ASTI Agricultural Science & Technology Indicators

IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
sustainable solutions for ending hunger and poverty
Supported by the CGIAR

CORAF/WECARD

BENCHMARKING AGRICULTURAL RESEARCH INVESTMENT AND CAPACITY INDICATORS IN WEST AND CENTRAL AFRICA

Gert-Jan Stads

Note • June 2011

INTRODUCTION

Extensive empirical evidence demonstrates that agricultural research and development (R&D) investments have greatly contributed to economic growth, agricultural development, and poverty reduction in developing regions over the past five decades (World Bank 2007; IAASTD 2008). Given important challenges, such as rapid population growth, adaptation to climate change, water scarcity, and the volatility of prices in global markets, policymakers are increasingly recognizing the value of greater investment in agricultural R&D as an essential element in increasing agricultural productivity in Sub-Saharan Africa (SSA).

The 2003 Maputo Declaration directed all member countries of the African Union (AU) to increase agricultural investments to at least 10 percent of their national budgets. To gauge progress toward this target, the Comprehensive Africa Agriculture Development Programme (CAADP) under the AU's New Partnership for Africa's Development (NEPAD) agreed to monitor agricultural expenditures, setting a 6-percent yearly target for growth in agricultural gross domestic product (AgGDP) in countries where agriculture plays a dominant economic role. One of CAADP's four foundational pillars focuses on increasing investments in agricultural research, extension, education, and training as a means of promoting growth in agricultural productivity (NEPAD–CAADP 2010). Moreover, NEPAD's African Ministerial Council on Science and Technology (AMCOST) established and adopted a Consolidated Plan of Action for developing regional science and technology (S&T). This plan calls for substantial increases in national R&D budgets, with each country taking concrete measures to allocate at least 1 percent of its gross domestic product (GDP) to R&D (NEPAD 2006).

Quantitative data are essential to measuring, monitoring, and benchmarking the inputs, outputs, and performance of agricultural S&T systems at national and regional levels and to assess progress toward the successful implementation of CAADP and AMCOST targets related to S&T. R&D indicators are an indispensable tool when assessing the contribution of agricultural S&T to agricultural growth and, more generally, to economic growth. They assist research managers and policymakers in formulating policy and making decisions about strategic planning, priority setting, monitoring, and evaluation. They also provide information to governments and others involved in the public debate on the state of agricultural R&D at national, regional, and international levels.

This brief assesses trends in investments and human resource capacity in public agricultural R&D in 15 of the 22 member countries of the West and Central African Council for Agricultural Research and Development (CORAF/WECARD; hereafter referred to as CORAF): Benin, Burkina Faso, Republic of Congo, Côte d'Ivoire, Gabon, The Gambia, Ghana, Guinea, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo. Unfortunately, data for Cameroon, Cape Verde, the Central African Republic, Chad, the Democratic Republic of Congo, Guinea-Bissau, and Liberia, were unavailable.[1] The analysis draws from a set of country notes prepared by the Agricultural Science and Technology Indicators (ASTI) initiative of the International Food Policy Research Institute (IFPRI) and national partners, using comprehensive datasets derived from primary surveys conducted during 2009–10.[2] These datasets have been linked with existing investment and human resources datasets.[3] This brief focuses on benchmarking ASTI's various indicators across CORAF countries and, as such, complements in-depth country notes published by ASTI and its collaborators during 2010–11, along with a report on agricultural R&D investment and capacity trends for SSA as a whole (Beintema and Stads 2011a).

LONG-TERM INVESTMENT AND CAPACITY TRENDS

After a decade of stagnation during the 1990s, investments and human resource capacity in public agricultural R&D in SSA grew by more than 20 percent during 2001–08. Most of this growth, however, occurred in only a handful of countries and was largely the result of increased government commitments to augment incommensurately low salary levels and to rehabilitate neglected infrastructure, often after years of underinvestment. In contrast, many other countries continued to face fundamental capacity and investment challenges. For some, national investment levels have fallen so low as to leave them dangerously dependent on often volatile, external funding sources (Beintema and Stads 2011a).

Box 1—Measuring agricultural R&D resources

The concept of purchasing power parity (PPP) prices

Comparing R&D data is a highly complex process due to important differences in price levels across countries. The largest components of a country's agricultural R&D expenditures are staff salaries and local operating costs, as opposed to capital investments, which are traded internationally. As examples, the wages of a field laborer or lab assistant at a research facility are much lower in Niger than in any European country, and locally made office furniture in Sierra Leone is considerably cheaper than a similar set of furniture bought in the United States.

Standard market exchange rates are the logical choice for conversions when measuring financial flows across countries; however, they are far from perfect currency converters for comparing economic data. At present, the preferred conversion method for calculating the relative size of economies or other economic data, such as agricultural R&D spending, is the purchasing power parity (PPP) index. PPPs measure the relative purchasing power of currencies across countries by eliminating national differences in pricing levels for a wide range of goods and services. They are also used to convert current GDP prices in individual countries to a common currency. In addition, PPPs are relatively stable over time, whereas exchange rates fluctuate considerably (for example, the fluctuations in the US dollar–euro rates of recent years).

The concept of full-time equivalent (FTE) researchers

ASTI bases its calculations of human resource and financial data on full-time equivalent staffing, or FTEs, which take into account the proportion of time researchers spend on R&D activities. University staff members, for example, spend the bulk of their time on nonresearch-related activities—such as teaching, administration, and student supervision—which need to be excluded from research-related resource calculations. As a result, four faculty members estimated to spend 25 percent of their time on research would individually represent 0.25 FTEs and collectively be counted as 1 FTE.

Sources: Beintema and Stads (2008, 2011b forthcoming) and ASTI's website (www.asti.cgiar.org/methodology).

In 2008, the 15 CORAF countries for which data were available spent close to $700 million 2005 purchasing power parity (PPP) dollars on public agricultural R&D and employed more than 4,000 full-time equivalent (FTE) researchers, accounting for 38 percent of total SSA spending and 35 percent of the region's total research capacity (see Box 1 for an explanation of PPPs and FTEs). Absolute levels of public agricultural R&D spending and staffing varied considerably across CORAF countries (Table 1). In 2008, Nigeria, Ghana, and Côte d'Ivoire invested $404 million, $95 million, and $43 million in agricultural R&D, respectively, whereas Gabon and The Gambia spent just $2 million and $3 million, respectively, all measured in inflation-adjusted PPP dollars. The 2008 distribution of research staff by country followed a similar pattern, with Nigeria employing more than 2,000 FTE researchers, and Ghana more than 500. In contrast, Gabon, Mauritania, Niger, The Gambia, the Republic of Congo, Sierra Leone, and Togo each employed fewer than 100 FTEs that year.

Considerable differences were reported not only in absolute investment levels across CORAF countries, but also in the magnitude of growth over time. Generally speaking, volatility in year-to-year agricultural R&D investment levels was more extreme in West and Central Africa than in other parts of the continent, particularly in the 1990s, but also since the turn of the millennium. Expenditure levels in Ghana rapidly accelerated after 2000, averaging double-digit growth of 12.4 percent per year for the 2001–08 period, which reflected a policy to improve the equity of staff salary levels of agricultural research staff. Yearly growth rates in other anglophone countries such as The Gambia, Nigeria, and Sierra Leone were also above the 3.1 percent per year average for the 15 CORAF countries combined. In contrast, spending in many of the region's francophone nations fell, in some cases severely. In Guinea, for instance, agricultural R&D expenditures fell by 7.5 percent per year during 2001–08. Burkina Faso, Gabon, Mali, Mauritania, Senegal, and Togo also experienced declining spending levels of 2 to 3 percent per year during this period. Positive yearly spending growth in the Republic of Congo and Niger during 2001–08 followed a decade of severe negative growth with the result that both countries actually invested less in agricultural R&D in 2008 than they did in the early 1990s. The large fluctuations in annual spending growth over time are indicative of a high dependency on funding from donors and development banks. For instance, the completion of large projects in Guinea and Niger funded through World Bank loans plunged agricultural research in these countries into a severe financial crisis.

Yearly growth in agricultural research staffing levels followed a very similar trend in the CORAF countries compared with countries in the rest of the continent. Compared with growth in agricultural research spending, annual agricultural R&D capacity growth was less variable across countries. Gabon, Nigeria, and Sierra Leone recorded the highest annual growth in R&D capacity during 2001–08, at 8.2, 5.9, and 3.8 percent, respectively. Gabon employed an increasing number of agricultural researchers over this timeframe, but the resources needed to carry out the

Table 1—Public agricultural R&D spending and staffing, 1991–2008

1A. R&D spending

Country	Total 2005 PPP dollars (million)				Annual growth rate (%)		
	1991–95	1996–2000	2001–05	2008	1991–96	1996–2001	2001–08
Benin	14.1	12.6	15.2	21.6	-1.6	1.0	6.2
Burkina Faso	30.3	21.0	25.4	19.4	-14.6	3.7	-3.1
Congo, Republic of	8.9	4.7	3.8	4.6	-15.8	-9.6	3.7
Côte d'Ivoire	49.1	47.8	40.4	42.6	-9.6	0.6	2.6
Gabon	2.4	2.5	2.2	1.6	-6.7	4.2	-2.3
Gambia, The	5.0	3.2	2.4	2.5	-14.2	-7.5	6.8
Ghana	34.2	39.3	48.6	95.4	1.6	2.7	12.4
Guinea	9.6	9.7	5.6	4.0	-6.3	0.9	-7.5
Mali	25.1	26.8	29.7	24.7	1.0	7.1	-2.8
Mauritania	na	na	11.8	6.4	na	na	-1.9
Niger	14.0	16.2	5.6	6.2	5.0	-31.9	3.0
Nigeria	109.5	140.8	280.3	403.9	-6.3	24.9	3.2
Senegal	37.6	29.6	25.4	25.4	-1.8	-6.4	-2.0
Sierra Leone	na	na	4.0	5.9	na	na	9.3
Togo	10.1	8.4	8.5	8.7	-6.9	4.1	-1.6
Subtotal (15)	356.5	369.1	509.0	672.9	-5.2	9.7	3.1
SSA total (45)	**1,257.7**	**1,247.3**	**1,486.5**	**1,727.0**	**-1.3**	**3.6**	**2.4**

1B. R&D staffing

Country	Total number of researchers (FTE)				Annual growth rate (%)		
	1991–95	1996–2000	2001–05	2008	1991–96	1996–2001	2001–08
Benin	107.6	114.4	111.1	115.4	1.0	1.9	-0.2
Burkina Faso	175.3	192.9	237.3	239.9	0.6	4.9	1.4
Congo, Republic of	109.8	123.5	104.2	93.8	3.1	-0.2	-2.5
Côte d'Ivoire	216.3	169.9	118.5	122.6	-4.1	-8.5	-0.1
Gabon	25.5	35.5	41.5	61.4	7.2	4.0	8.2
Gambia, The	33.2	41.3	40.9	37.7	-0.6	3.4	-1.8
Ghana	387.2	456.6	464.5	537.1	6.3	0.6	2.5
Guinea	219.4	235.3	217.6	229.2	1.6	-0.4	0.3
Mali	244.5	238.5	292.2	312.7	-0.4	-0.7	-0.7
Mauritania	na	na	65.8	73.7	na	na	3.1
Niger	100.8	112.6	100.4	93.4	3.5	-1.8	-1.9
Nigeria	1,083.2	1,201.5	1,438.7	2,062.0	1.1	4.0	5.9
Senegal	195.6	165.7	147.1	141.1	-1.8	-4.9	0.5
Sierra Leone	na	na	48.1	66.6	na	na	3.8
Togo	90.1	88.2	81.2	62.7	-2.4	1.6	-4.0
Subtotal (15)	3,074.7	3,261.3	3,509.1	4,249.1	1.0	1.3	2.9
SSA total (45)	**9,001.5**	**9,369.5**	**10,404.2**	**12,102.5**	**1.2**	**1.2**	**2.8**

Sources: Compiled by author based on country-level ASTI survey data, several secondary resources, and Beintema and Stads 2011a. (For more information, see individual ASTI Country Notes available at www.asti.cgiar.org.)

Notes: Calculations are based on five-year averages, with the exception of 2008. See the individual ASTI Country Notes for agency and coverage. Data for Mauritania and Sierra Leone for 1991–2000 (spending and staffing) were not available, so extrapolations were made to include these two countries in the subtotals for subregional spending and staffing. "na" indicates data is not available.

research were both extremely low and erratic. In Togo and the Republic of Congo, growth in the total number of agricultural research staff fell during 2001–08, at 4.0 and 2.5 percent per year, respectively, mostly due to the nonreplacement of retiring scientists. Sociopolitical turmoil and civil unrest is reflected in the severely negative growth rates in agricultural research capacity in Sierra Leone during 1991–95 and in Côte d'Ivoire during 1996–2000.

Recent key trends by country

As evidenced above, the individual CORAF countries reported widely differing trends in their agricultural R&D capacity and investments. These trends are briefly highlighted below.

Benin. Agricultural R&D spending in Benin gradually increased over time, reflecting higher levels of government funding and greater involvement in agricultural R&D by the higher education sector. Despite the recent increase in government funding, agricultural research in Benin remains largely dependent on donor support. Capacity at the National Agricultural Research Institute of Benin (INRAB), the country's main agricultural R&D agency, has fallen since 2000 due to the Institute's inability to compete with the higher salaries offered by universities and international organizations.

Burkina Faso. Agricultural R&D expenditures in Burkina Faso have been highly unstable due to significant fluctuations in donor funding. Following the closure of large World Bank-funded projects, the Environment and Agricultural Research Institute (INERA) and the Applied Science and Technology Research Institute (IRSAT) experienced financial crises, seriously disrupting their operations and preventing the recruitment of researchers. As a result, a disproportionate share of INERA's research staff are nearing retirement age, which poses a real threat to the country's agricultural research development.

Republic of Congo. Notwithstanding a slight improvement in recent years, agricultural R&D spending in Congo remains far below the levels recorded before the civil wars of the 1990s, and donors play only a modest role in funding the country's agricultural R&D. Congo also faces severe capacity challenges. National agricultural research capacity began to fall from the year 2000 due to the retirement of large numbers of researchers at the centers under the General Delegation of Scientific and Technical Research (DGRST). In addition, a further 60 percent of DGRST's current research staff is scheduled to retire by 2016.

Côte d'Ivoire. Agricultural R&D expenditures contracted around the turn of the millennium but remained relatively stable during 2002–08, although sociopolitical turmoil negatively affected agricultural R&D investments in the country's central, northern, and western zones. The National Center for Agricultural Research (CNRA) is the country's main agricultural R&D agency, and its research is mainly funded by the private sector through the Inter-Professional Fund for Agricultural Research and Extension (FIRCA).

Gabon. Agricultural R&D spending fluctuated significantly during 2000–08, but research staffing levels gradually increased. Research carried out by the institutes of the National Scientific and Technological Research Center (CENAREST) was severely underfunded during this time, reflecting the government's lack of focus on agricultural R&D. In addition, Gabon's middle-income status hinders its ability to attract donor funding for agricultural R&D.

The Gambia. Public agricultural R&D investments in The Gambia have followed an erratic pattern in recent years, largely due to significant fluctuations in government and donor funding. The country employed only two PhD-qualified agricultural researchers in 2008, illustrating that a key challenge to effective agricultural R&D is the serious lack of well-trained scientists.

Ghana. Agricultural R&D spending in Ghana more than doubled during 2000–08, largely as a result of rising salary costs at agencies under the Council for Scientific and Industrial Research (CSIR) and higher spending levels at the Cocoa Research Institute of Ghana (CRIG) due to a boost in cocoa production. Agricultural research staffing also grew steadily throughout this period, albeit at a much slower rate than expenditures.

Guinea. During 2000–08, agricultural R&D staffing levels in Guinea remained relatively stable. Agricultural R&D expenditures decreased significantly, however, due to cuts in both government and donor funding. The country's volatile political climate has hindered the development of agricultural R&D and continues to deter investment by foreign donors.

Mali. Agricultural R&D in Mali is largely dependent on donor funding and development bank loans. This dependence, combined with only modest levels of government funding, led to considerable yearly fluctuations in both research expenditures and research capacity during 2001–08. A number of donor-supported training programs were crucial to growth in the number of PhD-qualified researchers, but an aging pool of senior scientists remains a major area of concern.

Mauritania. Total agricultural R&D spending fluctuated during 2001–08. The Institute of Oceanographic Research and Fisheries (IMROP) is the principal agricultural R&D agency, accounting for close to half of all agricultural R&D expenditures and capacity. Ongoing lack of both funding and well-qualified scientists at the National Agricultural Research and Development Center (CNRADA) and the National Livestock and Veterinary Research Center (CNERV) seriously limits the quality of research and consequently its impact on the country's crop and livestock sectors.

Niger. Agricultural R&D spending fell by 80 percent in 2008 compared with levels in 1998—the final year of the World Bank loan–financed National Agricultural Research Project (PNRA)—and the country's agricultural research system has faced financial crisis ever since. Human capacity also decreased from the mid-1990s, and an extended public-sector recruitment freeze has significantly increased the average age of agricultural researchers employed at government agencies.

Nigeria. Agricultural R&D spending in Nigeria doubled during 2000–08, largely because of salary increases, together with substantial investments in the much-needed rehabilitation of research infrastructure and equipment. The higher education sector plays an increasingly important role in Nigerian agricultural R&D. Total

agricultural R&D capacity has grown rapidly in recent years, increasing to over 2,000 FTEs in 2008. However, the composition of research staffing has shifted toward more junior (BSc-qualified) researchers as opposed to those qualified to the MSc or PhD levels.

Senegal. Overall, public agricultural R&D expenditures have fallen since the 1990s due to reduced government and donor funding. Despite large investments in research capacity in recent years, both the Senegalese Agricultural Research Institute (ISRA) and the Food Technology Institute (ITA) reported significant declines in PhD-qualified staffing levels since 2004. In addition, the aging pool of well-qualified researchers, many of whom will retire in the next decade, is a major area of concern.

Sierra Leone. Agricultural R&D spending more than doubled between 2001 and 2009 in response to efforts to reconstruct the country's agricultural R&D system after a decade of civil war. However, funding levels are still low and erratic, hindering development. The Sierra Leone Agricultural Research Institute (SLARI) was established in 2007, but as of 2009 only two of SLARI's eight centers were operational.

Togo. Agricultural R&D spending in Togo, which is largely financed by the national government, has fluctuated significantly in recent years, and capacity levels have followed a negative trend, mainly due to the nonreplacement of retiring researchers at the Togolese Agricultural Research Institute (ITRA). On a positive note, the country is in the process of improving capacity levels, given that a number of young researchers have recently been recruited and are currently receiving training.

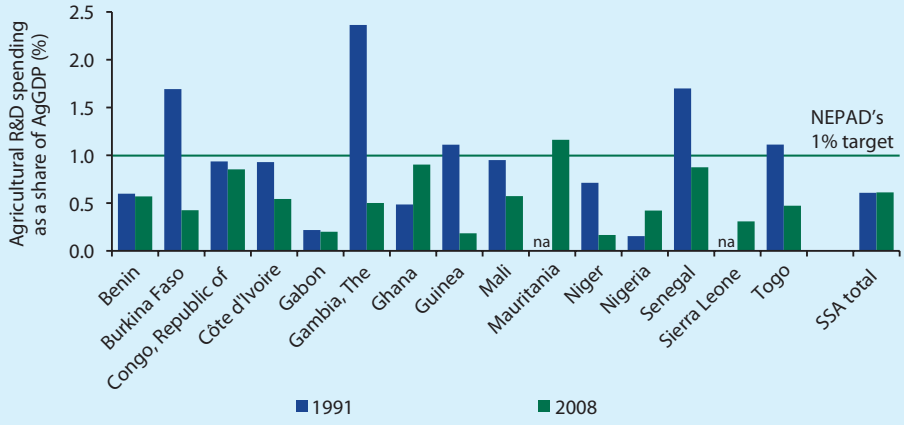
BENCHMARKING KEY INVESTMENT INDICATORS

Spending intensity. Analyzing absolute levels of research expenditures explains only so much. Another way of assessing public agricultural R&D investments is to measure total public agricultural R&D spending as a percentage of AgGDP (Figure 1). This relative measure indicates the intensity of investment in agricultural research, not just the absolute level of spending. In 2008, just one CORAF country recorded an intensity ratio that met or exceeded NEPAD's national R&D investment target of at least 1 percent of GDP: Mauritania (1.16). It should be noted, however, that although intensity ratios provide useful insights into relative investment and capacity levels across countries, they do not account for the policy and institutional environment within which agricultural research occurs nor the broader size and structure of a country's agricultural sector and economy. For example, rather than high levels of agricultural R&D investment, Mauritania's high intensity ratio actually reflects the relatively small size of the country's crop sector (given its arid climate). On the other hand, Gabon's intensity ratio (0.20 in 2008) has consistently been among the lowest in SSA, reflecting that agricultural R&D is a low priority to the national government. In Niger, the completion of the World Bank–funded PNRA led to a severe decline in overall spending levels and caused the 2008 intensity ratio to plummet to just 0.17 percent. In contrast, investment in public agricultural R&D in Ghana more than doubled during 2001–08, outpacing AgGDP growth; as a result, the country's intensity increased from 0.53 percent in 2001 to 0.90 percent in 2008. Although total spending in Nigeria also increased substantially, the country's intensity ratio remained relatively low, at 0.42 in 2008. Overall, intensity ratios in West and Central Africa are lower than in other parts of the continent. In 2008, the intensity ratios for just 4 of the 15 CORAF sample countries—the Republic of Congo, Ghana, Mauritania, and Senegal—exceeded the SSA average of 0.61.

Funding sources. Funding for African agricultural R&D is derived from a variety of sources, including national governments; donors, development banks, and (sub)regional organizations; producer organizations; the private sector; and internally generated revenues.[4] A large degree of variation in funding sources exists across the various agricultural research agencies (Figure 2). Funding sources can also change substantially over time, so Figure 2 only shows the average distribution for the 2001–08 period. During this time, the national government funded the bulk of agricultural R&D activities of the NARIs in Nigeria (98 percent), SLARI in Sierra Leone (93 percent), and INRAN in Niger (81 percent).

In contrast, the main agricultural R&D agencies in Benin, Burkina Faso, Guinea, and Mali are highly dependent on external funding. Benin's agricultural R&D has been financed largely through development aid from Denmark and Germany. French support has traditionally played a big role in agricultural R&D in Guinea, and research in Burkina Faso and Mali have received substantial funding through a number of successive World Bank loans and grants. Donor and development bank funding is typically short term and ad hoc, whereas the outputs of agricultural research can take a decade or more to materialize. The completion of some of these large donor and development bank–funded projects often precipitated severe financial crises, with the result that much of the progress

Figure 1—Intensity of agricultural R&D spending by country, 1991 and 2008



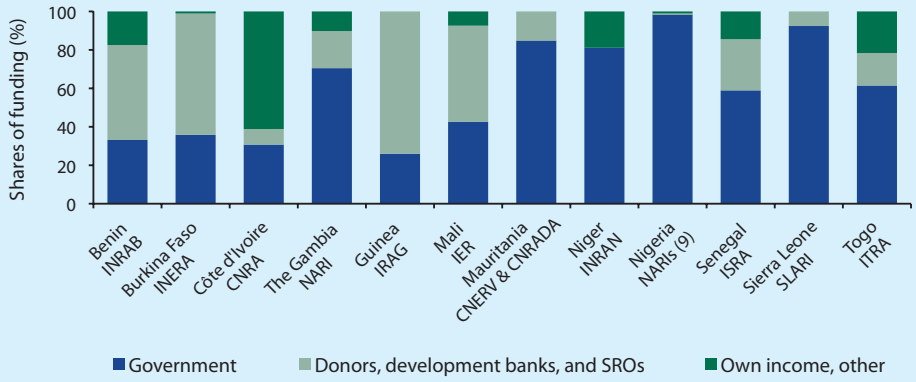
Sources: Compiled by author based on country-level ASTI survey data and several secondary resources (see individual ASTI Country Notes). AgGDP data are from World Bank 2010.

Notes: See Table 1; na indicates that data were not available.

made was eroded in the absence of viable mechanisms to sustain the gains achieved.

Although data were only available until the year 2008, the share of donors and development banks in overall agricultural R&D funding in West and Central Africa is believed to have risen again in more recent years, and is expected to increase further with the launch of sizable World Bank projects with R&D components in numerous countries as part of the West Africa Agricultural Productivity Program (WAAPP). WAAPP's overall objective is to generate and disseminate improved agricultural technologies in areas that align with participating country and regional priorities. Launched in 2007, the first phase of WAAPP focused on three priority areas of agricultural R&D in three countries: Ghana was given responsibility for roots and tubers, Senegal for cereals, and Mali for rice. In each country, WAAPP consists of a research and a rehabilitation component, along with a competitive fund. Planning for the second phase of the project (WAAPP-II) was launched in 2009 and entailed a further seven countries. As of mid-2011, WAAPP-II had already been launched in Burkina Faso, Côte d'Ivoire, and Nigeria, and was soon to be launched in Benin, The Gambia, Niger, and Togo.

Figure 2—Relative shares of funding sources for the main agricultural R&D agencies, 2001–08 average



Source: Compiled by author based on country-level ASTI survey data (see individual ASTI Country Notes).

Notes: Own income includes the sale of goods and services and contract research performed for public and private agencies. Funding shares for some agencies fluctuated over time (see individual ASTI Country Notes). SROs indicates subregional organizations. Figures in parentheses indicate the number of agencies included. Funding sources for the Republic of Congo, Gabon, and Ghana were not available.

Income generated through the sale of goods and services accounts for a large share of total funding for the main agricultural R&D agencies in Benin, Niger, and Togo. These funds are primarily derived from the provision of services, such as laboratory analyses and testing on phytosanitary products, supplemented by the sale of seed and plant and animal products. CNRA in Côte d'Ivoire is a unique case, in that the second National Agricultural Services Support Project (PNASA II)—launched in 1998 and administered by the World Bank—stipulated that CNRA be structured as a public–private entity, with 40 percent of its funding contributed by the government and 60 percent derived from the private sector. To this end, the Inter-Professional Fund for Agricultural Research and Extension (FIRCA) was established in 2002. FIRCA relies on financial contributions from the government and from the country's producers, who pay membership subscription dues through commodity-specific producer organizations. At least 75 percent of the subscription fees raised through agricultural production in a given subsector are allocated to programs serving the needs of that subsector. The remaining funds are allocated to programs designed to serve production sectors (mostly food crops) unable to raise sufficient funding through their own subscription fees. Despite the original stipulation that the Ivorian government provide 40 percent of CNRA's yearly budget, to date, government contributions have represented a very limited share (15 percent in 2008).

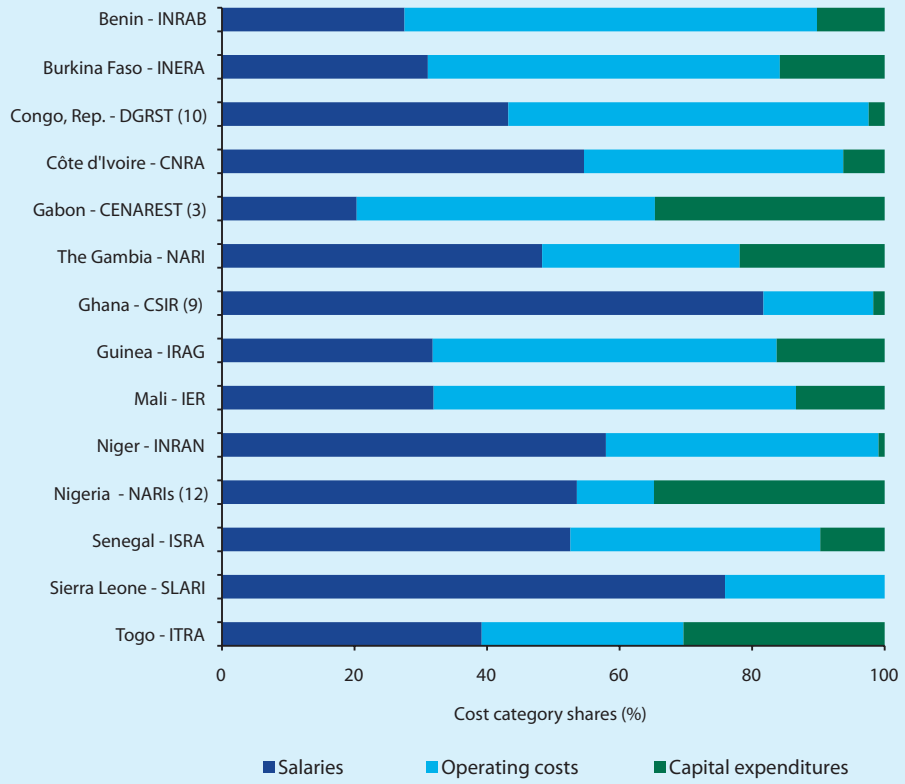
Cost-category shares. The allocation of research budgets across salaries, operating costs, and capital investments affects the efficiency of agricultural R&D, and the breakdown of category across West and Central African countries reveals a great deal of diversity. In 2008, the CSIR institutes in Ghana allocated the highest share of their total spending to salaries (83 percent) leaving little funding for operating expenditures or capital investment (Figure 3). In contrast, the principal agricultural R&D agencies in Burkina Faso, the Republic of Congo, and Mali spent more than half of their budgets on operating and program costs, and the NARIs in Nigeria invested close to half of their total spending in capital improvements.

Time-series data indicate that the rapid increase in Ghanaian agricultural R&D spending since the turn of the millennium was driven almost entirely by increased salary expenditure at CSIR rather than expanded research activities or greater investment in equipment or infrastructure. This unprecedented increase in expenditure on salaries, however, needs to be understood in the context of years of underfunding, during which salary levels became increasingly incommensurate and uncompetitive. The large increase in the relative share of capital investments in Nigeria during 2001–08, on the other hand, reflects increased commitment to funding agricultural R&D on the part of the national government. Nevertheless, despite this remarkable increase in investment, funding levels in Nigeria remain below those required to restore facilities to earlier levels and to sustain the country's agricultural research needs.

BENCHMARKING KEY HUMAN CAPACITY INDICATORS

Intensity of research staffing. Another method of comparing agricultural research systems across countries is to gauge researcher numbers against total population or economically active agricultural population. In 2008, SSA as a whole employed 70 FTE researchers per million farmers, a ratio that has remained relatively stable for two decades (Figure 4). A large degree of variation existed across West and Central African countries when looking at the total number of agricultural research staff per million agricultural labor force. In 2008, Gabon's ratio of 325 was one of the highest in Africa, indicating that the country's research

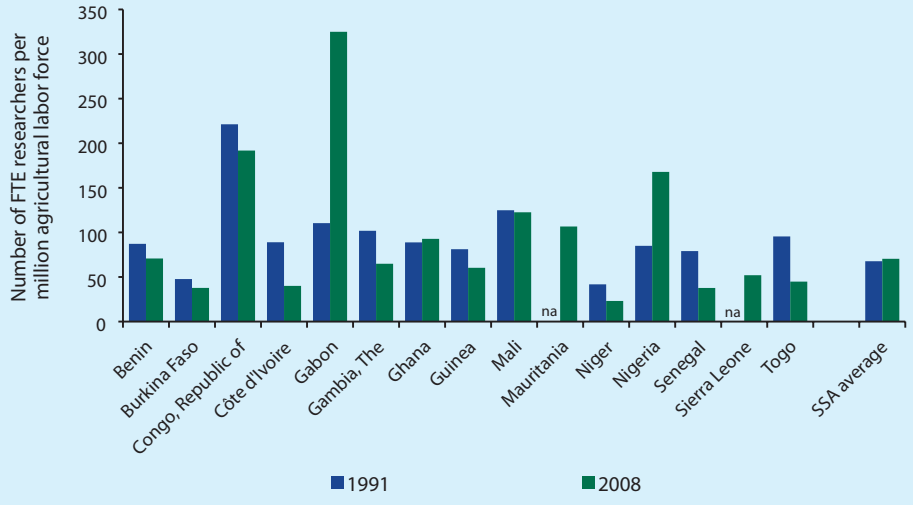
Figure 3—Share of cost categories in total spending of the main agricultural R&D agencies, 2001–08 average



Source: Compiled by author based on country-level ASTI survey data (see individual ASTI Country Notes).

Notes: Figures in parentheses indicate the number of agencies included. Cost category data for Mauritania were not available; data for Mali span the 2005–08 period; data for Nigeria exclude three national agricultural research institutes (NARIs); and data for Ghana exclude the Oil Palm Research Institute (OPRI).

Figure 4—Intensity of agricultural researchers by country, 1991 and 2008



Sources: Compiled by author based on country-level ASTI survey data and several secondary resources (see individual ASTI Country Notes); Economically active agricultural population data (here labeled as agricultural labor force) are from FAO 2009.

Note: "na" indicates that data were not available.

capacity is high compared with the size of its agricultural sector. Ratios in the neighboring Republic of Congo and in Nigeria, at 192 and 168 respectively, were also well above the SSA average. Both the ratios for Gabon and Nigeria have significantly increased in recent years due to a rapid rise in agricultural researcher numbers, while the ratio for the Republic of Congo has declined somewhat due to reductions in the number of researchers. In contrast, in 2008 countries like Burkina Faso, Côte d'Ivoire, Niger, and Senegal employed 40 FTE researchers or fewer for every million farmers. The ratios in these four countries have fallen rapidly since the early 1990s as a result of hiring freezes, staff retirement, and the loss of qualified researchers to the private sector or agencies abroad.

Degree distribution. Overall, agricultural researchers in West and Central Africa are more highly qualified than their colleagues in other parts of SSA. In 2008, more than half the FTE researchers employed in Burkina Faso, Côte d'Ivoire, and Senegal were trained to the PhD level, as were more than 40 percent of the scientists employed in Benin and the Republic of Congo (Figure 5). The high shares of scientists with doctorate degrees result in large part from 1990s (and earlier) training programs funded by bilateral donors or through World Bank–financed projects.

Agricultural researchers in The Gambia, Guinea, and Sierra Leone, on the other hand, are the least qualified in West Africa. In Guinea, just 38 percent of researchers were trained to the postgraduate (PhD or MSc) level in 2008, and 18 percent held PhD degrees. These low shares can be attributed to the country's political isolation until the mid-1980s and the fact that national universities do not offer PhD-level education in agricultural and veterinary sciences. The situation in Sierra Leone is similar. The civil war in the 1990s isolated the country and caused many well-trained scientists to move abroad. Given that Sierra Leone's universities currently offer no MSc or PhD training in agricultural sciences, scientists need to be trained elsewhere, which is expensive. The Gambia really suffers from a critical mass of PhD-qualified scientists. Between 2003 and 2009, NARI lost 7 PhD-qualified researchers, leaving

the Institute with only two. Many of the Institute's researchers are relatively inexperienced and not well-trained, which negatively impacts the quality and development of research, as well as the country's ability to attract external funding.

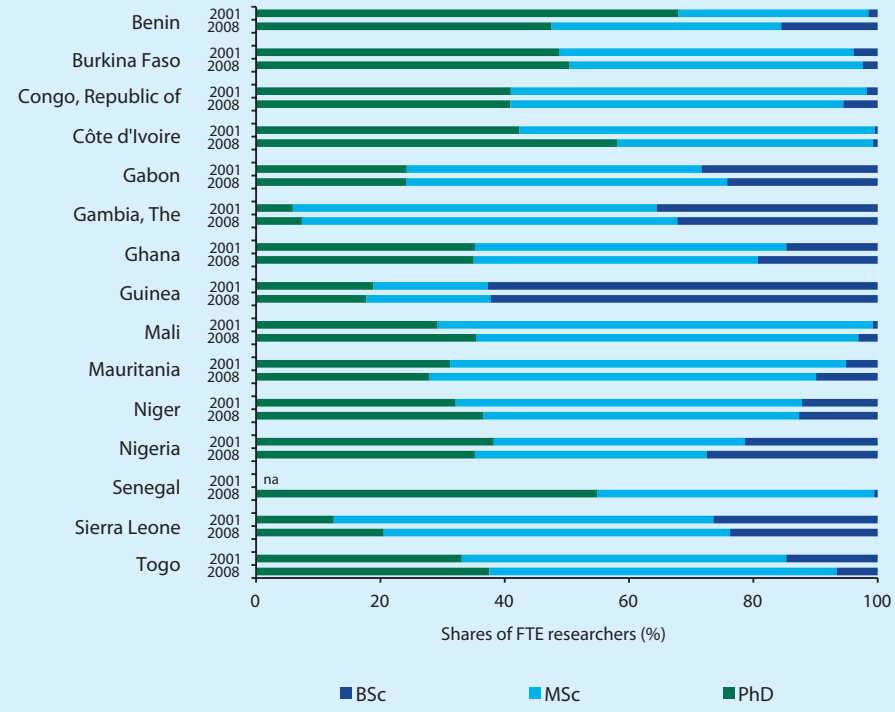
Since 2001, the composition of agricultural research staff in Nigeria has shifted toward junior scientists qualified to the BSc level only. Although researcher numbers increased across all degree levels, the number of BSc-qualified researchers increased faster (doubling between 2001 and 2008).

It is remarkable that many West and Central African countries have maintained relatively large pools of well-qualified researchers despite recent losses in human and financial resource capacities. In many countries, an aging pool of scientists—many of whom will approach retirement within the next decade—is a major concern. Given the prevalence of long-term recruitment freezes, many countries lack the middle-level staff needed to take on senior roles as older scientists retire and to train and mentor junior researchers. For example, in the Republic of Congo the average age of researchers, which already exceeds 50 years, is increasing rapidly. An estimated 175 permanent DGRST employees are scheduled to retire between 2010 and 2016; this represents 60 percent of the Delegation's current capacity, and hence presents a significant challenge. The combination of hiring restrictions and aging researchers are also affecting agricultural R&D in countries like Benin, Cameroon, Mali, Niger, and Senegal.

Another phenomenon that is manifesting itself in a large number of countries is the departure of agricultural researchers from government agencies to universities within the same country. In countries like Benin, the Republic of Congo, Ghana, and Senegal, universities offer better salaries and benefits than government agencies, making universities more attractive employers for agricultural scientists. The African and Malagasy Council for Higher Education (CAMES) aims to harmonize university diplomas and enhance recognition of these diplomas across its francophone member states. Some argue that countries should use CAMES classifications as a benchmarking tool for harmonizing the salaries of agricultural scientists and curbing the exodus of agricultural researchers to the higher education sector.

University-qualified research support. A number of CORAF countries employ support staff (technicians, research assistants, and laboratory assistants) with BSc, MSc, and occasionally PhD qualifications, who are not officially classified as researchers. In Senegal, for instance, the minimum requirement for a researcher is an MSc degree, so the 105 BSc-qualified scientists employed at ISRA are all classified as technicians (Figure 6). Mali, as another example, employed a comparatively large number of technicians with MSc degrees. Given proper training and promotional opportunities, these well-qualified technicians present an extremely valuable resource for the future development of agricultural R&D in the region.

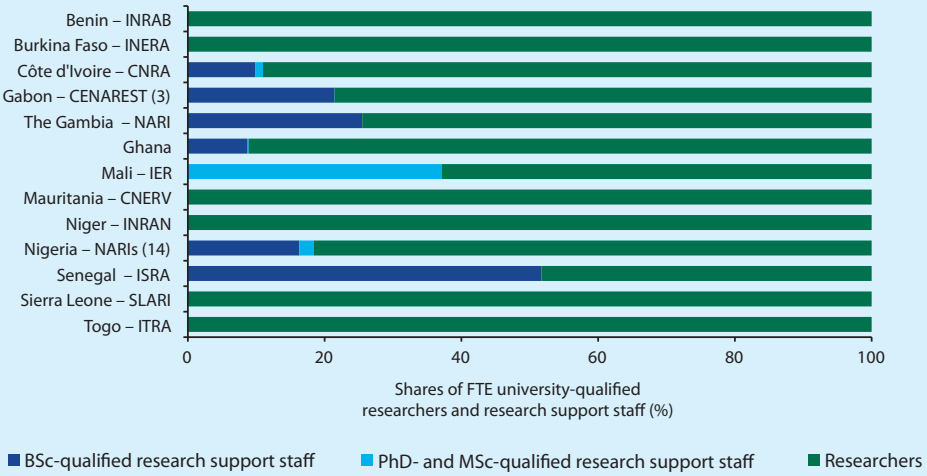
Figure 5—Distribution of agricultural researchers by degree qualification, 2001 and 2008



Source: Compiled by author based on country-level ASTI survey data (see individual ASTI Country Notes).

Notes: Figure exclude support staff holding university degrees, but who are not classified as researchers (see Figure 6). "na" indicates that data were not available.

Figure 6—Distribution of agricultural researchers and university-qualified research support staff, 2008



Source: Compiled by author based on country-level ASTI survey data (see individual ASTI Country Notes).

Shares of female research staff. Female scientists continue to be underrepresented in African agricultural research. Women provide different insights and perspectives that can enable research agencies to more fully address the unique and pressing challenges faced by African farmers—the majority of whom are female. SSA's overall share of female agricultural research staff increased from 18 percent in 2000 to 22 percent in 2008 (Figure 7). All CORAF countries for which time-series data were available reported an increase in their shares of female scientists in agricultural R&D, which is certainly encouraging. Nevertheless, just two West and Central African countries—Gabon (24 percent) and Nigeria (23 percent)—exceeded the SSA average; average shares in the subregion's remaining countries fell well below this level. The share of female scientists was particularly low in Guinea (3 percent), Mauritania (5 percent), and Sierra Leone (5 percent). Notably, rapidly increasing shares of female agricultural researchers were recorded in Burkina Faso, the Republic of Congo, The Gambia, and Mali.

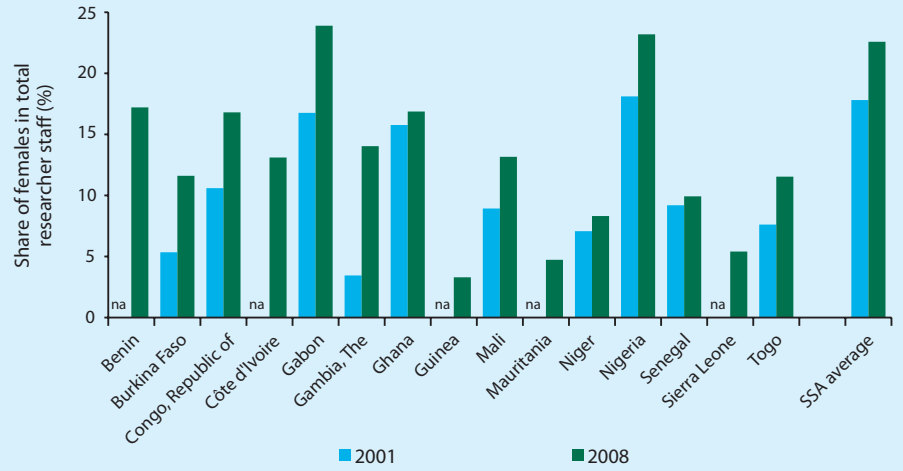
BENCHMARKING OTHER KEY AGRICULTURAL R&D INDICATORS

Institutional distribution. The institutional structure of agricultural research differs widely across countries.[5] The majority of West and Central African countries have a single national agricultural research agency that accounts for the bulk of agricultural R&D capacity and investments. Examples include INRAN in Niger, IRAG in Guinea, and NARI in The Gambia. In most of the smaller West and Central African countries, agricultural research is undertaken by a national agricultural research institute and a handful of other government agencies and university faculties. Sierra Leone, Niger, and Togo operate only three, six, and seven agricultural R&D agencies, respectively. In contrast, 88 Nigerian agencies were identified as carrying out agricultural R&D, three-quarters of which were higher education agencies. In some countries, an umbrella organization like Ghana's CSIR or the Republic of Congo's DGRST oversees and coordinates the R&D activities of a large number of commodity or thematic centers, whereas in a country like Mauritania, the national crop, livestock, and fisheries research agencies operate independently of each other without a coordinating body.

Overall, the government sector still dominates agricultural research in West and Central Africa, but its relative share has declined over time. In most countries in the subregion, the higher education sector is playing an increasingly important role. In Benin, for instance, the higher education sector accounted for 40 percent of agricultural researchers in 2008, up from 26 percent in 1991 (Figure 8). And in Nigeria, the higher education sector's share increased from 30 to 41 percent during the same period. In most other countries, the higher education sector plays a more modest role in agricultural R&D. Despite the high and increasing number of higher education agencies conducting agricultural research in a number of countries, the individual capacity of most of them is very small (in terms of FTE researcher numbers). While the amount of time spent on research by faculty staff has gradually risen over the years, it still represented less than 25 percent in 2008.

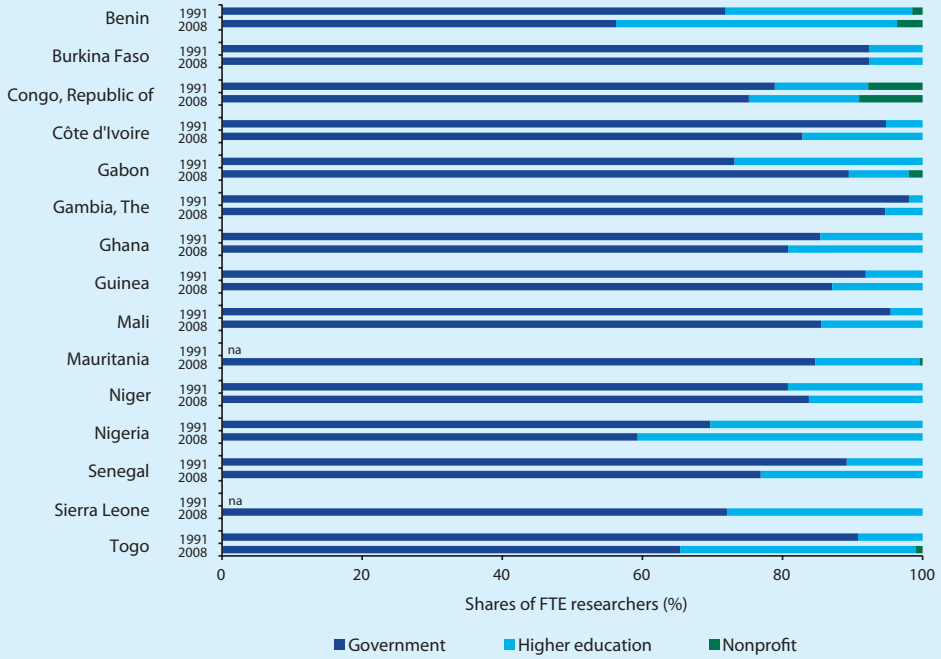
In contrast to some East and Southern African countries where nonprofit agencies (mostly producer organizations or commodity boards) are large contributors to research on tea, coffee, cotton,

Figure 7—Share of female research staff, 2001 and 2008



Source: Compiled by author based on country-level ASTI survey data (see individual ASTI Country Notes).
Note: "na" indicates that data were not available.

Figure 8—Distribution of agricultural researchers by institutional category, 1991 and 2008



Source: Compiled by author based on country-level ASTI survey data (see individual ASTI Country Notes).
Note: "na" indicates that data were not available.

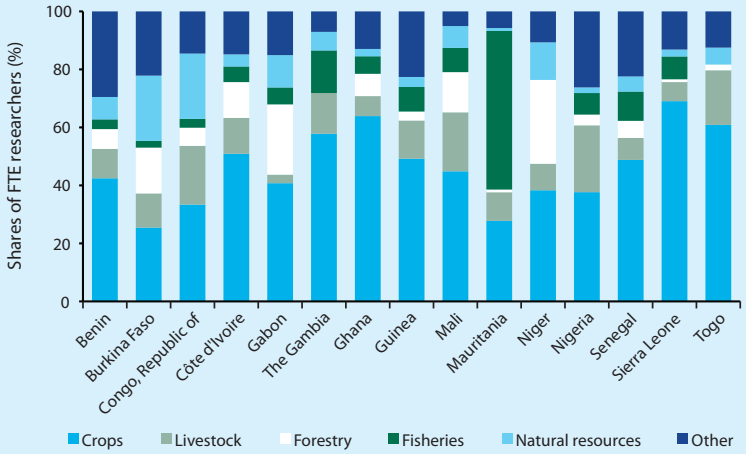
sugar, and tobacco, the role of the nonprofit sector in agricultural R&D in West and Central Africa is negligible. Most of this sector's research is carried out by small NGOs in countries like Benin and Togo, primarily focusing on socioeconomic topics connected with agriculture.

Little information could be accessed on capacity or expenditure trends in agricultural R&D in the private sector. Most private for-profit companies still outsource their research to government agencies or universities, or they import technologies from abroad. Only a limited number of private companies operate their own research programs, and the companies that do so often employ only a handful of researchers. Despite the limited overall involvement of the private sector in agricultural R&D, the private sector in Senegal, for example, plays an innovative role in some of the country's key export areas. While the government sector dominates the R&D related to food crops, companies like SENCHIM, SUNEOR, SODEFITEX, and SPIA are major innovators in the groundnut and cotton sectors, Senegal's principal export crops. In fact, these companies play a more crucial role than the public- sector agencies when it comes to releasing new varieties or providing high-quality solutions to crop diseases. The horticultural and fisheries sectors have also proved to be highly innovative in recent years. Innovations in food processing, storage, and packaging have enabled many Senegalese products to meet Europe's strict quality and hygiene standards, thereby boosting Senegal's exports. In addition, an increasing numbers of private-sector innovations are being patented or otherwise protected (both locally and abroad) (Stads and Sène 2011).

Research allocation by subsector. The allocation of resources among various lines of research is a significant policy decision, so detailed information was collected on the allocation of FTE researchers across specific commodity areas. Large differences were observed across countries reflecting varying natural endowments and research priorities (Figure 9). More than half of agricultural researchers in Côte d'Ivoire, The Gambia, Ghana, Sierra Leone, and Togo conducted crop research. In contrast, crop research played a relatively minor role in Burkina Faso and Mauritania, where roughly a quarter of all agricultural scientists focus on crop-related issues. Similar variation was reported across countries for livestock research, ranging from just 3 percent of FTEs in Gabon to 23 percent in Nigeria. Fisheries research dominates in Mauritania (55 percent), which is unsurprising given the country's arid climate. Forestry and natural resources research show similar variations across countries.

Crop research allocation. In 2008, the major crops being researched in ASTI's 15-country sample were rice (11 percent), cassava (9 percent), maize (7 percent), vegetables (6 percent), and oil palm (5 percent) (Table 2). Once again, important differences in the focus of commodity research exist across countries. In 2006, researchers in the region's tropical countries focused more on bananas, coffee, and oil palm, whereas those in the Sahel focused more on groundnuts, sorghum, and millet.

Figure 9—Distribution of agricultural researchers by major subsector, 2008



Source: Compiled by author based on country-level ASTI survey data (see individual ASTI Country Notes).

Table 2—Crop researchers by major crop item, 2008

Country	Major crop items
Benin	Cassava (18%), cotton (14%) oil palm (11%), yam (11%), rice (10%), bananas (9%), vegetables (7%)
Burkina Faso	Rice (26%), sorghum (26%), maize (19%), millet (10%), vegetables (10%)
Congo, Republic of	Cassava (31%), vegetables (14%), yam (8%), bananas and plaintains (7%), maize (7%), groundnuts (5%), other fruits (5%)
Côte d'Ivoire	Rice (9%), vegetables (8%), cotton (8%), cocoa (8%), oil palm (7%), bananas (5%)
Gabon	Bananas (36%), sugarcane (5%), oil palm (5%)
Gambia, The	Groundnuts (24%), millet (17%), rice (14%), maize (8%), fruits (8%), cassava (7%)
Ghana	Cocoa (11%), cassava (11%), maize (10%), rice (9%),vegetables (7%), oil palm (5%), potatoes (5%), yam (5%)
Guinea	Sorghum (26%), potatoes (13%), coffee (8%), oil palm (8%), maize (7%), ornamentals (6%)
Mali	Rice (31%), cotton (17%), vegetables (11%), millet (10%), potatoes (8%), sorghum (7%), fruits (5%)
Mauritania	Rice (33%), vegetables (22%), fruits (15%), sorghum (13%)
Niger	Groundnuts (26%), millet (15%), sorghum (13%)
Nigeria	Cassava (10%), maize (6%), oil palm (6%)
Senegal	Rice (20%), millet (14%), vegetables (10%), maize (9%), bananas (8%), cassava (7%), sorghum (7%), groundnuts (7%)
Sierra Leone	Rice (30%), cassava (29%), sorghum (8%)
Togo	Maize (18%), cotton (14%), rice (14%), sorghum (12%), yam (9%), cassava (9%), cocoa (7%), coffee (6%)
CORAF total	Rice (11%), cassava (9%), maize (7%), vegetables (6%), oil palm (5%)

Source: Compiled by author based on country-level ASTI survey data (see individual ASTI Country Notes).

Note: Major crop items are defined as those on which at least 5 percent of a country's crop researchers focused.

CONCLUSION

Total public agricultural R&D spending in West and Central Africa increased after a period of stagnation spanning most of the 1990s. Just two countries, Ghana and Nigeria, were responsible for most of this investment growth, which was largely the result of increased government commitments to improve incommensurately low scientist salary levels and to rehabilitate neglected infrastructure after years of underinvestment. The majority of the subregion's francophone countries, on the other hand, reported either declining or extremely volatile trends in their annual agricultural R&D spending levels. National investment levels in countries like Gabon, Guinea, and Niger have fallen so low that the impact of agricultural R&D on rural development and poverty reduction in these countries is questionable.

Like R&D investments, total agricultural R&D capacity in West and Central Africa has also increased since the turn of the millennium, but significant growth in R&D capacity in Nigeria overshadowed declines in countries like the Republic of Congo, Niger, and Togo. In addition, most of the new recruits in Nigeria were junior scientists with only BSc-degree qualifications, with the result that the average levels of degree qualifications of agricultural research staff deteriorated during 2001–08. A large number of countries also reported prolonged recruitment freezes combined with the retirement and departure of senior staff, limited training opportunities, and an overall aging pool of researchers. Nevertheless, on average, West and Central African agricultural researchers are still more highly qualified than their colleagues in other parts of the continent.

Many countries in SSA, particularly the francophone countries in West and Central Africa, continue to be highly dependent on unstable inflows of donor funding and development bank loans. In many instances the completion of large donor-financed projects precipitated severe financial crises in these countries, quickly eroding many of the gains achieved. The long-term nature of agricultural R&D highlights the need for stable long-term funding to ensure that advances in national agricultural research systems can be sustained and built upon. Hopefully WAAPP and other new projects in the region will be able to address some of these issues so that funding levels can be stabilized long term.

Building on the strategic recommendations of various highly influential reports and meetings, and taking into account the various investment and capacity challenges outlined in this report, the following key policy areas must be addressed. National governments must counteract decades of underinvestment by providing higher and more stable levels of funding to public agricultural R&D and by creating a more enabling environment for private-sector R&D. They will need to identify long-term national R&D priorities and design relevant research programs accordingly, while donor funding needs to be better aligned with these priorities. In addition, governments (and donors) must urgently address human capacity challenges in agricultural R&D. Investment in agricultural higher education needs to be enhanced to increase the number and size of PhD and MSc programs and to improve the curricula of existing programs. Finally, given that many small countries lack the required critical mass to produce and access relevant, high-quality research outputs, agricultural R&D must be maximized at the (sub)regional level.

NOTES

[1] ASTI plans to transform the program from an ad hoc data collection initiative to a sustainable system of up-to-date data compilation and analysis, including the institutionalization of activities at the national level. This will include a geographical expansion of benchmark countries, such as Cameroon and DR Congo, which have not been covered in previous survey rounds.

[2] A total of 32 Sub-Saharan African countries were included in the survey round; combined, they contributed more than 90 percent of the region's agricultural gross domestic product (AgGDP).

[3] These trends have been published in a series of ASTI Country Notes, listed in the reference section and available at http://www.asti.cgiar.org/publications/ssa. Underlying datasets can be downloaded via ASTI's Data Tool at http://www.asti.cgiar.org/data.

[4] See Beintema and Stads 2011a and Echeverría and Beintema 2009 for an overview of different funding sources and mechanisms.

[5] For agency directories, please see ASTI's individual country pages available at <http://www.asti.cgiar.org/countries>.

REFERENCES

Beintema, N. M., and G. J. Stads. 2008. *Measuring Agricultural Research Investments: A Revised Global Picture*. ASTI Background Note. Washington, DC: International Food Policy Research Institute.

_____. 2011a. *African Agricultural R&D in the New Millennium: Progress for Some, Challenges for Many*. IFPRI Food Policy Report. Washington, DC: International Food Policy Research Institute.

_____. 2011b. *ASTI Toolkit—Monitoring Agricultural R&D Capacity and Investment Indicators: A Practitioner's Guide to ASTI's Methodologies & Data Collection Standards*. Washington, DC: International Food Policy Research Institute. (Forthcoming)

Echeverría, R. G., and N. M. Beintema. 2009. *Mobilizing Financial Resources for Agricultural Research in Developing Countries: Trends and Mechanisms*. Rome: Global Forum on Agricultural Research.

FAO (Food and Agriculture Organization of the United Nations). 2009. FAOSTAT Database. Accessed March 23, 2010. <http://faostat.fao.org/site/452/default.aspx>.

IAASTD (International Assessment of Agricultural Knowledge, Science and Technology for Development). 2008. *Synthesis Report*. Washington, DC: Island Press.

NEPAD (New Partnership for Africa's Development, Office of Science and Technology). 2006. *Africa's Science and Technology Consolidated Plan of Action*. Pretoria: NEPAD.

NEPAD–CAADP (New Partnership for Africa's Development–Comprehensive Africa Agriculture Development Programme). 2010. Pillar 4: Agricultural Research. Accessed November 2010. <http://www.nepad-caadp.net/pillar-4.php>.

Stads, G. J., and L. Sène. 2011. *Private Sector Agricultural Research and Innovation in Senegal: Recent Trends in Investments, Capacity, and Policies*. Washington, DC: IFPRI.

World Bank. 2007. *World Development Report 2008: Agriculture for Development*. Washington, DC.

_____. 2010. *World Development Indicators*. Washington, DC. Accessed November 2010. <http://data.worldbank.org/data-catalog/world-development-indicators/wdi-2010>.

ASTI COUNTRY NOTES (2010–11)

Flaherty, K., G. Ayoola, J. Ogbodo, and N. Beintema. 2010. *Nigeria*. ASTI Country Note. Washington, DC, and Abuja: International Food Policy Research Institute, Agricultural Research Council of Nigeria, and Farm and Infrastructure Foundation.

Flaherty, K., G. O. Essegbey, and R. Asare. 2010. *Ghana*. ASTI Country Note. Washington, DC, and Accra: International Food Policy Research Institute and Council for Scientific and Industrial Research.

Stads, G. J. and S. Doumbia. 2010. *Côte d'Ivoire*. ASTI Country Note. Washington, DC, and Abidjan: International Food Policy Research Institute and National Agricultural Research Institute.

Stads, G. J., and J. Hinvi. 2010. *Benin*. ASTI Country Note. Washington, DC, and Cotonou: International Food Policy Research Institute and Benin National Agricultural Research Institute.

Stads, G. J., and K. Labare. 2010. *Togo*. ASTI Country Note. Washington, DC, and Lomé: International Food Policy Research Institute and Togolese Agricultural Research Institute.

Stads, G. J., and A. Maïga. 2011. *Mali*. ASTI Country Note. Washington, DC, and Bamako: International Food Policy Research Institute and Rural Economy Institute.

Stads, G. J., and F. Manneh. 2010. *The Gambia*. ASTI Country Note. Washington, DC, and Brikama, The Gambia: International Food Policy Research Institute and National Agricultural Research Institute.

Stads, G. J., and J. Momoh. 2010. *Sierra Leone*. ASTI Country Note. Washington, DC, and Freetown: International Food Policy Research Institute and Sierra Leone Agricultural Research Institute.

Stads, G. J. and P. Obiang-Angwe. 2011. *Gabon*. ASTI Country Note. Washington, DC, and Libreville: International Food Policy Research Institute and Agriculture and Forestry Research Institute.

Stads, G. J., and S. Sawadogo-Kaboré. 2010. *Burkina Faso*. ASTI Country Note. Washington, DC, and Ouagadougou: International Food Policy Research Institute and Environment and Agricultural Research Institute.

Stads, G. J., and L. Sène. 2010. *Senegal*. ASTI Country Note. Washington, DC, and Dakar: International Food Policy Research Institute and Senegalese Agricultural Research Institute.

Stads, G. J., G. Bani, and A. Itoua-Ngaporo. 2010. *Republic of Congo*. ASTI Country Note. Washington, DC, and Brazzaville: International Food Policy Research Institute and General Delegation of Scientific and Technical Research.

Stads, G. J., F. Béavogui, and S. Diawara. 2010. *Guinea*. ASTI Country Note. Washington, DC, and Conakry: International Food Policy Research Institute and Guinean Institute for Agricultural Research.

Stads, G. J., S. Guèye, and M. L. Dia. 2010. *Mauritania*. ASTI Country Note. Washington, DC, and Nouakchott: International Food Policy Research Institute and National Livestock and Veterinary Research Center.

Stads, G. J., M. Issoufou, and A. Malam Massou. 2010. *Niger*. ASTI Country Note. Washington, DC, and Niamey: International Food Policy Research Institute and Niger National Institute of Agricultural Research.

Acknowledgements

This publication was developed with funding from the Bill & Melinda Gates Foundation and additional support from the International Food Policy Research Institute. The author thanks the country collaborators and the 181 agricultural research agencies that participated in the national survey rounds; without their commitment, the publication would not have been possible. The author also thanks Kathleen Flaherty and Michael Rahija for their excellent help in preparing this report.

IFPRI-ROME
Agricultural Science and Technology Indicators (ASTI) initiative
c/o ESA, Food and Agriculture Organization (FAO)
Viale delle Terme di Caracalla • 00153 Rome, Italy
Telephone: +39.06.570.53192 / 56334 • Skype: ifpriromeoffice
Fax: +39.06.570.55522 • Email: asti@cgiar.org
www.asti.cgiar.org

CORAF/WECARD
BP 48 Dakar, Senegal
Telephone: +221.33.869.96.18
Fax: +221.33.869.96.31 • Email: secoraf@coraf.org
www.coraf.org

ASTI compiles, analyzes, and publishes data on institutional developments, investments, and human resources in agricultural R&D in low- and middle-income countries. The ASTI initiative is managed by the International Food Policy Research Institute (IFPRI) and involves collaborative alliances with many national and regional R&D agencies, as well as international institutions. The initiative is widely recognized as the most authoritative source of information on the support for and structure of agricultural R&D worldwide.

IFPRI is one of 15 agricultural research centers that receive their principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (www.cgiar.org).

CORAF/WECARD is a non-political organization of the National Agricultural Research Systems of 23 countries in West and Central Africa. It aims at increasing the efficiency of agricultural research in the region so as to facilitate economic growth, food security and export competitiveness through productive and sustainable agriculture.