred from the magnitude of the rates of growth discussed above, the initial levels of productivity were fairly low with the exception of Southern Africa (Figure 1.7). In 1980 Africa began with the lowest levels of land productivity of all regions of the world, but has raised those levels quite a bit since then. Nevertheless, other world regions also raised their

**FIGURE 1.7** Trends in land and labor productivity in Africa versus other world regions, 1980–2010

![Graph showing trends in land and labor productivity in Africa versus other world regions, 1980–2010.](image)

*Source:* Calculated by authors based on World Bank (2014b).

*Note:* The position, slope, and length of the lines reflect the magnitude of land versus labor productivity levels and their relative rates of growth over the entire period under consideration.
land productivity over this period, so a considerable land productivity gap remains between Africa and the rest of the world. In terms of raising labor productivity in agriculture, Africa made dismal progress during 1980–2010: labor productivity initially declined during the 1980s, and positive growth only began after 1990.

Overall productivity trends were positive during 1980–2011, despite considerable differences in terms of land and labor productivity levels and rates of growth across subregions (Figure 1.8). Land productivity increased across all subregions, while progress in increasing labor productivity was mixed. Labor productivity increased markedly in West Africa and also rose significantly in Southern Africa after initial decreases, but increased only slightly in Central Africa, and decreased in East Africa. West Africa experienced rapid productivity growth, surpassing the other three subregions and ending the period with

**FIGURE 1.8 Trends in land and labor productivity across Africa’s subregions, 1980–2011**

Source: Calculated by authors based on ReSAKSS (no date).

Notes: The position, slope, and length of the lines reflect the magnitude of land versus labor productivity levels and their relative rates of growth over the entire period under consideration. “Southern Africa” includes South Africa.
the highest levels of both land and labor productivity. Most of this increase was in Nigeria; the rest of the subregion showed levels of land productivity similar to those of Central and East Africa, although labor productivity levels were still higher than in these two subregions. Trends in land and labor productivity growth in Southern Africa are also biased by the inclusion of South Africa, but they reflect the much larger size of average holdings and related technology choices in that subregion. Central Africa, East Africa, West Africa (excluding Nigeria), and Southern Africa (excluding South Africa) still have low levels of labor productivity and remain highly dependent on agriculture. In addition, East and West Africa tend to have a higher concentration of vulnerable areas, in particular the hotspots of the Sahel and Horn of Africa. The challenge of raising TFP in general, and labor productivity in particular, remains a key strategic priority in these subregions.

The analysis in the preceding sections reveals that African countries have achieved a level of growth performance over the past 15 years that is without precedent in the continent’s postcolonial era. Improvement has occurred across the board in overall economic and agricultural growth, as well as in total and partial factor productivity in the agricultural sector. Poverty rates have also reversed their rising trends and have been declining since the late 1990s. The analysis also shows that African countries are still facing major challenges that make it necessary not only to sustain the current recovery, but also to accelerate its pace. A closer look reveals that the recent progress has primarily allowed African countries to make up for lost ground during the decades-long period of economic stagnation and decline that preceded the recent recovery. Fifteen years of recovery have moved the per capita food production index back to its level of the early 1960s. The same is observable for TFP levels (Benin et al. 2011). Furthermore, African countries, on average, are not on track to meet the MDG poverty goal by 2015. Although they may reach the goal in the near future, doing so would still leave average poverty levels for the continent at a high 30 percent.

While the recent recovery is both encouraging and proof that progress is possible, much work remains. The poverty reduction agenda through faster, broad-based—and thus agricultural—growth is still “unfinished business.” The ultimate contribution of agricultural growth to wealth creation and poverty reduction will depend on the extent to which it is linked to increases in land productivity, and—in particular—labor productivity, especially in the context of rapid population growth. A major component of the future growth and poverty reduction agenda, therefore, needs to deal with the technological, policy, and institutional innovations required to raise the productivity of rural farm and off-farm labor faster than has been the case to date.
Launched in 2003, the Comprehensive Africa Agriculture Development Programme (CAADP) is a continentwide framework to facilitate faster agricultural growth and progress toward poverty reduction and food and nutrition security in Africa. It seeks to promote policies and partnerships, raise investments in Africa’s agricultural sector, and achieve better development outcomes. CAADP has defined a limited set of clear continentwide goals, including the attainment of a 6 percent yearly agricultural growth rate at the national level. For that purpose, the allocation of at least 10 percent of national budgets to the sector is another target under CAADP. In addition, the program contains the following key values and principles:

1. Leadership and ownership of all aspects of the agenda at all levels by African decisionmakers and their constituencies. CAADP is fundamentally a home-grown agenda to increase the likelihood of alignment with local priorities and concerns.

2. Inclusiveness of all major stakeholder groups to facilitate participation in planning and implementation decisionmaking. Albeit far from perfect, the CAADP effort has invested heavily in creating wide understanding of and support for its goals and action agenda.

3. Partnership and mutual accountability among African governments, their constituencies, and development agencies. A number of dialogue and review platforms have been established at the country, subregional, and regional levels to support this principle.

4. Evidence- and outcome-based planning and implementation to improve the growth and poverty reduction outcomes of agricultural strategies. One of the main innovations of CAADP is the use of locally based empirical economic analysis to support strategic decisionmaking, priority setting, and investment planning in the sector.

This strategy was established on the basis of four pillars to guide investments. The pillars deal with (1) sustainable land and water management, (2) agribusiness development and market access, (3) hunger and social safety nets, and (4) science and technology.

Key milestones in the CAADP implementation process are (1) the organization of a roundtable and signing of a country CAADP compact specifying policy and investment priorities and commitments guided by the analysis discussed above; (2) the design of a comprehensive, multiyear agricultural investment plan by each country; and (3) the organization of a business meeting and an independent technical review to systematically evaluate the technical quality of country investment programs and to discuss funding and
implementation modalities. As of November 2015, 46 countries had launched the CAADP process, 42 had held roundtables and signed compacts, and 39 had completed national agricultural investment plans. In addition, four sub-regional economic communities had signed subregional CAADP compacts. While it is too early to say anything definitive about the impact of CAADP on the agricultural sector in Africa, the broad adoption and implementation of the CAADP agenda is of great significance, offering the opportunity to sustain and deepen the recovery process. If, through CAADP, a large number of countries manage to maintain a 6 percent growth trajectory, living conditions on the continent would change dramatically within a generation.

Sources: Based on Badiane (2011) and IFPRI (2014).

Aware of the interlinked challenges involved in raising agricultural productivity, in 2003 African countries launched CAADP, under which they identified priorities and designed investment plans seeking to invest at least 10 percent of government budgets in agriculture and achieve a sectoral growth rate of 6 percent (Box 1.2). The CAADP framework emphasizes agricultural S&T combined with natural resource management, agribusiness development and market access, social safety nets, and institutional innovation to promote inclusive agricultural policymaking and support an enabling environment for agricultural development. The goals and ambitions declared under CAADP provide a more legitimate benchmark for evaluating the need for future S&T policies and interventions than do goals or targets based on arbitrary projections. CAADP facilitates an assessment of the degree to which African countries are addressing policy and institutional changes, and investing in their agricultural sectors to meet CAADP’s goals and targets and to sustain and broaden the current recovery to further reduce poverty. These issues are dealt with in subsequent chapters of this book. The remainder of this chapter reviews and summarizes country-level goals under CAADP, using examples from the Economic Community of West African States (ECOWAS) as background for analysis in subsequent chapters.

**Country Goals and Ambitions under CAADP**

The most compelling evidence of the need for African countries to invest in technical change and raise TFP in the agricultural sector is the strong linkage between agricultural growth and poverty reduction. While recent growth and productivity trends are encouraging and indicate that countries are on the right trajectory, undoing the cumulative impact of decades-long stagnation
and decline stemming from neglect remains an immense challenge. Future progress will depend on the extent to which countries will succeed in sustaining and accelerating the current recovery process. How much is at stake can be seen from the simulated cumulative impact of an additional 1 percentage point of agricultural growth per year on poverty levels by 2025 (Figure 1.9).

The pace of agricultural growth leading to reduced poverty rates—which in some countries can be as high as 50 percent—depends on the initial size of the agricultural sector and its share of employment among poor and vulnerable people. Simulation results indicate that most countries would register a decline in poverty rates of more than 10 percent. The decrease in the absolute number of poor people would be as high as 17.9 million for the subregion as a whole, ranging from 38,000 in Cape Verde to 6.0 million in Nigeria. It is this critical role of agricultural growth in reducing poverty that has motivated CAADP. The program, in other words, is a reflection of the ambition of African countries to achieve higher rates of economic growth and significantly reduce poverty levels across the continent. It is against this goal that future efforts and needs to increase technological and institutional innovations to accelerate technical change should be evaluated. This would carry
greater policy relevance than benchmarking countries against arbitrary future outcomes. The question should be whether African countries are making sufficient efforts to meet the required outcomes resulting from their own ambitions, which are couched in the compacts and national agricultural investment plans (NAIPs) prepared by all countries as part of the implementation of CAADP. The compact is a formal document that lays out a country’s priorities, as well as its policy and budgetary commitments. The NAIPs present priority investments through which every country aims to accelerate growth and reduce poverty.

Figure 1.10 and Figure 1.11 summarize simulation results of achievable rates of agricultural growth and poverty reduction by 2025 under the NAIP scenario compared with a “business-as-usual” scenario that reflects the continuation of the prevailing trends at the time the compact was signed. As expected, individual country results under the NAIP scenario imply significantly higher rates of agricultural growth such that, in some cases, the magnitude of the difference calls into question whether the NAIP goals can be considered realistic. Most countries have the ambition of raising agricultural growth rates by between 0.5 and 8.5 percentage points (Figure 1.10). In some

**Figure 1.10** Projected agricultural growth rates under national agricultural investment plan and business-as-usual scenarios in the countries of the Economic Community of West African States to 2025

![Projected agricultural growth rates](image)

*Source: Calculated by authors based on IFPRI simulation results.*
cases (such as Benin, Cape Verde, and Guinea), the projected growth rates would mean more than doubling the historical rate of agricultural growth.

Is it realistic to expect that countries can achieve these high rates of growth, given the growth and productivity trends and patterns discussed above? Is the current pace of recovery enough? What additional changes need to occur in terms of technical change and factor productivity growth? What actions do they call for with respect to the different drivers identified? What would be the building blocks of a technological and institutional innovation agenda to support these ambitions? This volume endeavors to provide answers to these questions.

The remainder of the analysis in this chapter deals with the possible growth and investment gaps that are emerging from or have significant implications for the country investment plans (Figure 1.12). For most countries, achieving the CAADP target of 6 percent yearly agricultural growth would be sufficient to at least halve poverty from its 1990 level and achieve the MDG poverty goal, although 10 years later than intended. Several countries would even achieve single-digit poverty rates. About half the countries—including Burkina Faso, The Gambia, Guinea, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo—

**FIGURE 1.11** Reduction in national poverty rates under national agricultural investment plan and business-as-usual scenarios in the countries of the Economic Community of West African States to 2025

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Source: Calculated by authors based on IFPRI simulation results.
Nigeria, and Senegal—achieved an average agricultural growth rate of about 6 percent or higher between 2003 and 2010 (ReSAKSS 2013a). For some of these countries, achieving and sustaining a 6 percent rate of agricultural growth would not be enough to halve poverty by 2025 (The Gambia, Liberia, Nigeria, and Niger); the historical growth rates of four of the other countries fall far below that mark (Côte d’Ivoire, Benin, Guinea-Bissau, and Togo). It appears, therefore, that about half of the ECOWAS countries need to realize agricultural growth rates far in excess of the CAADP target or far above their historical growth rates.

Possible considerable gaps in public expenditures are also indicated (Figure 1.12), which countries will have to deal with in their efforts to raise productivity and accelerate growth. Most countries would have to maintain double-digit rates of growth of public expenditure in the agricultural sector. The countries that have the lowest level of actual public expenditure in agriculture—The Gambia, Guinea-Bissau, Liberia, and Togo (ReSAKSS no...
date)—would need to significantly raise sector expenditures to meet their declared ambitions under CAADP. The “big spenders”—historically, Burkina Faso, Mali, Niger, and Senegal—would need to raise sector expenditures the least, next to Benin and Nigeria.

The gaps identified above in terms of desirable rates of agricultural and expenditure growth primarily refer to ECOWAS member countries for which the data are readily available. However, it would be safe to generalize the results beyond this particular grouping. The gaps imply that countries will face great pressure to increase the effectiveness of the growth process in order to achieve the CAADP goals: they will need to achieve more with limited resources. The best option for doing that is to target investments that would accelerate the pace of technical change the most.

**Country Investment Priorities under CAADP**

African countries are pursuing a number of priorities to improve poverty outcomes through their CAADP investment plans (Figure 1.13). The distribution of priority areas can be compared with the drivers of productivity growth discussed earlier. While investments in agricultural R&D were identified by several authors as key drivers of productivity growth, only 5 of 15 countries (Nigeria, Senegal, Togo, Guinea, and The Gambia) are planning to make any sizable investments in R&D. It is difficult to imagine how countries intend to promote considerable technical change, when they are underinvesting in a key priority area, such as R&D and systems for developing and supplying modern inputs to farmers.

The other leading priority area that is in line with the productivity drivers is management of water resources. Several authors have shown that investment in irrigation had a positive impact on productivity growth. Four of the countries have planned to allocate around 20 percent or more of investment resources to water management. Agricultural value chains are another area of concentration of investment resources. It is to be anticipated that the other set of productivity drivers—sector policy reforms and incentives—will be addressed here; however, it is not clear how the underinvestment in R&D and input systems is going to affect efforts in the above areas. Social and political stability, another key contributor to lagging productivity growth, is understandably missing from Figure 1.13 because it is addressed outside of the investment planning process. Nevertheless, investment plans should be expected to contribute to greater political and economic stability if they lead to better economic outcomes.
FIGURE 1.13 Share of budgets allocated to priority areas in national agricultural investment plans

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<tr>
<th>a. Agricultural value chains</th>
<th>b. Food crisis/disaster management</th>
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<th>c. R&amp;D and input systems</th>
<th>d. Nonwater resources</th>
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<th>e. Improved water management</th>
<th>f. Implementation capacity</th>
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Source: Calculated by authors based on national agricultural investment plans.
Notes: The horizontal bars denote the share of each country’s investment budget allocated to each of the six priority areas. R&D = research and development.
Implications for the Science and Technology Agenda

The evidence presented in this chapter indicates how imperative it is that African countries make the necessary efforts to sustain and accelerate the current recovery process. In particular, efforts must be made to foster technological progress more than has been the case in the past. Technological progress is market driven and depends on the development, adoption, and effective use of improved technical inputs and production processes in all segments of value chains. Agricultural market development, however, is constrained by the high costs of transport and, for smallholder agriculture, high transaction costs. Reducing these will require institutional and organizational innovations, such as farmers’ organizations, community seed systems, agro-dealer networks, and warehouse receipt systems—in essence, rural capacity that incentivizes the delivery and uptake of new technologies and motivates the adaptation and innovation of these technologies across the extraordinary heterogeneity of African smallholder farming systems. Such an evolving rural innovation system will enable all key categories of actors, including farmers, agribusiness firms, input and service suppliers, research institutes, and other public-sector institutions, to continuously identify technology bottlenecks and generate adequate solutions to overcome them (see Chapter 13, this volume). Improvements in education and training, better access to markets and information (facilitated by the expansion of information and communications technologies, particularly cellular phones), and more fully developed links between farmers and service providers are also needed to facilitate the adoption of productivity-enhancing technologies, while also increasing productivity in their own right.

The new generation of investment plans being prepared under the CAADP agenda could be a good opportunity to boost investment in innovation systems to support growth. The example of ECOWAS member countries suggests, however, that countries may not be making the necessary investments in critical areas, such as R&D and input systems. This has to be corrected if countries want to achieve the growth and poverty reduction ambitions declared through their respective investment plans.

The above evidence calls for a better understanding of the nature and evolution of agricultural R&D systems in Africa in order to identify required actions to increase their contribution to the quest for faster growth and more broadly shared development outcomes. It calls for a closer assessment of the levels and determinants of investments by governments, the global community, and the private sector in agricultural R&D and associated returns in Africa. The question of the adequacy of the stock of human and institutional
capital and future needs in this area must be answered in order to map long-
term strategies to advance technical progress and raise productivity to reduce
poverty. Because it is unlikely that any given African country can meet all
of its research and technology needs alone, the inquiry and debate should
include the role of, as well as opportunities for, cross-border collaboration
and partnership with global centers of expertise, including CGIAR. These
and other strategic questions dealing with the future of the agricultural S&T
agenda are treated in depth throughout the rest of this book.

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