AN ASSESSMENT OF THE CRITICAL HUMAN, FINANCIAL, AND INSTITUTIONAL CAPACITY ISSUES AFFECTING WEST AFRICAN AGRICULTURAL R&D

Synthesis and Policy Considerations

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November 2014

CORAF/WECARD

CONSEIL OUEST ET CENTRE AFRICAIN POUR LA RECHERCHE ET LE DEVELOPPEMENT AGRICOLES

WEST AND CENTRAL AFRICAN COUNCIL FOR AGRICULTURAL RESEARCH AND DEVELOPMENT

ASTI AGRICULTURAL SCIENCE & TECHNOLOGY INDICATORS

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INTRODUCTION

High population growth, deteriorating soils, climate change, and volatile food prices are major factors affecting food security in West Africa. To respond effectively to these challenges, agricultural productivity in West Africa needs to be accelerated without delay. Given widespread evidence that investments in agricultural research and development (R&D) have tremendously enhanced agricultural productivity around the world over the past five decades, West African governments have a critical responsibility when it comes to providing sufficient and sustained funding for agricultural R&D and creating a more enabling environment for agricultural innovation to flourish.

Public agricultural R&D spending has grown significantly in West Africa since the turn of the millennium, rising from $418 million in 2000 to $648 million in 2011 (in 2005 PPP prices; Table 1). The number of full-time equivalent (FTE) agricultural researchers has grown rapidly as well, with close to 5,000 FTE researchers engaged in agricultural R&D in 2011. Nevertheless, member states of the Economic Community of West African States (ECOWAS) spent just 0.39 percent of their combined agricultural gross domestic product (AgGDP) on agricultural R&D in 2011, a ratio that is still well below both the average for Africa South of Sahara (SSA) as a whole (0.51 percent), and the minimum 1-percent target recommended by the New Partnership for Africa's Development (NEPAD) and the United Nations.

ECOWAS consists of a relatively large number of small countries, almost all of which also qualify as having relatively small agricultural research systems. Small countries face particular challenges when undertaking agricultural R&D because they lack the ability to take advantage of economies of scale and scope. These countries generally have much to gain from increased regionalization. Regional economic communities in Africa have strengthened gradually over the past decade, as has the regional and subregional coordination of agricultural R&D through initiatives like the Comprehensive Africa Agriculture Development Program (CAADP) and organizations like the West and Central African Council for Agricultural Research and Development (CORAF/WECARD) and the Forum for Agricultural Research in Africa (FARA).

ECOWAS's Regional Research Policy, developed in 2012, seeks greater involvement of the West African research community in the formulation of ECOWAS's programs. Relevant ministers from ECOWAS member countries have validated the Regional Research Policy, which is a broad framework for harmonizing and establishing synergy among scientific research initiatives in various sectors, including the agricultural sector. The ministers indicated that information on the status of scientific research capacity would need to be improved, and determined that an in-depth assessment of critical human, financial, and institutional capacity issues was needed on agricultural research in West and Central Africa. To accomplish this assessment, CORAF/WECARD solicited support from the Agricultural Science and Technology Indicators (ASTI) program of the International Food Policy Research Institute (IFPRI).

Table 1. Public agricultural research spending and researchers, 2000–2011

Country	Spending (million 2005 PPP dollars)			Researchers (full-time equivalents)		
	2000	2008	2011	2000	2008	2011
Benin	12.9	23.1	26.2	121.3	121.6	155.7
Burkina Faso	23.1	19.8	25.4	209.4	246.4	218.0
Cape Verde	na	1.8[a]	2.1	na	23.0[a]	21.0
Côte d'Ivoire	51.1	37.2	37.8	143.0	122.6	130.6
The Gambia	4.2	4.4	5.5	52.4	50.2	65.9

Ghana	42.5	57.2	68.1	469.6	499.0	607.0
Guinea-Bissau	na	0.3[a]	0.2	na	11.0[a]	9.0
Liberia	na	4.0[a]	4.8	na	18.9[a]	45.1
Mali	33.5	25.3	33.6	232.8	318.7	307.0
Niger	4.7	6.3	na	110.2	93.4	na
Nigeria	190.3	402.3	393.9	1,310.9	2,051.0	2,687.6
Senegal	23.8	23.8	24.8	133.3	134.3	112.2
Sierra Leone	na	6.6	6.9	na	58.6	81.7
Togo	13.6	8.3	7.6	94.8	67.1	114.7
Total	**417.5**	**623.6**	**647.8**	**3,216.2**	**4,047.4**	**4,927.4**

Source: Compiled by authors from ASTI country factsheets.
Notes: "na" denotes that data were unavailable. Total includes estimated data for countries without complete time series. To facilitate cross-country comparisons, financial data have been converted to 2005 purchasing power parity (PPP) prices using the World Bank's World Development Indicators. 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. Full-time equivalents (FTEs) only take into account the time researchers actually spend on research, as opposed to other activities like teaching, time spent on secondment to other agencies, or unrelated administrative duties.
a. 2009 data.

During 2013–2014, ASTI, CORAF/WECARD, and national focal points carried out the assessment of the national agricultural research institutes (NARIs) in six ECOWAS member countries:

- National Institute of Agricultural Research of Benin (INRAB);
- Environment and Agricultural Research Institute (INERA), Burkina Faso;
- Ten institutes involved in agricultural research under the Council for Scientific and Industrial Research (CSIR)[1], Ghana;
- Senegalese Agricultural Research Institute (ISRA);
- Sierra Leone Agricultural Research Institute (SLARI); and
- Togolese Agricultural Research Institute (ITRA).

The assessment included a quantitative survey collecting information on human and financial resources, R&D infrastructure, and R&D outputs; a series of face-to-face interviews with selected research and managerial staff; and a staff motivation survey distributed to a selected group of researchers and managerial staff. The country-level outcomes of this in-depth assessment have been summarized in a series of country reports and country summary notes.[2] This current synthesis highlights the cross-cutting trends and challenges that emerged from the country-level data for West Africa, structuring it within five broad areas: funding capacity, human resource capacity, research outputs, research-related infrastructure, and institutional conditions—all in terms of whether they support or impede the effective and efficient conduct of agricultural R&D. This report concludes with a set of national and regional policy recommendations for ECOWAS's Council of Ministers of Agriculture, national-level decisionmakers, and other stakeholders.

[1] These are the Animal Research Institute (ARI), Crops Research Institute (CRI), Soil Research Institute (SRI), Oil Palm Research Institute (OPRI), Food Research Institute (FRI), Forestry Research Institute of Ghana (FORIG), Plant Genetic Resources Research Institute (PGRRI), Savanna Agricultural Research Institute (SARI), Water Research Institute (WRI), and Science and Technology Policy Research Institute (STEPRI).

[2] Country-level reports and summary notes can be downloaded at ASTI's website: www.asti.cgiar.org/asti-coraf.

CHALLENGES: R&D FUNDING

- **Growth in agricultural R&D spending over time, but not everywhere and not quickly enough**

Investments in public agricultural R&D in West Africa grew by more than 50 percent between 2000 and 2011, following two decades of nearly stagnant growth. This recent trend, however, is almost entirely driven by Nigeria and Ghana, and primarily stemmed from the urgent need to institute some degree of parity and competitiveness in researcher salary levels in both countries and—in the case of Nigeria—to rehabilitate derelict infrastructure and equipment. Investment levels in many other countries in the region, particularly the francophone countries, have either stagnated or fallen, although the data indicates an upsurge in spending levels in more recent years, largely in response of the launch of the West African Agricultural Productivity Program (WAAPP).

- **Widespread underinvestment**

Overall investment levels in most countries remain below the levels required to sustain viable agricultural R&D programs that address current and future priorities. In fact, almost all West African countries still fall short of the minimum target of 1 percent of AgGDP recommended by NEPAD and the United Nations (Table 2). Mobilizing domestic political support for agriculture, and especially for agricultural R&D, has been difficult. One reason for this is the inherently long time lag between investing in research and attaining tangible benefits. Policymakers are unable to extract immediate political credit from agricultural R&D investments and their benefits, and therefore have limited incentive to commit to such investments.

Table 2. Public agricultural research intensity ratios, 2000–2011

	Agricultural R&D spending as a share of AgGDP		
Country	**2000**	**2008**	**2011**
Benin	0.43%	0.60%	0.62%
Burkina Faso	0.80%	0.32%	0.42%
Cape Verde	na	1.26%[a]	1.12%
Côte d'Ivoire	0.70%	0.47%	0.49%
The Gambia	0.85%	0.67%	1.03%
Ghana	0.59%	0.61%	0.69%
Guinea	0.68%	0.15%	0.22%
Guinea-Bissau	na	0.04%[a]	0.02%
Liberia	na	0.39%[a]	0.42%
Mali	1.01%	0.51%	0.61%
Niger	0.19%	0.15%	na
Nigeria	0.21%	0.42%	0.33%
Senegal	0.97%	0.82%	0.83%
Sierra Leone	na	0.23%	0.21%
Togo	0.88%	0.40%	0.42%

Source: Compiled by authors from ASTI country factsheets.
Note: "na" denotes that data are unavailable.
a. 2009 data.

- **Governments not always acting on their stated intentions and commitments**

Although governments across West Africa are committed to funding agricultural R&D on face value, disbursed amounts are habitually lower than—and in many cases only a fraction of—budgeted allocations. The governments of Ghana and Senegal, for example, only disbursed 15 percent of the development budget originally allocated to CSIR agencies and ISRA during 2008–2012. It goes without saying that these funding discrepancies have severe repercussions on the day-to-day operations of agricultural R&D institutes and their planned research activities based on anticipated funding levels.

- **Ongoing high levels of donor dependency**

In 2011, close to 30 percent of the funding to West African NARIs (excluding Nigeria) was derived from donors and development banks. Aside from the costs of salaries (which in most cases are entirely funded by national governments and represent the majority share of total R&D spending), donor funding for West African agricultural R&D would exceed 50 percent. Apart from being an uncertain funding source, high donor dependence has the potential side effect of skewing the research agenda away from national priorities.

- **Donor dependency as a major cause of yearly funding volatility**

Given that long period of time elapse between the inception of agricultural R&D and the adoption of resulting technologies, sustained and stable funding is necessary for the attainment of high research returns. Extreme volatility in yearly funding levels can have a severely negative impact on the continuity of R&D programs and on long-term research outputs. Detailed time-series data on agricultural R&D funding sources from across West Africa for the period 2001–2011 reveal that funding from donors and development banks has been much more volatile over time than has government funding. By definition, donor funding is short term and ad hoc. On average, institutes that are highly dependent on funding

from donors and development banks are more vulnerable to funding shocks. Agricultural R&D funding in countries like Burkina Faso, Guinea, Sierra Leone, and Togo has been particularly volatile since the turn of the millennium.

- **WAAPP targets training and R&D infrastructure, not actual research**

At the same time, donor funding increasingly appears to be shifting to regional initiatives rather than national agricultural R&D programs. WAAPP is a subregional program co-financed through World Bank loans, a multi-donor trust fund, and national governments for the purpose of increasing the productivity of priority crops in West Africa. The program aims to facilitate regional cooperation in generating and disseminating agricultural technology and to establish national centers of specialization to strengthen the alignment of national and regional priorities. The project also funds demand-driven technology generation and adoption through a competitive funding scheme managed by CORAF/WECARD. WAAPP supports national agricultural R&D institutes mostly by rehabilitating laboratories and equipment for research on the identified priority crops and by investing in postgraduate training for young scientists (all of which is much-needed). Nevertheless, it should be noted that WAAPP funding for the actual operation of research programs is limited in most countries.

- **Disincentives to generate funding through the sale of goods and services**

Given low or nonexistent government funding for the operation of actual research programs, many institutes across West Africa have no choice but to seek alternative sources of funding such as through the sale of goods and services. In Benin, two-thirds of INRAB's program costs are funded through the sale of rice, maize, cowpea, and germinated palm oil seeds. In Ghana, CSIR institutes are mandated to generate a significant share of their financial resources through commercial means. Although this is a sound long-term goal, it is impeded in the short- to medium-term given the level of funding required, lack of capacity at CSIR to generate funds internally, as well as patent issues. Funding diversification through the sale of goods services is not encouraged in all West African countries, however. ITRA in Togo reverted from a semiautonomous agency to a public agency in 2008, and with that change ceased to benefit from any revenues it generates internally. Similarly, INERA in Burkina Faso and INIDA in Cape Verde must transfer any funding they generate internally back to the Treasury. ARCN in Nigeria is only allowed to keep 30 percent of its internally generated income. The disincentive effect of such policies in these countries is a missed funding opportunity.

- **Lack of national competitive agricultural R&D funds**

Despite the popularity of competitive funding for agricultural R&D and innovation in other parts of the world, few West African countries have adopted competitive funding mechanisms as an instrument for allocating (and prioritizing) a portion of their national agricultural budgets to research and innovation. A notable exception is Burkina Faso, where the National Innovation and Research and Development Fund (FONRID) has disbursed 500 million CFA per year on a competitive basis for (both agricultural and nonagricultural) R&D projects since 2011. Some competitive agricultural S&T funds were established around the turn of the millennium as components of World Bank projects in a number of West African countries, and more recently as part of WAAPP (for example, the National Agricultural and Food Research Fund [FNRAA] in Senegal). These funds finance R&D through grants allocated to projects on the basis of their scientific merit and their congruence with broadly defined agricultural R&D priorities. A main concern of these types of funding mechanisms is their long-term sustainability, given that so many

of them are highly dependent on external funding—once the initial loan or grant has run its course, the competitive fund is exhausted as well.

CHALLENGES: HUMAN RESOURCES

- **Inadequate numbers of researchers, particularly in certain key disciplines**

A minimal number of PhD-qualified researchers is generally considered fundamental to the conception, execution, and management of high-quality research and to communicating its results to policymakers, donors, and other stakeholders at national and regional levels. Despite the overall growth in the total number of agricultural researchers in West Africa, a number of countries have yet to achieve a critical mass, especially in the number of researchers with PhD degrees. The NARIs of The Gambia and Liberia employed only 6 and 5 researchers, respectively, with PhD degrees; none of the researchers at Guinea-Bissau have been trained to the PhD level. While the NARIs in Togo and Sierra Leone experienced an increase in the number of PhD-qualified researchers, actual numbers are still low relative to NARIs in neighboring countries. These institutes also have severe shortages of researchers trained in certain disciplines. Most NARIs predominantly employ crop and livestock scientists; other disciplines are often lacking sufficient capacity, including agricultural machinery, social sciences, animal health, natural resources management, biotechnology, and biometrics. ITRA has no maize, rice, or sorghum breeders or researchers in soil fertility, and the institute currently employs only one researcher focusing on animal health. WAAPP's training component aims to address these shortages, especially in the smaller countries where the gaps are the largest (see below). CSIR, in contrast, has a large number of agricultural researchers at its 10 institutes, and the overall composition of researchers by discipline is balanced, although some disciplines are limited at some of the institutes.

- **Aging pools of researchers, particularly at the PhD level**

Long-term public-sector recruitment restrictions have left institutes in many countries with an aging pool of agricultural researchers, many of whom are set retire within the next decade. On average, more than half the agricultural scientists in West Africa with PhD degrees were more than 50 years old in 2011 (Table 3). In Guinea, Liberia, Mali, Sierra Leone, and Togo, the situation is even more alarming, with more than 70 percent of PhD-qualified researchers being more than 50 years old. An official retirement age of either 60 or 65 years only puts further pressure on already inadequate researcher capacities in most countries. This is particularly grave in disciplines that are already severely underrepresented: INRAB in Benin, for example, employs only one plant breeder who is close to retirement and who has no assistant to train as a replacement. To (temporarily) address this issue, the Senegalese government recently increased the official retirement age for ISRA's researchers from 60 to 65 years. While this is sound policy under the circumstances, it won't solve the succession issue longer term without increased recruitment and training.

Table 3. Aging of agricultural researchers, 2011

Country	Share of researchers older than 50 years (%)		Official retirement age (years)
	Total	PhD	
Benin	51	57	60 for government agencies/ 65 for higher education agencies
Burkina Faso	25	29	65
Cape Verde	24	50	65
The Gambia	33	47	60
Ghana	35	60	60
Guinea	74	95	60 for women / 65 for men
Guinea-Bissau	67	—	60
Liberia	25	71	60
Mali	46	82	65
Nigeria	19	54	65
Senegal	42	38	65
Sierra Leone	26	74	65
Togo	60	71	60 for government agencies/ 65 for higher education agencies

Source: Compiled by authors from ASTI country factsheets.
Notes: Age data were unavailable for Côte d'Ivoire and Niger and exclude the higher education sector for Burkina Faso and Senegal. Nigeria only includes the 15 institutes affiliated with the Agricultural Research Council of Nigeria (ARCN).

- **Female researchers severely underrepresented**

Female researchers offer unique insights, perspectives, and skills that can help research institutions more effectively address the specific challenges of farmers in Africa, the majority of whom are female. Furthermore, attracting women into agricultural research would be a highly beneficial strategy for addressing the aforementioned low researcher capacity in many countries. Despite increases in the shares of female researchers over time in most countries, female participation in agricultural R&D in West Africa remains very low compared with other African subregions, and with the rest of the world. Moreover, the roles, status, and ability of female researchers to participate in decisionmaking processes remain limited. Female participation is particularly low in Guinea-Bissau (0 percent), Guinea (4 percent), and Togo (9 percent; Table 4). In addition, female scientists are far less likely to hold PhD degrees than their male colleagues, so West Africa still has a long way to go in increasing female participation in agricultural R&D and hence integrating gender perspectives into the formulation of related policies. On a positive note, the share of female researchers has increased in most West African countries during 2008–2011.

Table 4. Share of female researchers, 2011 compared with 2008

	Share of female researchers by degree, 2011 (%)			Share of female researchers (%)	
Country	PhD	MSc	BSc	2011	2008
Benin	10	15	0	12	15
Burkina Faso	7	15	13	11	13
Cape Verde	50	38	33	38	na
The Gambia	—	16	14	14	11
Ghana	15	21	21	19	16
Guinea	0	5	5	4	5
Guinea-Bissau	—	—	—	—	na
Liberia	2	40	16	20	na
Mali	8	15	80	22	10
Nigeria	19	34	30	29	27
Senegal	19	15	40	19	10
Sierra Leone	7	17	9	14	6
Togo	na	na	na	9	na

Source: Compiled by authors from ASTI data.
Notes: Data on the share of female researchers were not available for Côte d'Ivoire and Niger and exclude the higher education sector for Senegal. Nigeria only includes the 15 institutes affiliated with the Agricultural Research Council of Nigeria (ARCN). "na" denotes that data were unavailable.

- **Poor incentive structures for researchers resulting in high staff turnover**

Many NARIs are challenged in their ability to compete with universities, the private sector, and other organizations when it comes to recruiting, retaining, and motivating well-qualified researchers. Key issues include low salaries and poor benefit and retirement packages; limited promotional opportunities and work flexibility (for example, in terms of working hours or opportunities to collaborate with other agencies); lack of infrastructure, services, and equipment; and poor management structures. For example, many well-qualified researchers have left INRAB in recent years as a result of the large differences in salary levels and benefit packages between INRAB and the higher education sector and international organizations. INERA lost 40 PhD-qualified researchers during 2006–2011, most of whom departed for more lucrative opportunities elsewhere. To halt the high rates of staff attrition, various NARIs increase salary levels with government support to improve incentives. For example, the Senegalese government more than doubled the salary levels of ISRA's researchers and improved their promotional opportunities. The government of Ghana instituted the "Single Spine Pay Policy," which introduced parity between the salaries of CSIR scientists and those of university-based scientists. Staff morale has improved considerably at both institutes, the supply of candidates for vacant positions has increased, and staff departures appear to have declined.

Box 1. Staff motivation survey

As part of the ASTI/IFPRI–CORAF project, a staff motivation survey was conducted for the purpose of eliciting a better understanding of the factors that both positively or negatively affect staff motivation. Unsurprisingly, staff members are motivated by a variety of factors. Although financial rewards are generally paramount, numerous other factors come into play, including conditions of service, job satisfaction, institutional culture, and job security—to name a few.

Overall, researchers and managerial staff in Ghana, Senegal, and Sierra Leone reported being more motivated and feeling more appreciated by their institute than their colleagues in Benin, Burkina Faso, and Togo. The same country divide is apparent in respondents' ratings of the conduciveness of civil service policies to their work. This dichotomy can largely be explained by differences in the official status of researchers across countries, as well as differences in salaries and benefits. Researchers in Ghana, Senegal, and Sierra Leone have received substantial salary increases in recent years. In the other three countries, salary disparities between the national agricultural research institutes and the university sector remain significant, and hence act as a strong detractor of motivation. A large percentage of researchers in all six countries indicated that their level of motivation was negatively affected by a lack of research funding and inadequate research infrastructure and equipment. Limited promotional opportunities and a lack of attractive benefit packages remain areas of concern in all six countries.

It should be noted that factors motivating staff followed a logical distribution, as indicated by the focus on salary levels in the three countries where inequities exist. Similarly, younger researchers were understandably more concerned with training and promotional opportunities than older, more qualified researchers approaching retirement age; and researchers employed in areas lacking facilities and equipment were more focus on these issues. Hence, motivating factors have an inherent hierarchy depending on the institutional context.

- **Limited access to in-country postgraduate training**

The provision of postgraduate (PhD and MSc) training programs at national universities is limited in many West African countries. For example, SLARI's human resource plan recommended that the institute focuses on recruiting MSc-qualified researchers, but most graduates from national universities hold only BSc degrees. Many NARIs do not have plans addressing their human resources and training needs. Furthermore, most governments do not allocate funding to train researchers; training generally depends on donor funding, which has been increasingly scarce in the past few decades. The large capacity strengthening components of WAAPP will address this to some degree in countries that have experienced growing skill gaps and limited training opportunities. In 2012–2013, 26, 30, and 38 researchers in Burkina Faso, Togo, and Sierra Leone, respectively, received grants to pursue MSc- or PhD-degree training at universities in their own countries or elsewhere in West Africa. One short-term downside of this massive training effort is that the institutes are operating with an even more limited pool of researchers while those undertaking training are away. WAAPP also supports training through exchange programs with researchers of other West African countries, as well as regional and international organizations. These large training components under WAAPP also have a positive impact on staff morale, motivation, and career opportunities. A further downside, however, is the potential to increase staff attrition as more highly qualified and experienced researchers become more attractive to the other agencies, and researchers are motivated to seek more attractive salaries benefits, and conditions. This can be dealt with to some degree through training stipulations that require a commitment from researchers for a definitive period once they complete their training.

CHALLENGES: R&D OUTPUTS

- **Low scientific output of research institutes**

In 2008, SSA (excluding South Africa) represented just 0.6 percent of global scientific publications, and this share has been relatively consistent over the past decade.[3] The scientific output of agricultural research institutes across West Africa is very low as well. In 2012, 68 ISRA researchers produced a combined 32 journal articles, books, or book chapters, resulting in a publication-per-researcher ratio of just 0.47 that year. The average number of scientific publications per researcher produced by the other NARIs was even lower, ranging from just 0.01 at ITRA to 0.41 at INRAB.[4] The fact that scientific output remains so low despite the increased availability of funding over the years is a major cause for concern. Research institutes with a track record of high-quality research and publications are more likely to generate funding through competitive funds or engage in high-profile collaborative projects with scientific partners in the developed world. Nonetheless, most West African agricultural research institutes provide insufficient incentives for their scientists to publish. Few agricultural research institutes assess the performance of their scientists based on the number of publications they produce. Moreover, given that so few researchers are used to publishing in renowned journals, many actually lack the expertise and technical writing skills needed to be accepted for publication in academic or journal articles and other forums.

- **Limited innovative capacity of smaller national agricultural research systems**

The release of new varieties and technologies reflects the extent to which agricultural research institutes fulfill their mandates and respond to the needs of their end users (that is, farmers). The number of varieties released in West Africa varied greatly among NARIs. INERA and CSIR released a steady flow of new varieties during 2008–2012 (Table 5). In contrast, ITRA adapted just two rice varieties (developed by AfricaRice) and developed no new varieties in-house during this period, whereas INRAB developed just one cotton and one maize variety in-house and adapted two maize varieties developed by the International Maize and Wheat Improvement Center (CIMMYT). The low innovative capacity of these institutes is a reason for concern, raising questions as to the effectiveness of national agricultural R&D outputs, and whether these countries would not be better served by focusing on (and potentially contributing to) technology spill-ins in from their larger neighbors. Weak domestic intellectual property rights legislation remains a challenge across West Africa and can also be seen as a factor impeding innovation; many countries struggle with how to reconcile intellectual property rights with farmers' rights and other local interests, which is a valid concern. Of the six NARIs under study, INERA is the only one that succeeded in protecting some of its improved varieties (two cotton and two sorghum varieties) with the African Organization of Intellectual Property (OAPI). Increased regionalization of agricultural research in West Africa through WAAPP raises complex intellectual property rights issues that urgently need to be resolved.

[3] UNESCO (United Nations Educational, Scientific and Cultural Organisation). 2010. Accessed June 2014. http://unesdoc.unesco.org/images/0018/001899/189958e.pdf.

[4] These data are for 2012. The total number of publications can fluctuate considerably from one year to the next.

Table 5. Number of improved crop varieties developed or adapted by NARIs, 2008–2012

NARI	Number of improved crop varieties developed in-house by NARI	Externally developed crop varieties tested and adapted by NARI	Crops
INRAB	2	2	Cotton, maize
INERA	64	43	Millet, cotton, soy, maize, rice, sorghum, other
CSIR	47	2	Rice, maize, groundnuts, sweetpotatoes, cowpeas, soy, and oil palm
ISRA	9	30	Rice, sesame, maize, millet, sorghum, and cowpeas
SLARI	6	7	Rice, cassava, sweetpotatoes, groundnuts, and cowpeas
ITRA	0	2	Rice

Source: Compiled by authors from ASTI/IFPRI–CORAF/WECARD survey data.

CHALLENGES: R&D INFRASTRUCTURE

➢ **Outdated research infrastructure impedes the conduct of productive research**

One of the principal reasons for the relatively limited scientific output of West African agricultural research institutes is the lack of adequate research infrastructure and equipment. ITRA has numerous laboratories that are not operational because of the dilapidated state of their equipment and infrastructure (this includes ITRA's entomology and phytopathology/virology laboratories, as well as its animal research unit). INRAB also has two defunct laboratories for similar reasons, and although its center serving the north of the country is still in operation, it lack access to electricity, raising questions as to the effectiveness of its research. NARIs in Burkina Faso, Senegal, and Sierra Leone all reported similar challenges to their research efforts due to outdated research infrastructure; equipment that has gone into disrepair; insufficient access to vehicles to conduct field research; frequent power cuts that disrupt trials; unreliable Internet access; and a lack of up-to-date hardware, software, and servers. CSIR considered most of its laboratories adequate, but issues have been raised related to the need for maintenance and upgrades. It goes without saying that outdated agricultural R&D infrastructure has a significant detrimental impact on the quantity and quality of research outputs in West Africa.

➢ **WAAPP-supported infrastructure upgrades only target priority commodities**

The rehabilitation of research infrastructure is one of the key objectives of WAAPP. Currently, research stations and laboratories, offices, field infrastructure, and staff residences are being upgraded across West Africa with WAAPP support. WAAPP is also addressing electricity, Internet access, and staff mobility challenges by investing in broadband Internet, generators, and vehicles. Despite these much-needed investments, much more is needed. WAAPP funding is predominantly targeted to upgrades of centers and stations focusing on preselected priority commodities, and largely overlooks many other centers and stations that are in urgent need of rehabilitation as well.

➢ **Lack of staff training on the operation of R&D equipment impedes its use**

Many donors fund the rehabilitation of research infrastructure and equipment, but often fail to provide training to researchers and technicians on how to operate new equipment. For example, the West African Economic and Monetary Union (UEMOA) has invested heavily in upgrading biosecurity research

infrastructure in member countries as part of the development of a common biosecurity policy for West Africa. In all UEMOA member countries, biosecurity laboratories have been renovated and equipped with multi-million dollar state-of-the-art technology. However, much of the new equipment remains unused because researchers and technicians were not given appropriate training on how to operate (and maintain) it and hence prefer to work with the old equipment instead. Moreover, despite the inflow of these technologies, in the absence of funding and hence projects requiring its use, these technologies are rendered idle.

CHALLENGES: INSTITUTIONAL STRUCTURE OF AGRICULTURAL R&D

- **Lack of (semi)autonomous status or reporting to an entity other than Ministry of Agriculture**

Most NARIs in West Africa are administered by the ministry of agriculture or the ministry of science and technology, and receive most of their funding from the government (often through the ministry of finance). A number of NARIs still do not have (semi)autonomous status, and as such are limited in their ability to set their own financial, human resource, or other operating policies as a means of diversifying their funding sources, offering competitive working conditions, and more generally becoming more efficient. Larger countries like Ghana and Nigeria have adopted a council model, which should facilitate coordination, but collaboration among institutes remains limited. Even though many NARIs have some degree of autonomy, lack of funding prevents them from exercising this autonomy. In Benin and Togo, for example, the ministry of agriculture can second experienced researchers to other ministerial departments at will; INRAB and ITRA have little to say on this issue and lose much-needed expertise this way each year. INERA falls under the Ministry of Higher Education and Scientific Research rather than the Ministry of Agriculture. This is often seen as a major impediment to effective linkages with the end users of its research. In Senegal, research coordination is too dispersed across ministries, and linkages between ministries are generally seen as weak, often leading to duplication of research activities. The coordination of scientific research at the ministerial level underwent considerable restructuring at frequent intervals in recent years, but lack of policy continuity is widely seen as having a damaging effect on the effectiveness of research.

- **Lack of strategic planning within many national agricultural research institutes**

Many NARIs in West Africa have outdated or nonexistent long-term strategic plans and accompanying operational plans. For example, council-level strategic planning at CSIR remains limited, and the most recent plan (for 2005–2009) has long been outdated. With the assistance of FARA, SLARI developed a set of strategic, operational, and investment plans during 2011–2012. However the costs of implementing the first operational plan exceeds the funding levels expected from government, donor, and private sector sources, resulting in an estimated shortfall of 60 percent. In addition, planning and monitoring and evaluation capacity is weak across West Africa. Many countries lack efficient administration systems and practices. Data management at INERA, for example, is weak, with each center managing its own financial and human resource databases. Donor funding is often disbursed directly to the centers without passing through headquarters, and without the knowledge of the director of finance. Many researchers officially listed as being on INERA's payroll by the administration do not work at the institute, but instead are from other ministerial divisions. This understandably impedes effective human resource management.

- **Weak linkages between research and extension impede the adoption of improved varieties**

The lack of a close working relationship between NARIs and extension agencies, and with farmer organizations, is one of the most difficult institutional problems confronting agricultural R&D in West Africa. In many countries (formal) extension agencies are extremely weak or non-existent, and where they do exist, they often compete with research agencies for the same scarce government resources. In Ghana, the Research–Extension–Farmer Linkage Committees (RELCs) were established to encourage demand-oriented research involving farmers with the goal of enhancing farming practices and productivity. In reality, however, the RELCs perform steering rather than implementation functions, so the dynamic interface to promote technology transfer has not been realized.

CONCLUSIONS AND POLICY OPTIONS

Well-developed national agricultural research systems and adequate levels of investment and human resource capacities are prerequisites in the attainment of agricultural development, food security, and poverty reduction. Some encouraging signs indicate that African countries have become increasingly focused on investing in agriculture for economic growth in recent years, evidenced by a number of influential initiatives and regional and subregional processes that have put agriculture and agricultural R&D firmly back on political and donor agendas. Many countries have developed solid agricultural development and financing plans to strengthen agricultural production and food security as part of CAADP. Another important move toward a stronger agricultural sector is the Science Agenda for Agriculture in Africa (S3A), which was initiated in early 2013.

Despite this increased political support to agricultural R&D, West Africa is still severely lagging behind other parts of Africa when it comes to agricultural R&D capacity and investment. Compared with other African regions, West Africa invests a substantially smaller share of its AgGDP in agricultural research, is more dependent on volatile donor funding, and employs both a much older pool of scientists (many of whom are approaching retirement age) and a much smaller share of female agricultural scientists. Moreover, West Africa is severely challenged in terms of R&D infrastructure. Outdated research equipment and facilities are impeding the conduct of productive research, which compromises the number and quality of research outputs and ultimately translates into reduced impact.

Success in achieving ambitious future agricultural growth targets set by CAADP and the United Nations is intrinsically dependent on sufficient and stable financial resources for agricultural R&D and the development of adequate human resource and institutional capacity. The apparent recent increase in political support to agricultural R&D must be translated into a clear set of policy directives by governments if the many challenges facing agricultural R&D systems are to be addressed. Taking into account the various challenges related to agricultural R&D funding, human capacity, outputs, infrastructure, and institutional structure presented in this report, policy implications for West African governments are indicated in the key areas outlined below.

- ***Governments must address underinvestment in agricultural R&D and take the necessary policy steps to diversify funding sources***

Evidence does not indicate significant improvement in the relative intensity of agricultural research investment (agricultural R&D spending as a share of AgGDP) in West Africa over time. Despite CAADP's efforts to promote stronger investment in agriculture (including agricultural research) across the region, as well as increased allocations to agricultural research by a number of West African governments in recent years, agricultural R&D spending in most West African countries is still far below the levels required to sustain their agricultural sectors' needs. Countries that have increased their expenditures

substantially, such as Ghana and Nigeria, have directed most of the funds toward (much-needed) salary increases, rather than actual research programs. National governments urgently need to address underinvestment in agricultural R&D and ensure the full disbursement of approved budgets. They must provide stable and sustainable levels of funding to secure a strategic program of effective research activities that yields increased agricultural productivity.

Rather than relying too much on donor contributions and development bank loans to fund critical areas of research, governments need to determine their own long-term national priorities and design relevant, focused, and coherent agricultural R&D programs accordingly. Donor and development bank funding needs to be closely aligned with national priorities, and donor programs should synergistically complement these priorities. Mitigating the effects of any single donor's abrupt change in aid disbursement is crucial, highlighting the need for greater funding diversification—for example, through the sale of goods and services, or by attracting complementary investment from the private sector. The private sector is currently the least developed source of sustainable financing for agricultural R&D in West Africa (its funding potential remains largely untapped in most countries). Cultivating private funding requires that national governments provide a more enabling policy environment through tax incentives, protection of intellectual property rights, and regulatory reforms to encourage the spill-in of international technology.

- ***Governments must invest in training and capacity building and remove status and salary discrepancies between NARI researchers and university-based researchers.***

Few NARIs in West Africa have autonomous status in setting their own financial, human resource, or operating policies, which limits their ability to diversify their funding sources, offer competitive salaries and working conditions, and generally maximize efficiency levels. Growing concern exists regarding the lack of human resource capacity in agricultural R&D to respond effectively to the challenges that agriculture in West Africa is facing. In nearly all countries in West Africa, the majority of PhD-qualified researchers will retire by 2025. NARIs therefore need to develop systematic human resource strategies without delay, incorporating existing and anticipated skills gaps and training needs. The successful implementation of such strategies will require both political and financial support. National governments must expand their investments in agricultural higher education to allow universities to increase the number and size of their MSc and PhD programs—or establish such programs in countries were MSc and PhD programs are still lacking—and to improve the curricula of existing programs. This includes the expansion of various regional capacity-building initiatives initiated in recent years, including those under WAAPP. In addition to degree-level training, NARIs should involve present and past tenured researchers in mentoring their younger colleagues. In some countries, this may involve increasing the official retirement age of researchers or instituting some form of flexible working arrangements for retired researchers. Developing incentives to create a more conducive work environment for agricultural researchers is crucial. In a large number of countries, significant discrepancies exist in the remuneration, working conditions, and incentives offered to NARI researchers compared with their university-based colleagues. These inequities need to be removed or overcome to enable the NARIs to attract, retain, and motivate well-qualified researchers.

- ***Governments must develop long-term national agricultural research policy agendas and provide stronger institutional, financial, and infrastructural support to NARIs***

Although many NARIs in West Africa have (semi)autonomous status, funding and capacity constraints often prevent them from exercising this autonomy. Most NARIs are bound by ministerial directives and regulations, and therefore have little or no flexibility in recruiting staff, setting competitive salary levels, or determining what laboratories need renovation—all of which are needed to strengthen NARIs institutionally and ensure the continuity of their research. A critical area needing urgent attention is the development of strong, national agricultural research policy agendas, together with the necessary expertise to support these agendas long term. It is also essential that governments strengthen the institutional, financial, and infrastructural foundations of NARIs so they can more effectively address farm productivity challenges and poverty issues. Strengthening the planning capacity at the research program level is crucial to the overall effectiveness of NARIs. Many NARIs currently lack efficient administration systems and practices needed to more effectively monitor progress and inform strategic decisionmaking.

Governments will also need to provide the necessary policy environment to stimulate cooperation among the country's agricultural R&D agencies in order to maximize synergies and efficiencies in the use of the scarce resources available to universities and government agencies. In addition, governments must take action to ensure that improved varieties and technologies released by the NARIs are disseminated to and adopted by farmers. This involves strengthening extension agencies and more clearly delineating the roles of NARIs and extension agencies to actively promote cooperation. Gender considerations also need to be taken into account in terms of identifying gender-specific research needs, designing training programs, and determining criteria for technology development and adaptation.

Appendix

AGRICULTURAL R&D IN BENIN

An Assessment of the National Institute of Agricultural Research of Benin

Marcellin C. Allagbe and Gert-Jan Stads

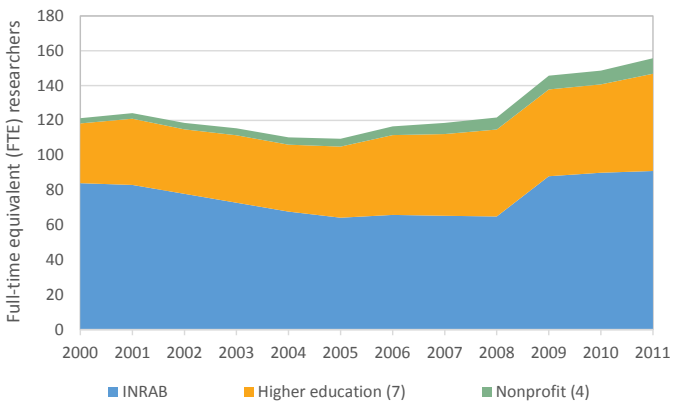
Summary Note • July 2014

OVERVIEW OF NATIONAL AGRICULTURAL R&D

Twelve public agencies conduct agricultural R&D in Benin. The National Institute of Agricultural Research of Benin (INRAB) is by far the largest, employing close to 60 percent of Benin's full-time equivalent (FTE) agricultural researchers in 2011 (91 FTEs), as well as being the only government agricultural R&D agency.[1] INRAB falls under the Ministry of Agriculture, Livestock, and Fisheries (MAEP), is headquartered in Cotonou, and operates three regional centers (in the Center, North, and South) and two commodity-based centers (one focusing on cotton and other fibers, the other on perennial plants). INRAB's scientists conduct research on crops, livestock, postharvest technologies, socioeconomics, forestry, agricultural engineering, and natural resources.

Benin's higher education sector plays an important role in national agricultural R&D. Seven units under the University of Abomey-Calavi (UAC) are actively engaged in agricultural R&D, the largest of which is the Faculty of Agricultural Sciences (employing 22 FTEs in 2011). The Faculty of Agronomy of the University of Parakou (8 FTEs in 2011) is the only non–UAC higher education agency that conducts agricultural R&D. Four nongovernment organizations also conduct agricultural R&D in Benin and together employed 9 FTEs in 2011, largely focusing on research related to socioeconomics, but also concerning agricultural issues. Agricultural research conducted by the private for-profit sector in Benin is negligible.

Figure 1. Agricultural researchers by institutional category, 2000–2011



Source: Compiled by authors from ASTI–INRAB data.
Note: For full details of the agencies included in the dataset, see www.asti.cgiar.org/benin.

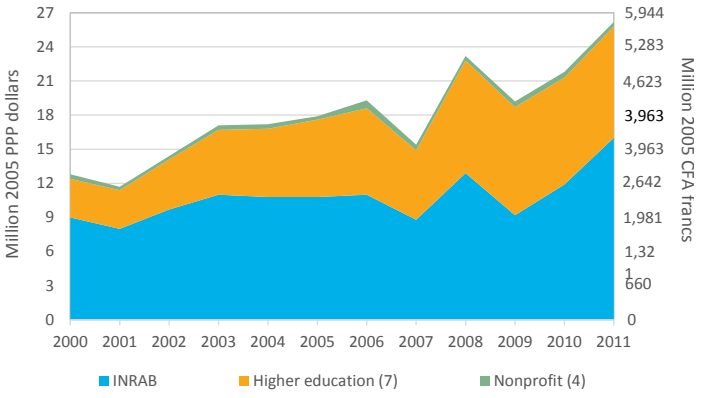
After a period of stagnation, the national number of agricultural researchers grew from 121 in 2000 to 156 in 2011 2011 (Figure 1), representing overall growth of 28 percent. Agricultural R&D spending more than doubled from 2,827.2 million CFA Francs in 2000 to 5,756.3 CFA francs in 2011. This was largely driven by the combined effect of growth in internally generated revenues at INRAB, and greater involvement in agricultural R&D by UAC (Figure 2). Agricultural research spending as a share of agricultural GDP increased from 0.43 percent in 2000 to 0.62 percent in 2011; the number of FTE researchers per 100,000 farmers remained fairly stable over the same timeframe at around 8 to 9.

INRAB'S CURRENT STATUS

Institutional Issues

- Unlike their university-based counterparts, INRAB's scientists are classified as public servants, not researchers. As a result, their salaries are significantly lower, creating a challenge for INRAB to attract and retain well-qualified researchers. In addition, university-based scientists are enrolled in the African and Malagasy Council for Higher Education (CAMES), which offers them greater international recognition and better career opportunities.
- Another aspect of INRAB's current institutional status is the government's ability to second highly qualified researchers to other departments at will, depleting INRAB of much-needed expertise each year.

Figure 2. Agricultural research spending by institutional category, 2000–2011



Source: Compiled by authors from ASTI–INRAB data.
Note: For full details of the agencies included in the dataset, see www.asti.cgiar.org/benin.

- The Government of Benin is currently considering modifying INRAB's status to give it greater autonomy and hence flexibility in its funding and recruitment practices, which will enable the institute to offer its researchers more competitive salaries and conditions. A final determination is expected in 2014.
- Government support for agricultural R&D has been low because policymakers lack appreciation of its importance to agricultural productivity and economic development. In addition, INRAB has not yet adequately demonstrated the impact of its research outcomes.
- Linkages between INRAB and the national provider of extension services the Regional Centers of Action for Rural Development (CARDER) are weak. CARDER no longer has sufficient staff to effectively collaborate or respond to farmers' needs.
- INRAB is lacking in efficient centralized administration systems and practices. Data management, for example, is weak, with each center managing its own financial and human resource databases. INRAB's headquarters is hence not always apprised of what is happening at centers in remote areas.

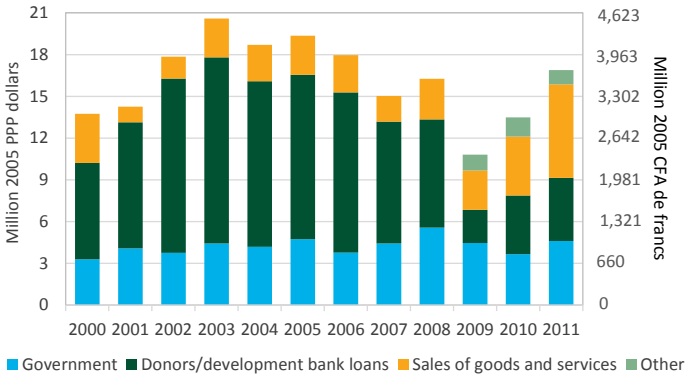
Human Resources

- Given large salary and benefit discrepancies between INRAB and the higher education sector and international organizations, large numbers of well-qualified researchers have left the institute in recent years. In addition, the benefits inherent with CAMES membership further attract researchers away from INRAB to the higher-education sector. Universities, however, have much weaker linkages with farmers given their academic focus on scientific research and publications compared with applied research of relevance to the needs of producers.
- Civil service recruitment restrictions were in effect from 1986 until very recently. During this time, INRAB could only appoint contract-based researchers, but lack of project funding made this problematic. Consequently, many research positions have been vacant over a long time span.
- As a side-effect of the recruitment restrictions, 70 percent of INRAB's PhD-qualified researchers are more than 50 years old, and given an official retirement age of 60 years, many researchers will retire in the next decade.
- Another consequence of the recruitment restrictions and salary discrepancies is that INRAB currently lacks a critical mass of scientists in a number of key disciplines. For example, the single researcher working on plant breeding has no assistant and will retire soon; the only researcher working in the area of soil science retired in 2013; and the only researcher focused on weed science is on secondment to the Food and Agriculture Organization of the United Nations.
- As of 2012, 37 percent of INRAB's researchers held PhD degrees, and 63 percent were qualified to the MSc level. Further capacity building is needed focusing on developing career paths and recruiting young researchers.
- During 2008–2012, 34 researchers were undertaking MSc- or PhD-level training (or equivalent), mostly through self-funding, although funding from AfricaRice, CIRAD, and Danida has also provided training opportunities. A large number of INRAB's young researchers received PhD training at UAC (often funded by Danida), but upon graduation many of them chose a career at UAC instead of returning to INRAB.
- Unions have blocked merit-based promotion; currently, all promotions are based on seniority. Productive researchers who generate funding and whose work gets published advance no faster than scientists who do not. Obviously this is serious impediment to motivation and job satisfaction.

Financial Resources

- Government funding to INRAB is only sufficient to cover salaries and related expenses. The institute's ability to operate research programs and build and maintain infrastructure is extremely dependent on donors and the funding INRAB generates internally through the sale of goods and services (Figure 3).
- In 2009, INRAB's funding drastically declined due to the cessation of Danish funding and a significant reduction in the contribution from the national budget for agricultural research. INRAB is no longer able to conduct all of its activities, including those relating to the management cycle of agricultural research and competitive funds.
- With the decline of donor funding, INRAB has had to develop alternative funding sources. As of 2011, two-thirds of the institute's program costs were funded internally, predominantly through the sale of germinated palm oil seeds by the Perennials Center (CRA-PP) and the sale of rice, maize, and cowpea seed by the Research Center for the South (CRA-Sud).
- Funding to INRAB has increased since 2012, when the West Africa Agricultural Productivity Program (WAAPP) was

Figure 3. INRAB's funding sources, 2000–2011



Source: Compiled by authors from ASTI–INRAB data.

launched (with a budget of over 8 billion CFA francs for five years). Under WAAPP, Benin will be the home of a center of excellence in maize research, so associated funding will largely be allocated to the rehabilitation of maize-related research infrastructure and equipment, as well as those of the Soil, Water, and Environmental Science Laboratory (LSSEE). WAAPP includes a small competitive fund, which has financed 13 research projects since 2013. WAAPP also funded 26 PhD and 21 MSc courses during the 2013/14 academic year.

R&D Infrastructure

- All of INRAB's research facilities are old and run down. Most laboratory lack up-to-date research equipment, hardware, software, and servers, and the number and quality of vehicles are inadequate. With such low levels of capital investment, R&D infrastructure has deteriorated over time and this has had understandable impacts on quality of research and the resulting outputs.
- In 2012, the government funded the construction of new INRAB headquarters in Agonkanmey and a greenhouse at the plant physiology laboratory in Pobè. The new headquarters are scheduled to become operational in the near future. The Agonkanmey research center (CRA-A) will be rehabilitated under WAAPP, but no other centers will benefit from WAAPP funding.
- In 2011, the NERICA Rice Development Project (PDRN) funded the acquisition of eight small combine harvesters, five rice mills, weed control equipment, and six power generators.

Table 2. The condition of INRAB's research laboratories

Center	Laboratory	Condition
CRA-Sud Niaouli	Micro-organism/virology laboratory	Nonfunctional due to derelict equipment
CRA-Nord Ina	No laboratories	–
CRA-Centre Savè	No laboratories	–
CRA-CF Parakou	Cotton fiber analysis laboratory	Functional
CRA-CF Cana	Pathogenic and cotton entomology laboratory	Partially functional (equipment is derelict and serious electricity and water issues exist)
CRA-PP Pobè	Plant physiology laboratory	Functional
CRA-A Agonkanmey	Soil science laboratory	Functional, but equipment is derelict
	Food technology laboratory	Partially functional, but equipment is derelict
	Biometric analysis laboratory	Nonfunctional due to lack of biometricians
	Laboratoire de défense des cultures	Partially functional, but equipment is derelict

Source: Compiled by authors based on ASTI/IFPRI–CORAF/WECARD survey data.

- The Research Center for the North (CRA-Nord) does not have access to electricity, raising questions as to limitations on the research it conducts.

Research Outputs

- The number of improved varieties released by INRAB is limited. During 2008–2012, the institute's in-house research led to the development of just one new cotton and one new maize variety. INRAB released a number of other varieties developed by CGIAR centers and adapted to local conditions, including a number of maize varieties. Lack of access to improved seed, poor dissemination practices, and the low incomes of producers are generally seen as the major causes of low adoption.
- The number of scientific publications produced by INRAB is low as well. In 2011, INRAB scientists published just 42 articles in (national and international) journals, corresponding to a publication-per-researcher ratio of 0.4 per year.
- INRAB does play an important role, however, in producing "RTE sheets," the sale of which generates significant funding for INRAB. RTE sheets are booklets designed to present research results to farmers in a way that they can comprehend. Subjects include issues related to crops, forestry, and livestock.

CONCLUSION AND POLICY OPTIONS

- A training and recruitment plan needs to be implemented to allow INRAB to fill the large number of positions that will become vacant in the coming years. Moreover, policies need to be implemented to ensure that scientists return to INRAB upon completing their training;
- Discrepancies in the status, salaries, and retirement age of INRAB's researchers and their university-based colleagues need to be removed or overcome to improve the overall remuneration, working conditions, and incentives at INRAB so that the institute can attract, retain, and motivate well-qualified researchers.
- The institute needs to advocate for increased government funding and explore mechanisms to improve the coordination of donor funding to avoid duplication in some areas of research and underfunding in others.
- Databases and monitoring and evaluation systems need to be improved through coordination and harmonization; currently they are ad hoc and disjointed.
- It is important for the institute to be able to invest in the rehabilitation of its research centers (other than the ones that are currently being rehabilitated under WAAPP) to support the conduct of effective research, to retain and motivate researchers, and to facilitate the growth of effective research outputs that will have impact, all of which are currently hindered by inferior research facilities.

- Linkages between research and extension need to be enhanced. Until 2005, INRAB worked closely with the expert R&D (ASRD) service under CARDER, whose mission was to synergize research results and extension. With the closure of the ASRD service, relations between INRAB and CARDER have weakened.
- As previously noted, the Government of Benin is currently considering changing INRAB status of to give it greater autonomy and hence flexibility in its funding and recruitment practices. This new status will significantly assist INRAB in competing for well-qualified researchers, in securing their commitment over time, and in instituting appropriate incentives through a more attractive overall working environment. The process is currently quite advanced, and a final outcome is expected in 2014.

FOR FURTHER READING

www.asti.cgiar.org/pdf/factsheets/benin-factsheet.pdf

NOTES

1. FTEs only take into account the time researchers actually spend on research, as opposed to other activities like teaching or unrelated administrative duties.

ABOUT THE ASSESSMENT

Given the importance of agriculture in West Africa, the Economic Community of West African States (ECOWAS) asked the West and Central African Council for Agricultural Research and Development (CORAF/WECARD) to undertake an in-depth assessment of agricultural research capacity in the region focusing on key institutional, human resource, and financial resource issues. The assessment is a critical input into the development of national and regional agricultural policy recommendations, which will in turn feed into a regional agricultural research strategy for West Africa.

To accomplish the assessment, CORAF/WECARD requested the support of the Agricultural Science and Technology Indicators (ASTI) initiative of the International Food Policy Research Institute (IFPRI). ASTI facilitated the assessment in six countries—Benin, Burkina Faso, Ghana, Senegal, Sierra Leone, and Togo—which included a quantitative survey on human and financial resources, R&D infrastructure, and R&D outputs; a series of interviews with selected research and managerial staff; and a staff motivation survey distributed to a selected group of researchers and managerial staff.

ASTI Led by IFPRI

CORAF/WECARD

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ABOUT ASTI, IFPRI, AND CORAF/WECARD

Working through collaborative alliances with numerous national and regional R&D agencies and international institutions, **Agricultural Science and Technology Indicators (ASTI)** is a comprehensive and trusted source of information on agricultural R&D systems across the developing world. ASTI is led by the **International Food Policy Research Institute (IFPRI)**, which—as a CGIAR member—provides evidence-based policy solutions to sustainably end hunger and malnutrition and reduce poverty.

The **West and Central African Council for Agricultural Research and Development (CORAF/WECARD)** is a nonpolitical organization of the national agricultural research systems of 23 countries of West and Central Africa. It aims to increase the efficiency of agricultural research in the region in order to facilitate economic growth, food security, and export competitiveness through productive and sustainable agriculture.

ASTI/IFPRI and CORAF/WECARD gratefully acknowledge INRAB's managerial and research staff for their contributions to the data collection and preparation of this summary note. ASTI also thanks CORAF/WECARD for its financial support of the assessment; the Bill and Melinda Gates Foundation for its generous support of ASTI's work in Africa South of the Sahara; and Mary Jane Banks, Lang Gao, Wilmer Gutierrez, and Léa Vicky Magne Domgho for their contributions to the assessment. This note has been prepared as an ASTI output and has not been peer reviewed; any opinions are those of the authors and do not necessarily reflect the policies or opinions of IFPRI or CORAF/WECARD.

AGRICULTURAL R&D IN BURKINA FASO

An Assessment of the Environment and Agricultural Research Institute

Hamidou Traoré, San Traoré, and Gert-Jan Stads

Summary Note • July 2014

OVERVIEW OF NATIONAL AGRICULTURAL R&D

Fifteen public agencies conduct agricultural research in Burkina Faso. The Environment and Agricultural Research Institute (INERA) is the largest, accounting for about two-thirds of the country's full-time equivalent (FTE) agricultural researchers (144 FTEs in 2011).[1] Aside from its headquarters in Ouagadougou, INERA comprises an environmental and agricultural research and training center located in Kamboinsé, and five regional agricultural and environmental research centers distributed among the country's agroecological zones. INERA's research programs are structured around four themes: animal production, crop production, forestry, and natural resource and farming-systems management. Five other government agencies conduct agricultural R&D in Burkina Faso, the largest of which include the Research Institute for Applied Sciences and Technologies (IRSAT), which focuses on food technology and employed 21 FTEs in 2011, and the National Forest Seed Center (CNSF), which focuses on forestry research and employed 8 FTEs in 2011. The higher education sector plays an increasingly important role in agricultural R&D in Burkina Faso. The University of Ouagadougou (UO), is by far the largest agency in this category, employing 19 FTEs in 2011. Two nonprofit agencies—the Association for the Promotion of Livestock in the Sahel and the Savanna (APESS) and Albert Schweitzer Ecological Center (CEAS)—conduct agricultural R&D, albeit on an ad hoc basis. Private for-profit research in Burkina Faso is limited, although SOFITEX plays an important role in cotton research.

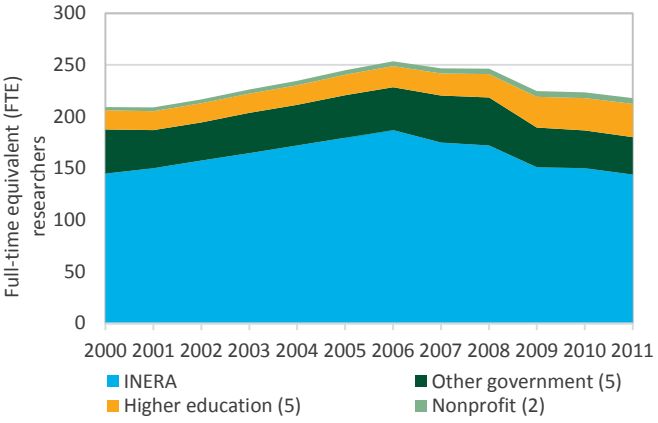
The national number of agricultural researchers grew until 2006, but thereafter steadily declined (Figure 1). In 2011, the country employed 218 FTE researchers, roughly half of whom held PhD degrees. Total agricultural research expenditures fluctuated significantly over the same timeframe, with spending peaks and lows coinciding with the initiation and completion of large donor-funded projects (Figure 2). Underinvestment in agricultural R&D in Burkina Faso remains serious. In 2011, the country invested only 0.42 percent of its agricultural GDP in agricultural R&D, which is well below the recommended 1-percent target set by the the New Partnership for Africa's Development and the United Nations.

INERA'S CURRENT STATUS

Institutional Issues

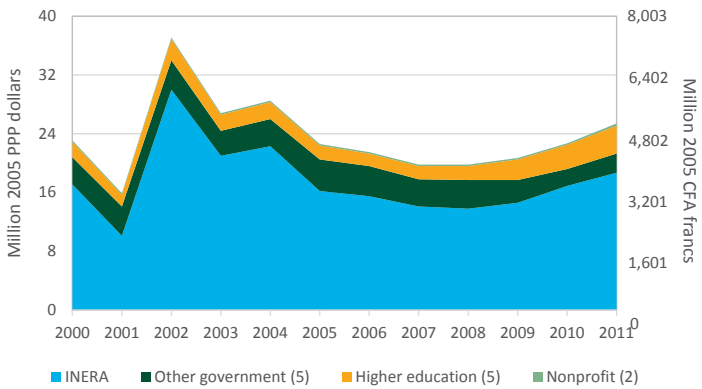
- INERA falls under the National Center for Scientific and Technological Research (CNRST), which in turn is administered by the Ministry of Higher and Tertiary Education and Scientific Research. Linkages between research and extension remain weak, in part because of different ministerial affiliations, but also because of a lack of a clear demarcation between the roles of each sector.

Figure 1. Agricultural researchers by institutional category, 2000–2011



Source: Compiled by authors from ASTI–INERA data.
Note: For full details of the agencies included in the dataset, see www.asti.cgiar.org/burkina-faso.

Figure 2. Agricultural research spending by institutional category, 2000–2011



Source: Compiled by authors from ASTI–INERA data.
Note: For full details of the agencies included in the dataset, see www.asti.cgiar.org/burkina-faso.

- Discrepancies in the salary levels of INERA's researchers and university-based researchers have recently been removed through a 35–40 percent salary increase, combined with a number of other benefits. Nevertheless, salary levels remain well below those of neighboring countries.
- CNRST's administrative procedures are deficient. Many researchers officially listed as being on INERA's payroll by to the administration do not work at the institute, but instead are from other ministerial divisions. This understandably impedes effective human resource management.
- INERA is lacking in efficient administration systems and practices. Data management, for example, is weak, with each center managing its own financial and human resource databases. Donor funding is often disbursed directly to the centers without passing through headquarters, and without the knowledge of the director of finance.

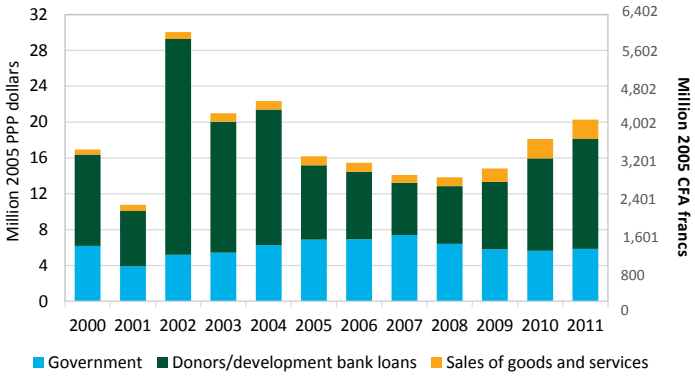
Human Resources

- INERA's research capacity has contracted since 2006. Between 2006 and 2011, INERA lost more than 40 PhD-qualified researchers. Some retired, but most departed for more lucrative positions in the private sector, at international organizations, or in neighboring countries.
- In 2013, close to half of INERA's PhD-qualified researchers were at least 50 years. Given the official retirement age of 60–65 years (depending on the scientist's CAMES rank), many researchers will soon retire, and the remaining pool of researchers will be inadequate—both in terms of numbers and skills mix—to enable the institute to effectively carry out its mandate.
- INERA did not recruit any researchers during 2008–2012. Recognizing that INERA will soon face significant human resource challenges, the government approved a plan to recruit approximately 30 young researchers qualified to the MSc and PhD levels per year between 2013 and 2017. It will be crucial for these young researchers to receive appropriate training and mentoring so they can develop the skills and experience needed to conduct effective research, and that appropriate conditions and incentives are established to encourage their long-term commitment to INERA.
- Some disciplines, including animal health, agricultural machinery, agroeconomics, and others currently lack PhD-qualified researchers. Recent recruitments have addressed the pressing lack of cotton and horticulture breeders.
- INERA has always had a training plan, but lack of funding has prevented the plan from being implemented. Virtually all training is funded by donors. In March 2013, 26 young researchers and technicians from INERA and IRSAT were chosen to receive MSc (18) and PhD (8) training, both locally and in other West African countries as part of the West Africa Agricultural Productivity Program (WAAPP). Many more are expected to take advantage of this opportunity in the coming years.
- Unions have blocked merit-based promotion in favor of promotions based on seniority, whereby all researchers advance one step every two years. Productive researchers who generate funding and whose work gets published advance no faster than scientists who do not. Obviously this is serious impediment to motivation and job satisfaction.

Financial Resources

- INERA's funding has been highly volatile over time (Figure 3).
- Despite the recent influx of funding to support the recruitment of government-based researchers, daily operations and research infrastructure remain severely underfunded and dependent on donor contributions, predominantly through small-scale, mostly ad hoc projects. Since the completion of the World Bank loan–funded PNDSA–II in 2004, no capital investments have been made to maintain or upgrade research laboratories and equipment.
- Under WAAPP, INERA will become the center of specialization for research on mangoes, onions, and tomatoes.[2] Most of the WAAPP funding is allocated to staff training and the rehabilitation of R&D infrastructure. Actual funding for R&D programs remains limited. WAAPP includes of a competitive fund for research on maize, rice, grounduts, shea butter, and cattle. Notably, however—and unlike most West African countries—WAAPP's support of in Burkina Faso takes the form of a grant, not a loan.
- While previous World Bank loan-funded projects (PRA-I and PNDSA) were implemented institute-wide, WAAPP only focuses on a few commodities, leaving others underfunded. Management of WAAPP in Burkina Faso has faced severe capacity constraints that have delayed the project's implementation. This has been further compounded by bureaucratic approval procedures.

Figure 3. INERA's funding sources, 2000–2011



Source: Compiled by authors from ASTI–INERA data.

- Until recently, all funds INERA raised internally were channeled back to the Treasury, creating a disincentive for the institute to focus on the sale of goods and services. The change opens up new opportunities for INERA to increase its revenues.
- To date, INERA has been moderately successful in securing funding from the National Innovation and Research and Development Fund (FONRID), a competitive government fund created in 2011 that disburses 500 million CFA francs per year.

R&D Infrastructure

- INERA has 21 research laboratories, 13 of which are located in Kamboinsé and 8 in Farako-Bâ; 90 percent of the institute's research equipment—most of which is outmoded or derelict—is located in Kamboinsé.
- Families have permanently occupied some of INERA trial fields. INERA needs more legal protection to prevent this from happening.
- Numerous other issues impede INERA's research in terms of infrastructure:
  - frequent power outages (that can, for example, disrupt trials to the point of having to repeat them);
  - lack of training on how to use (and repair) complex equipment;
  - lack of facilities to manage and destroy organic waste;
  - too few vehicles to meet the institute's needs; and
  - insufficient computer servers, unreliable Internet connections, and outdated software.

Research Output

- INERA developed 92 new varieties during 2008–2014, mainly of cotton, maize, sorghum, groundnuts, and rice. The institute adapted a further 78 varieties, mainly of millet, soybeans, and cotton. Compared with most other West African national agricultural research institutes, INERA's release of new varieties is substantial.
- Only two cotton and two sorghum varieties have been protected by the African Intellectual Property Organization (OAPI). Increased regionalization of agricultural research in West Africa through WAAPP raises complex intellectual property rights issues that urgently need to be resolved.
- Data on INERA's publications during 2008–2012 were derived from a catalog that potentially is not exhaustive (Table 1). The available data reveal that researchers tend to publish more in international rather than national journals given the impact the first have on their CAMES ratings. Nonetheless, the average number of publications per researcher per year (0.3 according to the available data) remains very low.

CONCLUSION AND POLICY OPTIONS

- The government made significant financial commitments to agricultural research during 1990–2004 through the World Bank loan-funded PRA I and PNDSA II, which facilitated upgrades to infrastructure and research facilities, and enabled a critical mass of researchers to be trained. Neverthelesss, many of the gains achieved in the past are now being eroded: scientists are nearing retirement age, and laboratories are urgently in need of rehabilitation.
- The government recently approved the recruitment of 30 young MSc- and PhD-qualified scientists per year during 2013–2017. Further training will be needed, however, which will be costly.
- WAAPP will address some of the training and rehabilitation, needs, but much more is needed. Rigid procedures under WAAPP also need to be revised if objectives are to be attained.
- Recent salary increases had a positive impact on staff morale, but more is needed. Salary discrepancies with neighboring countries need to be addressed, and other incentives need to be instituted.
- INERA has been extremely dependent on volatile donor funding over time. The government needs to allocate funding for research programs, not just staff salaries. Donor funding could become more coherent if it were channeled through FONRID, or another centralized entity, and distributed on a competitive basis.
- The Economic Community of West African States (ECOWAS) should address the issue of intellectual property rights under WAAPP given that new varieties can only be registered in one country but will (hopefully) be adopted by farmers across the region.
- M&E systems need to be improved. The development and maintenance of databases on staff, funding, research

Table 1. INERA's scientific publications, 2008–2012

Publications	2008	2009	2010	2011	2012
National publications					
Journal articles	2	1	0	3	0
Books	0	0	0	1	0
Book chapters	1	1	2	3	0
Theses	5	9	8	9	6
Extension journals	3	0	1	1	0
"Fiches techniques"	5	3	3	0	3
Presentations at scientific meetings	3	1	10	1	0
Total	**19**	**15**	**24**	**17**	**9**
International publications					
Journal articles	41	17	53	32	22
Total	**60**	**32**	**77**	**49**	**31**

Source: Compiled by authors from ASTI/IFPRI–CORAF/WECARD survey data.

equipment and agricultural equipment, research data, publications help R&D managers to plan better.

- Linkages between research and extension need to be strengthened. Since the 1990s, the number of extension agents has declined and the National Agricultural Extension and Advisory System (SNVACA) is no longer effective. More manpower and funding for extension is needed, so that INERA's research outputs can be disseminated and adopted widely.

FOR FURTHER READING

www.asti.cgiar.org/pdf/factsheets/burkinafaso-factsheet.pdf

NOTES

1. FTEs only take into account the time researchers actually spend on research, as opposed to other activities like teaching or unrelated administrative duties.
2. Burkina Faso is by no means an expert in these areas, but rice had already been assigned to Senegal, and cotton was assigned to Mali.

ABOUT THE ASSESSMENT

Given the importance of agriculture in West Africa, the Economic Community of West African States (ECOWAS) asked the West and Central African Council for Agricultural Research and Development (CORAF/WECARD) to undertake an in-depth assessment of agricultural research capacity in the region focusing on key institutional, human resource, and financial resource issues. The assessment is a critical input into the development of national and regional agricultural policy recommendations, which will in turn feed into a regional agricultural research strategy for West Africa.

To accomplish the assessment, CORAF/WECARD requested the support of the Agricultural Science and Technology Indicators (ASTI) initiative of the International Food Policy Research Institute (IFPRI). ASTI facilitated the assessment in six countries—Benin, Burkina Faso, Ghana, Senegal, Sierra Leone, and Togo—which included a quantitative survey on human and financial resources, R&D infrastructure, and R&D outputs; a series of interviews with selected research and managerial staff; and a staff motivation survey distributed to a selected group of researchers and managerial staff.

ABOUT THE AUTHORS

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ABOUT ASTI, IFPRI, AND CORAF/WECARD

Working through collaborative alliances with numerous national and regional R&D agencies and international institutions, **Agricultural Science and Technology Indicators (ASTI)** is a comprehensive and trusted source of information on agricultural R&D systems across the developing world. ASTI is led by the **International Food Policy Research Institute (IFPRI)**, which—as a CGIAR member—provides evidence-based policy solutions to sustainably end hunger and malnutrition and reduce poverty.

The **West and Central African Council for Agricultural Research and Development (CORAF/WECARD)** is a nonpolitical organization of the national agricultural research systems of 23 countries of West and Central Africa. It aims to increase the efficiency of agricultural research in the region in order to facilitate economic growth, food security, and export competitiveness through productive and sustainable agriculture.

ASTI/IFPRI and CORAF/WECARD gratefully acknowledge INERA's managerial and research staff for their contributions to the data collection and preparation of this summary note. ASTI also thanks CORAF/WECARD for its financial support of the assessment; the Bill and Melinda Gates Foundation for its generous support of ASTI's work in Africa South of the Sahara; and Mary Jane Banks, Lang Gao, Wilmer Gutierrez, and Léa Vicky Magne Domgho for their contributions to the assessment. This note has been prepared as an ASTI output and has not been peer reviewed; any opinions are those of the authors and do not necessarily reflect the policies or opinions of IFPRI or CORAF/WECARD.

AGRICULTURAL R&D IN GHANA

An Assessment of the Council for Scientific and Industrial Research

George Essegbey, Roland Asare, and Nienke Beintema

Summary Note • July 2014

OVERVIEW OF NATIONAL AGRICULTURAL R&D

Twelve government agencies conduct agricultural research in Ghana, of which 10 fall under the Council for Scientific and Industrial Research (CSIR). CSIR operates largely autonomously under the Ministry of Environment, Science, Technology, and Innovation and collectively employed 62 percent of the country's full-time equivalent (FTE) agricultural researchers in 2011, or 379 FTEs.[1] CSIR institutes conduct agriculture-related research focusing on crops, livestock, forestry, savannah, soil, water, food, oil palm, plant genetic resources, and science and technology policy. The other government institutes involved in agricultural research are the Cocoa Research Institute of Ghana (CRIG) under the Ministry of Finance (51 FTEs in 2011), which conducts research on tree crops of economic importance to Ghana (cocoa, coffee, kola, and cashews), and the Marine Fisheries Research Division (MFRD) of the Ministry of Food and Agriculture (12 FTEs in 2011). Agricultural R&D is also a core activity of numerous agricultural faculties of Ghana's public universities, notably the University of Ghana (66 FTEs), Kwame Nkrumah University of Science and Technology (41 FTEs), University of Cape Coast (27 FTEs), and University for Development Studies (28 FTEs). Nonprofit and for profit private companies, although involved in some collaboration with CSIR and the higher education sector, have minimal involvement in agricultural R&D in Ghana.

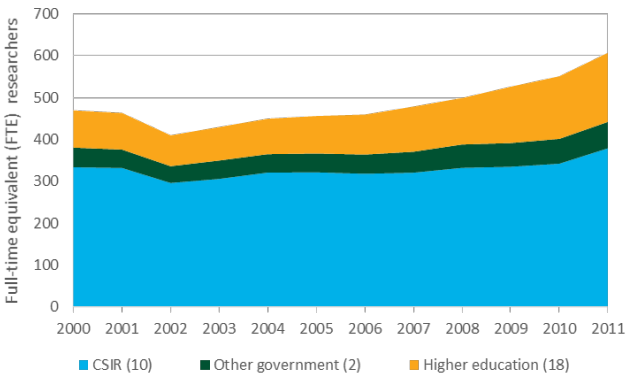
Overall, the national number of agricultural researchers steadily increased from 470 FTEs in 2000 to 607 FTEs in 2011 (Figure 1). Agricultural research spending also increased considerably during this period, from 15.8 million 2005 cedis in 2000 to 25.1 million 2005 cedis in 2011 (Figure 2). The spending trend did, however, follow an erratic pattern, in part due to the country's high dependence on donor funding for agricultural research, combined with declining government support.

CSIR'S CURRENT STATUS

Institutional Issues

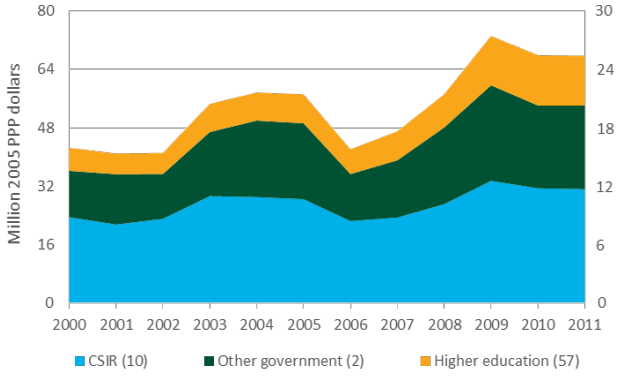
- To date, overarching strategic planning by CSIR has been limited, and the council's most recent plan (for 2005-2009) has long-since been outdated. Institute-level planning strategies also need to be updated.
- Collaboration among CSIR institutes and with other ministries and the higher education sector does occur but could be enhanced and encouraged to improve outputs, increase their dissemination, and potentially support the institutes in developing new funding mechanisms and generating their own income.

Figure 1. Agricultural researchers by institutional category, 2000–2011



Source: Compiled by authors based on ASTI–STEPRI survey data.
Note: Other government comprises CRIG and MFRD; Higher education comprises 18 faculties, departments, and institutes. For full details of the agencies included in the dataset, see www.asti.cgiar/ghana/directory.

Figure 2. Agricultural research spending by institutional category, 2000–2011



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- The Research–Extension–Farmer Linkage Committees (RELCs) were established to encourage demand-oriented research involving farmers with the goal of enhancing farming practices and productivity. In reality, however, the RELCs perform steering rather implementation functions, so the dynamic interface to promote technology transfer has not been realized.

Human Resources

- Overall, the composition of researchers by qualification level at CSIR is well-balanced, in part because the minimum requirement for a researcher is an MSc degree (Table 1). Nevertheless, given the high level of specialization required across the 10 institutes, the number of researchers with PhD degrees is still low—exacerbated by the departure of 63 researchers between 2008 and 2012, two-thirds of whom were qualified to the PhD-degree level. Since new recruits are most often only qualified to the MSc level, and considering that about 60 percent of the remaining PhD-qualified research are 50 years or older, PhD-level training will need to be a priority in the coming years, particularly to fill existing and anticipated gaps.
- To curb the high turnover of researchers, the government instituted the "Single Spine Pay Policy," which came into effect in 2012 and put CSIR researchers' salaries on par with their university-based counterparts. These measures should have a significant impact on the researcher attrition rate, although they have significantly widened the salary gap between researchers and support staff.
- In efforts to further address human resource issues, CSIR has incorporated capacity building into some of its research projects, and recruitment efforts continue despite a general public-sector employment freeze. The availability of paid study leave acts as an incentive for researchers to pursue training opportunities.
- Female researchers only constituted 20 percent of CSIR's agricultural researchers in 2011. The gender disparity stems in part from the minimum (MSc degree) qualification requirement, since fewer women pursue higher degrees in physical and applied sciences.

Financial Resources

- Financing is the most pressing issue for CSIR's institutes. Although total expenditures grew from 12.3 million 2005 cedis in 2000 to 24.7 million 2005 cedis in 2011, salaries represented 79 percent of CSIR's expenditures in 2011, leaving little remaining resources for operating costs or capital investments (Figure 3).
- Although government support to CSIR has remained strong, the institutes are almost fully dependent on donor funding for their research activities. Apart from being an uncertain source of funding, the high dependence of donor funding has the potential side effect of skewing the research agenda away from national priorities.

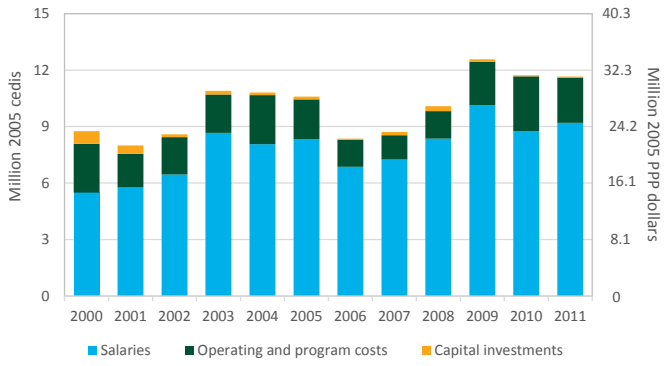
Table 1. CSIR's project funding by source, 2009–2012 (1,000 Ghana cedis)

Donor	2009	2010	2011	2012	Total	Share (%)
Government	326.1	406.1	233.1	235.9	1,391.6	4
AGRA	816.5	640.0	20.0	20.0	1,790.1	6
CORAF/ WECARD	82.8	237.1	483.4	447.4	1,250.7	4
Other regional	293.7	1,255.6	2,165.4	1,841.0	6,046.9	19
Canada	74.0	180.0	555.8	102.9	935.7	3
European Union	50.4	91.0	104.2	2,913.8	3,371.1	11
United Kingdom	10.4	7.1	62.5	1,102.2	1,201.5	4
Other bilateral	199.4	352.5	696.3	498.8	1,938.5	6
World Bank	220.0	367.5	732.0	867.2	2,834.0	9
CGIAR	432.9	321.1	1,172.8	928.5	3,231.7	10
IFDC	318.5	12.0	545.2	24.3	947.5	3
IITO	286.6	223.9	166.0	95.0	1,091.6	3
Other	382.7	1,384.3	1,492.1	1,227.5	5,617.8	18
Total	**3,494.0**	**5,478.2**	**8,428.8**	**10,304.5**	**31,648.7**	**100**

Source: Compiled by authors from ASTI/IFPRI–CORAF/WECARD survey data.
Notes: AGRA = Alliance for a Green Revolution in Africa; CORAF/WECARD = West and Central African Council for Agricultural Research and Development; IFDC = International Fertilizer Development Center; IITO = International Tropical Timber Organization.

- The key policy issue is the government's intention that the institutes generate a significant share of their financial resources through commercial means. This is a sound long-term goal, but it is impeded in the short- to medium-term given the level of funding required, lack of capacity at CSIR to generate funds internally, and patent issues (discussed below).
- Funding for actual research activities during 2009–2012 was derived from international agencies (29 percent), regional organizations (28 percent, and bilateral donors (24 percent). Among these, the European Union and CGIAR

Figure 3. CSIR's expenditures by cost category, 2000–2011



Source: Compiled by authors based on ASTI–STEPRI survey data.
Note: PPP =purchasing power parity (exchange rates).

centers are the main donors. World Bank funding, mostly through WAAPP, accounted for 9 percent of the total during this timeframe. Domestic sources of funding accounted for only 5 percent of total project funding received during 2008–2012. Specific institutes, such as Crop Research Institute (CRI), the Savanna Agricultural Research Institute (SARI), and Forestry Research Institute of Ghana (FORIG), receive significant amounts of donor funding for their research activities.

- WAAPP has become an important donor to CSIR. Most institutes have benefited from WAAPP's competitive grant scheme, especially CRI, SARI, and the Soil Research Institute (SRI).

R&D Infrastructure

- Most CSIR laboratories are considered adequate, but issues have been raised related to the need for maintenance and upgrades. Challenges cited include lack of funding (and tax exemptions) for the purchase of scientific equipment, obsolete equipment, and inadequate staff training on the use of equipment.

Research Outputs

- The number of publications during 2008–2012 totaled 1,204, resulting in an average of 0.7 publications per researcher per year. These include journal articles, books and book chapters, and other scientific and nonscientific publications. Researchers' record of publications is already included as a criterion for promotion. To increase the publication per researcher ratio, other incentives—such as grants and yearly prizes for the best papers/articles—could be instituted.
- CRI, SARI, and the Oil Palm Research Institute (OPRI) produce a diverse range of plant genetic resources for food crops with high value for food security, such as maize. The issue is that the technologies produced do not meet the criteria for being patented. Even the crops were not registered because Ghana is yet to pass regulations governing plant breeders' rights.
- The issue of technology transfer has become crucial to increase and sustain productivity in Ghana, especially in light of the current policy drive toward greater commercialization. Improving linkages between research and extension systems is vital to ensure outcomes.

CONCLUSION AND POLICY RECOMMENDATIONS

Key considerations for policy directions in relation to CSIR's agricultural research institutes include

- developing, regularly maintaining, and effectively implementing strategic plans—both for CSIR as a whole and for the individual institutes—to support CSIR in identifying, shaping, and achieving its goals;
- developing training and succession plans (including skills-gap analyses), involving present and past tenured researchers in providing mentorship for their younger colleagues, and developing incentives—such as opportunities for scientific achievement and career advancement—to create a more conducive work environment;
- continuing to maintain and build researcher capacity so that at least 50 percent of the institutes' researchers are trained to the PhD-degree level in order to be able to initiate and drive research projects across the institutes' diverse range of disciplines and specializations;
- ensuring the government's constructive engagement in enhancing public funding, while supporting the institutes in diversifying their funding sources and developing the means of increasing internally generated funds over time;
- devising clear strategies for improving and sustaining government support;
- improving R&D outputs and dissemination through better coordination and collaboration across research agencies and with the relevant sectors, such as the extension system and the private sector;
- devising better strategies to improve linkages with the agricultural extension system through extension officers, especially now that MOFA's extension system has been decentralized to the districts and municipalities; and
- ensuring effective systems for monitoring, evaluation, and performance assessment to enhance outcomes.

FOR FURTHER READING

www.asti.cgiar.org/pdf/factsheets/ghana-factsheet.pdf (forthcoming)

NOTES

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ABOUT THE AUTHORS

George Essegbey is the director of the Science and Technology Policy Research Institute (STEPRI). **Roland Asare** is a research scientist at STEPRI. **Nienke Beintema** is program head of the Agricultural Science and Technology Indicators (ASTI) initiative of the International Food Policy Research Institute (IFPRI).

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AGRICULTURAL R&D IN SENEGAL

An Assessment of the Senegalese Agricultural Research Institute

Lamine Gaye, Louis Sène, and Gert-Jan Stads

Summary Note • July 2014

OVERVIEW OF NATIONAL AGRICULTURAL R&D

Nine public agencies conduct agricultural R&D in Senegal. The Senegalese Agricultural Research Institute (ISRA) is by far the largest, accounting for two-thirds of Senegal's agricultural researchers in 2011 (76 full-time equivalent [FTE] researchers).[1] The institute focuses on research related to crops, livestock, forestry, fisheries, and socioeconomics, and operates various centers, units, and research laboratories located across the country's agroecological zones. ISRA falls under the Ministry of Agriculture and Rural Equipment, and its funding is administered the Ministry of Economy and Finance. ITA (employing 9 FTEs in 2011) conducts research on the storage, conservation, and processing of agricultural products and is the only other government agency involved in agricultural R&D in Senegal. The higher education sector employed an estimated 27 FTE researchers in 2011, mainly at Cheikh Anta Diop University (UCAD) and Gaston Berger University (UGB). The private sector plays a relatively important role in agricultural R&D in Senegal compared with many other African countries. Companies like the Chemical Commercialization Company (SENCHIM), Suneor, Textile Fiber Development Company (SODEFITEX), and Industrial and Agricultural Products Company (SPIA) are major innovators in the production and processing of groundnuts and cotton, Senegal's principal export crops.

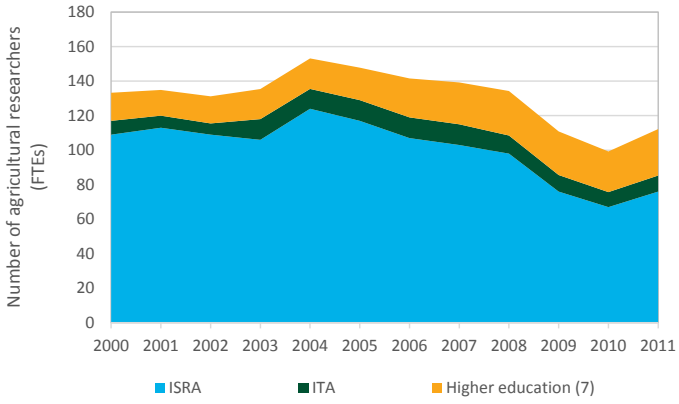
The numbers of researchers employed at ISRA and ITA have steadily declined in recent years due to significant staff attrition combined with public-sector recruitment restrictions; the higher education sector has exibited the opposite trend (Figure 1). National funding for agricultural research increased moderately during 2000–2011, from 5,989.2 to 6,230.8 million CFA francs (in constant 2005 prices). Senegal's research intensity ratio (agricultural R&D investment as a share of agricultural GDP) and ratio of FTE researchers per 100,000 farmers declined from 2000 to reach 0.83 and 2.85, respectively, in 2011.

ISRA'S CURRENT STATUS

Institutional Issues

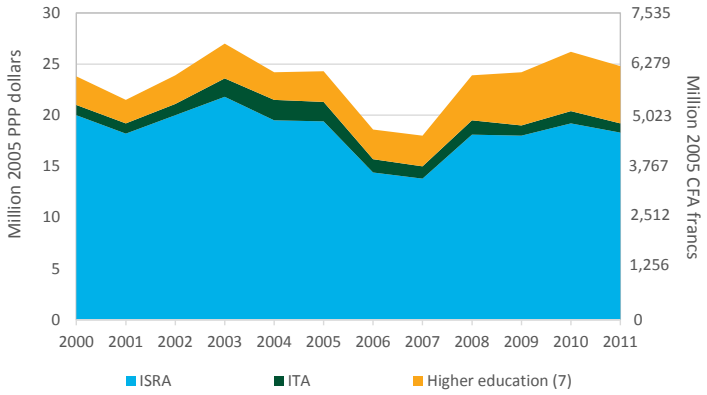
- ISRA is a semiautonomous public institution, which allows it to commercialize its research results as a means of generating revenue. This status even allows the institute to create private subsidiaries (that could fund R&D activities), which is an avenue the institute has yet to explore.
- ISRA develops a strategic plan every five years in collaboration with its financial and technical partners. Numerous coordination mechanisms are in place, and each center is required to report monthly to the Science Directorate.
- ISRA collaborates with other national and international agencies in setting and fulfilling the research agenda, including training university students, working with

Figure 1. Agricultural researchers by institutional category, 2000–2011



Source: Compiled by authors from ASTI–ISRA data.
Note: Higher education comprises UCAD, UGB, and five other, smaller, agencies; for full details, see www.asti.cgiar.org/senegal.

Figure 2. Agricultural research spending by institutional category, 2000–2011



Source: Compiled by authors from ASTI–ISRA data.
Note: Higher education comprises UCAD, UGB, and five other, smaller, agencies; for full details, see www.asti.cgiar.org/senegal.

producer organizations, and collaborating with CGIAR centers.

- Despite its recent move back from the Ministry of Science and Technology to the Ministry of Agriculture, collaboration between ISRA and the agricultural extension system is too weak, with ISRA and extension competing for scarce resources and often failing to see themselves as part of a broader agricultural innovation system.

Human Resources

- Recruitment restrictions, combined with the retirement and departure of many highly qualified researchers have caused significant capacity losses at ISRA over the past decade. ISRA's current pool of researchers, and their skills mix (Table 1) is inadequate for the institute to effectively accomplish its mandate. There is an acute lack of soil, forestry, and veterinary scientists, as well as entomologists.
- As of 2012, 79 percent of ISRA's employees were PhD qualified. This is a significant advantage in the conduct of research, but it has been a factor in the high attrition rate of researchers in search of opportunities elsewhere, notably the country's universities and private sector. Recent changes to create equitable career path opportunities should curb this "braindrain" to greener pastures.
- In 2012 the government more than doubled researchers' salary levels at ISRA and improved their promotional opportunities to halt the high attrition rate, which had a considerable impact on staff morale. In addition, to return capacity to the preferred level (about 130 researchers), it was determined that 10 new researchers would be recruited and trained yearly for five years. The government also increased the official retirement age from 60 to 65 years, which will give senior researchers the opportunity to train and mentor their younger colleagues.

Table 1. ISRA's researchers by degree and discipline, 2012

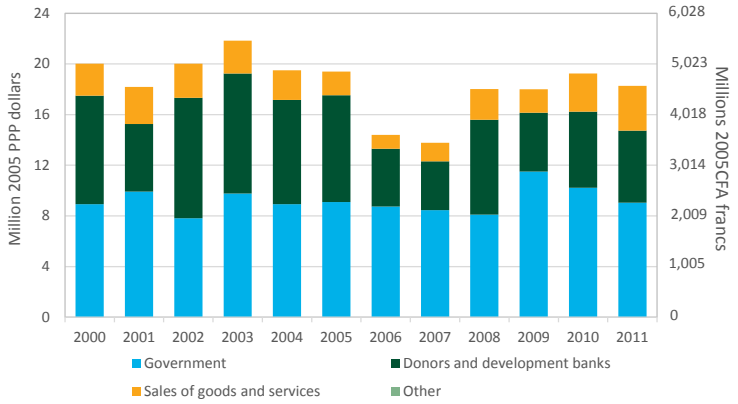
	FTE researchers by degree qualification		
Discipline	**PhD**	**MSc**	**Total**
Agricultural economics	3	1	4
Agronomy	22	4	26
Animal science (incl. veterinary medicine)	9	3	12
Biodiversity preservations	0	0	0
Crop science (incl. horticulture)	0	2	2
Ecology	1	0	1
Entomology	6	0	6
Extension and training	0	0	0
Fisheries and aquaculture	6	0	6
Food and nutrition science	0	0	0
Forestry and agroforestry	3	3	6
Molecular biology (for crops and livestock)	1	0	1
Natural resource management	0	0	0
Soil science	1	0	1
Irrigation science and water management	1	1	2
Other	1	0	1
Total	**54**	**14**	**68**

Source: Compiled by authors from ASTI/IFPRI–CORAF/WECARD survey data.

Financial Resources

- More than half of ISRA's funding during 2009–2011 was derived from the national government, yet contributions were insufficient to cover the cost of ISRA's total salary bill. The institute's operating costs and capital investments, plus any shortfall in the cost of salaries, are entirely financed by donors, development bank loans, and internally generated funding through the sale of seeds, vaccines, and fruit plants or through research conducted on behalf of the private sector.
- ISRA's most important external funding sources include the West Africa Agricultural Productivity Program (WAAPP), CORAF/WECARD, CGIAR centers, and the Canadian International Development Agency (CIDA). Some argue that too much of the critical decisionmaking about research priorities is devolved to donors, with the result that ISRA's research agenda is somewhat skewed toward goals that are not necessarily aligned with national priorities. Rice research, for instance, is underfunded.
- Under WAAPP, Senegal was selected as home to the subregion's center of excellence for dryland cereals, and received a budget of CFA 7.5 billion for the 2008–2012 period. Most of this funding was allocated to short-term and degree-level training for researchers and to the rehabilitation of laboratories and equipment for research on cereals. WAAPP also funds a competitive research scheme, the National Agricultural and Food Research Fund (FNRAA), which accepts multidisciplinary research proposals from stakeholders. Roughly 35 percent of the projects submitted to FNRAA by ISRA were funded during the first phase of WAAPP. UCAD had more success in securing FNRAA funding than ISRA.
- In 2013, the World Bank approved a second phase of WAAPP in Senegal with a total budget of roughly CFA 30

Figure 3. ISRA's funding sources, 2000–2011



Source: Compiled by authors from ASTI–ISRA data.

billion for 2013–2017. The scope of this phase has been widened to also cover the livestock and horticulture sectors, and capacity strengthening will play an even more important role.

R&D Infrastructure

- ISRA has approximately 40 laboratories covering a wide variety of specializations, including entomology, plant pathology, weed science, molecular genetics, molecular biology, and avian pathology; however, many of ISRA's centers are in a dilapidated state.
- The crop protection and biosecurity laboratory was recently renovated, and WAAPP supported the purchase of new equipment for some of the other laboratories, although upgrades based on obsolescence are still needed for many other centers.
- It is urgent for ISRA's laboratories to attain International Organization for Standardization (ISO) certification through upgrades and the acquisition of advanced equipment. For example, a level 3 biosafety certification would enable the National Livestock and Veterinary Research Laboratory to handle dangerous avian virus isolates and undertake efficacy testing for vaccine trials. Various other centers are now attempting to obtain ISO certification for their laboratories with the infrastructure upgrades that WAAPP funding has facilitated.
- ISRA's fleet of vehicles needs to be upgraded, and licenses on critical software required for data analyses need to be renewed. In some cases Internet and electricity access are problematic; access to water and lack of fencing to secure production plots are also a problem at some stations.

Research Outputs

- During 2008–2012, ISRA developed nine new varieties in-house, including four varieties of sorghum, three of millet, and two of cowpeas, resulting in a 40 to 60 percent performance improvement compared with existing varieties grown locally. ISRA also adapted a large number of varieties that were developed by CGIAR centers, including 11 varieties of irrigated rice, 5 of upland rice, 8 of corn, and 6 of sesame and groundnuts.
- None of the generated or adapted varieties released by ISRA have been patented, so little progress has been made in terms of protecting intellectual property.
- In addition to new varieties, ISRA generated around 70 new technologies and successfully disseminated these to farmers.
- The number of publications during 2008 and 2012 totaled 878, resulting in an average of about two publications per researcher per year (Table 2). These results partly reflect the fact that promotional opportunities at ISRA are now tied to performance, which enhances incentives, equity, and a generally more attractive work environment for researchers.

Table 2. ISRA's scientific publications, 2008–2012

Publications	2008	2009	2010	2011	2012	Total
National publications						
Journal articles	4	9	19	1	3	36
Books	0	0	0	1	0	1
Book chapters	6	8	0	0	0	14
Scientific articles/ publications	16	11	19	9	33	88
Papers and posters presented at conferences	11	18	31	25	9	94
Nonscientific publications (such as newspaper/ magazine articles)	38	40	37	0	45	160
Total	**75**	**86**	**106**	**36**	**90**	**393**
International publications						
Journal articles	36	41	43	5	26	151
Books	0	0	0	0	0	0
Book chapters	9	11	21	9	3	53
Scientific articles/ publications	22	31	16	16	20	105
Papers and posters presented at conferences	16	43	76	9	12	156
Nonscientific publications (such as newspaper/ magazine articles)	2	6	3	5	4	20
Total	**85**	**132**	**159**	**30**	**65**	**485**
Publications per researcher per year	*1.6*	*2.1*	*2.6*	*0.8*	*1.5*	

Source: Compiled by authors from ASTI/IFPRI–CORAF/WECARD survey data.

CONCLUSIONS AND POLICY RECOMMENDATIONS

- ISRA has made a lot of progress in recent years: researcher salaries have doubled, and promotional opportunities have improved significantly. These measures have also halted the exodus of researchers to the universities, private sector, and abroad.
- The retirement of scientists remains a challenge, especially because the total number of researchers at ISRA is very low compared with other African countries of similar size, and insufficient to fulfill the institute's mandate.
- ISRA needs to double its number of scientists (to 130). Recent salary increases and promotional opportunities are a step in the right direction, but recruitment processes are still too cumbersome, and need to be simplified. Many researchers who left before the salary increases have shown an interest in returning. New appointments need to be negotiated on a case-by-case basis, which is impractical for large-scale recruitment in the short term. ISRA needs greater autonomy in recruiting staff.
- On the heels of the success of its recent human resource initiatives, ISRA needs to develop a systematic human resource strategy incorporating existing and anticipated skills gaps and training needs (working closely with universities to make sure that researchers receive the

right training), but also to plan for staff attrition through retirement (and unforeseen departure) of researchers. The successful implementation of such a plan would also require both political and financial support. Such a plan would also support ISRA in further improving working conditions, based on the significant advances made in recent years through salary increases, equitable career path opportunities, and training opportunities.

- Donor dependency is too high. The government leaves the funding of ISRA's R&D programs entirely in the hands of donors and development banks. The government needs to clearly identify its long-term R&D priorities and secure stable and sustainable funding for R&D programs. Donor funding also needs to be aligned with national priorities to ensure the consistency and complementarity of resulting research programs.
- Government funding for the operating and capital expenses associated with conducting research programs is still very low. Rehabilitation of research equipment and infrastructure is urgently needed, both in terms of basic needs, such as reliable electricity, Internet, and computer software access, but also in terms of achieving ISO certification where appropriate.
- The government needs to take action and make sure that improved varieties and technologies released are adopted by farmers. This will involve improving the linkages between research and extension.

ABOUT THE ASSESSMENT

Given the importance of agriculture in West Africa, the Economic Community of West African States (ECOWAS) asked the West and Central African Council for Agricultural Research and Development (CORAF/WECARD) to undertake an in-depth assessment of agricultural research capacity in the region focusing on key institutional, human resource, and financial resource issues. The assessment is a critical input into the development of national and regional agricultural policy recommendations, which will in turn feed into a regional agricultural research strategy for West Africa.

To accomplish the assessment, CORAF/WECARD requested the support of the Agricultural Science and Technology Indicators (ASTI) initiative of the International Food Policy Research Institute (IFPRI). ASTI facilitated the assessment in six countries—Benin, Burkina Faso, Ghana, Senegal, Sierra Leone, and Togo—which included a quantitative survey on human and financial resources, R&D infrastructure, and R&D outputs; a series of interviews with selected research and managerial staff; and a staff motivation survey distributed to a selected group of researchers and managerial staff.

FOR FURTHER READING

www.asti.cgiar.org/pdf/factsheets/senegal-factsheet.pdf

NOTES

1. FTEs only take into account the time researchers actually spend on research, as opposed to other activities like teaching or unrelated administrative duties.

ABOUT THE AUTHORS

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ASTI/IFPRI and CORAF/WECARD gratefully acknowledge ISRA's managerial and research staff for their contributions to the data collection and preparation of this summary note. ASTI also thanks CORAF/WECARD for its financial support of the assessment; the Bill and Melinda Gates Foundation for its generous support of ASTI's work in Africa South of the Sahara; and Mary Jane Banks, Lang Gao, Wilmer Gutierrez, and Léa Vicky Magne Domgho for their contributions to the assessment. This note has been prepared as an ASTI output and has not been peer reviewed; any opinions are those of the authors and do not necessarily reflect the policies or opinions of IFPRI or CORAF/WECARD.

AGRICULTURAL R&D IN SIERRA LEONE

An Assessment of the Sierra Leone Agricultural Research Institute

John Momoh and Nienke Beintema

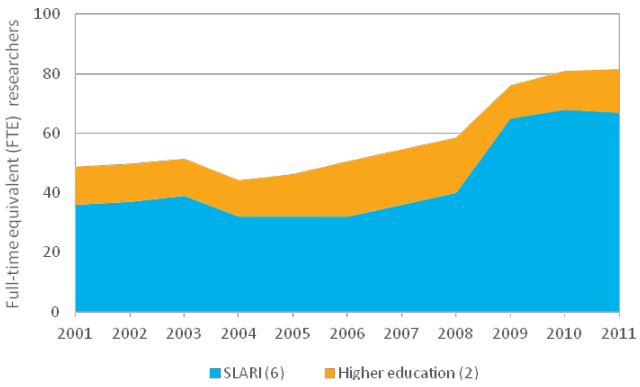
Summary Note • July 2014

OVERVIEW OF NATIONAL AGRICULTURAL R&D

Three agencies conduct agricultural research in Sierra Leone: the Sierra Leone Agricultural Research Institute (SLARI), Njala University School of Agriculture, and Fourah Bay College Institute of Marine Biology and Oceanography (IMBO). SLARI is the country's principal agricultural research agency, accounting for more than 80 percent of national agricultural researchers and expenditures in 2011. The institute falls under the Ministry of Agriculture, Forestry, and Food Security (MAFFS) and, in addition to its headquarters, comprises five centers: Njala Agricultural Research Center (NARC), which conducts research on roots, tubers, and legumes; Rokupr Agricultural Research Center (RARC), which conducts research on cereals; Kenema Forestry and Tree Crops Research Center (KFTCRC); Teko Livestock Research Center (TLRC); and Magbosi Land and Water Research Center (MLWRC).

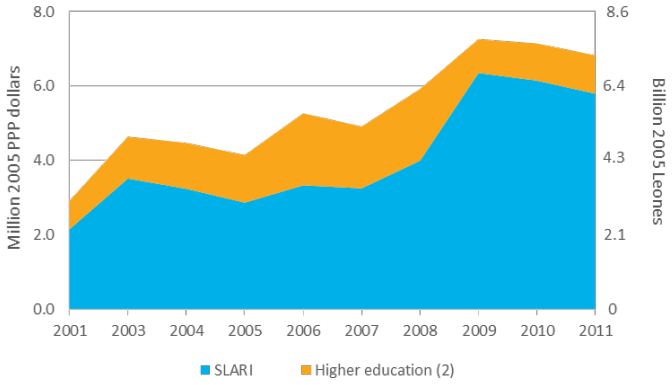
Between 2001 and 2011, the national number of full-time-equivalent (FTE) researchers grew from 37 to 70 at SLARI and from a combined 13 to 15 at the two higher education institutions (Figure 1).[1] Agricultural research spending increased dramatically between 2001 and 2011, based on a significant influx of donor funding and government grants (Figure 2). Spending rose from 3.1 billion Leones in 2005 prices in 2001 (while the war was still ongoing), to 7.3 billion Leones in 2011. Sierra Leone is still grappling with the effects of the country's 10-year civil war, so it not surprising that its research intensity ratios are extremely low, especially compared with other countries in the region. Total spending as a share of agricultural GDP has fallen over time, from 0.22 in 2001 to 0.17 in 2011; the ratio of agricultural researchers to farmers grew somewhat over this timeframe, from 4.6 to 6.1 FTEs per 100,000 farmers.

Figure 1. Agricultural researchers by institutional category, 2001–2011



Source: Compiled by authors based on ASTI–SLARI survey data.
Note: For full details of the agencies included in the dataset, see www.asti.cgiar.org/sierraleone.

Figure 2. Agricultural research spending by institutional category, 2001–2011



Source: Compiled by authors based on ASTI–SLARI survey data.
Note: For full details of the agencies included in the dataset, see www.asti.cgiar.org/sierraleone.

SLARI'S CURRENT STATUS

Institutional Issues

- SLARI has developed a strategic plan (for the 2012–2021period), as well as operating and investment plans involving key stakeholders within and outside SLARI to ensure alignment with national and regional goals. The top priority of the first operating plan (2012–2016) is to develop the necessary human resources, infrastructure, and equipment to support the effective conduct of research at all levels. Value chain analysis (and prioritization given the limited resources available), infrastructure development analysis, and promotional strategies will also be undertaken as a means of allocating research resources to achieve the strongest economic and development outcomes.
- While MAFFS does not influence SLARI in setting research priorities, it does disseminate and promote the adoption of SLARI's technologies to farmers through 12 innovation

- platforms; it also assists in implementing the West Africa Agricultural Productivity Program (WAAPP), as well as more generally disseminating information.

Human Resources

- Staff attrition is low at SLARI, aided by a 75-percent salary increase for senior staff as of January 2013, and a 38-percent increase as of January 2014. Training opportunities and overseas travel create additional incentives for researchers to remain at SLARI. Promotions are infrequent, however, based on limited financial resources. Furthermore, funds for research activities also remain very limited, which negatively impacts staff motivation.
- The number of newly recruited scientists grew from 22 in 2009 to 40 in 2012. SLARI's human resource plan recommended a focus on MSc-qualified recruits, but only 26 percent of recent recruits held MSc degrees, and 6 percent PhD degrees. Candidates with MSc degrees are lacking, so the default practice has been to recruit good BSc graduates with a minimum of second-class honors. Most of these recruits have been sent to complete MSc training, primarily through WAAPP: in 2013, 38 researchers were offered scholarships to pursue MSc and PhD degree training.
- Of the newly recruited researchers during 2009–2013, only 20 percent were female, but absolute numbers were higher in recent years (eight in 2012 and six in 2013), which is encouraging.
- The retirement age at SLARI is 65 years for researchers, and retired researchers may continue to work on a contract basis, renewable once a year. This is a beneficial strategy for supervising and mentoring younger researchers.

Financial Resources

- As an indication of its high priority for agriculture, Sierra Leone has allocated 10 percent of the national budget to agriculture, although not all the funds are approved or disbursed. Compounding the problem of poverty is corruption, distorting government priorities and promoting wasteful spending, which has contributed to the country's current economic recession and discrepancies in budgeted and disbursed government funding to SLARI.
- From 2009 to 2011, the government was SLARI's primary funding source both for salaries (and related expenses), and operating costs. During this period, salaries accounted for about two-thirds of SLARI's total expenditures, and operating and capital expenses accounted for the remainder. From 2009 to 2012, total government funding disbursed increased, indicating Sierra Leone's commitment to sustainable food security, but growth was lower than the inflation rate, so in real terms represented a decline.
- SLARI receives funding support from numerous donors, the largest during 2009–2012 being the African Development Bank (Table1).
- WAAPP provides financial support for training; rehabilitation and building of infrastructure; and the generation, dissemination, and adoption of modern varieties of rice and cassava.
- Implementing SLARI's first operating plan (2012–2017) will require a total of US$274.1 million for SLARI's headquarters and seven research centers. Expected funding levels from government contributions, development partners, and the private sector over this period were estimated at only US$ 105.6 million, resulting in a shortfall of more than 60 percent, or US$168.4 million.

R&D Infrastructure

- SLARI's R&D infrastructure is poor. Laboratories at RARC and NARC are poorly equipped, and researchers lack training on the use of some equipment (although this is being address through training under WAAPP). The other research centers have no equipment at all and hence are not fully operational (Table 2).

Table 1. SLARI's project funding by source, 2009–2012 (million Leones)

Donor	2009	2010	2011	2012	Total	Share (%)
Government	143.4	18.0	46.0	0	207.4	2
World Bank	77.8	190.0	268.5	0	536.4	6
AfricaRice	510.6	115.3	105.0	148.5	879.4	10
Other CGIAR	117.1	1.0	0.0	187.2	305.3	3
IAEA	36.7	41.5	0.0	78.5	156.7	2
IFAD	71.0	284.9	52.4	0	408.3	4
CORAF/ WECARD	0	0.0	118.9	126.8	245.7	3
FAO	0	309.3	186.6	73.3	569.2	6
FARA	87.2	76.6	46.1	129.3	339.1	4
IRC	0	16.7	153.2	291.4	461.3	5
CFC	244.9	263.2	151.9	0	660.0	7
AfDB	299.7	477.5	608.7	1,252.0	2,637.9	29
AGRA	0	0	525.2	94.7	619.9	7
Other	496.3	85.3	246.6	294.3	1,122.6	12
Total	**2,084.7**	**1,879.2**	**2,509.1**	**2,675.9**	**9,149.0**	**100**

Source: Compiled by authors from ASTI/IFPRI–CORAF/WECARD survey data.
Notes AfDB = African Development Bank; AGRA = Alliance for a Green Revolution in Africa; CORAF/WECARD = West and Central African Council for Agricultural Research and Development; CFC = Common Fund for Commodities; IAEA = International Atomic Energy Agency; IFAD = International Fund for Agricultural Development; FAO = Food and Agricultural Organization of the United Nations; FARA = Forum for Agricultural Research in Africa; IRC = International Rescue Committee.

Table 2. The condition of SLARI's research laboratories

Research center/station	Laboratory	Satellite stations
Njala Agricultural Research Center (3)	• Tissue culture • Molecular biology • Food and nutrition technology	8
Rokupr Agricultural Research Center (4)	• Tissue culture • Molecular biology • Soils • Biotechnology	7
Kenema Forestry and Tree Crops Research Center (2)	Two laboratories are newly built labs but yet to be equipped	3
Teko Livestock Research Center (2)	Two laboratories are newly built but have yet be equipped	1
Magbosi Land and Water Research Center (0)	No laboratories have been built or rehabilitated as of 2014	None

Source: Compiled by authors from ASTI/IFPRI–CORAF/WECARD survey data.

- Internet and water facilities are available at NARC, but not at the other research centers. Adequate vehicles are not available at the centers, and one center has only two roadworthy vehicles. Not all researchers have computers, and there are only two computer specialists (based at headquarters) to meet the needs of the entire institute. Important research areas are ignored due to lack of equipment and adequate training to operate the equipment; these include biotechnology, tissue culture, molecular biology, and irrigation systems.

Research Outputs

- During 2004–2012 NARC developed two varieties of cassava, two of sweetpotatoes, one of groundnuts, and one of cowpeas. RARC's new varieties were developed both in-house and externally, including two varieties of rice developed in-house, and seven developed externally. All varieties were interspecific rice hybrids released in 2012, but none have been patented.
- SLARI has not yet established an entity to oversee the release of new varieties; the seed board is currently in its formative stage.
- On average, SLARI publishes 0.25 publication per researcher per year for the period 2009–2013.

CONCLUSION AND RECOMMENDATIONS

Ten years of civil war virtually destroyed Sierra Leone's agricultural research capacity. Although the war ended in 2002, it has taken a long time to re-establish a national system, rehabilitate research infrastructure, and rebuild human resource capacity. Despite these challenges, SLARI has made marked progress in developing human and financial resources, and WAAPP and other donor agencies have significantly contributed. Several challenges remain, however, that pose serious barriers to agricultural R&D in Sierra Leone:

- low rates of adoption of research technologies;
- lack of appropriate policies, standards for food products, and marketing opportunities, and limited stakeholder involvement in the rice and cassava value chains—SLARI's mandated crops;
- limited infrastructure, inadequate human resource capacity, limited access to current and relevant scientific literature, inadequate support services, and logistical issues;
- inadequate development and validation of new technologies, and release and information sharing to value chain participants, including farmers, processors, marketers, service providers, researchers, policymakers, and consumers.

Additional research is needed regarding policy constraints that have inhibited the growth of agricultural research in Sierra Leone, and on opportunities that may form the basis for advocacy for policy reform. Potential measures needed to address remaining agricultural R&D challenges include

- developing appropriate policies to promote the production, processing, and consumption of agricultural products and food diversification;
- adopting participatory approaches to technology adoption, and developing appropriate communication systems for agricultural information;
- analyzing the influence of constraints, such as the lack of protocols for the release of new varieties and seed regulation, in order to gather sufficient data to address current restrictions;
- increasing government funding, ensuring the full disbursement of approved budgets, and improving the alignment of donor funding; and
- increasing training in the use and development of improved databases and monitoring and evaluation systems.

FOR FURTHER READING

www.asti.cgiar.org/pdf/factsheets/sierraleone-factsheet (forthcoming)

NOTES

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ABOUT THE ASSESSMENT

Given the importance of agriculture in West Africa, the Economic Community of West African States (ECOWAS) asked the West and Central African Council for Agricultural Research and Development (CORAF/WECARD) to undertake an in-depth assessment of agricultural research capacity in the region focusing on key institutional, human resource, and financial resource issues. The assessment is a critical input into the development of national and regional agricultural policy recommendations, which will in turn feed into a regional agricultural research strategy for West Africa.

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ABOUT THE AUTHORS

John Momoh is the monitoring and evaluation officer at the Sierra Leone Agricultural Research Institute (SLARI). **Nienke Beintema** is the program head of the Agricultural Science and Technology Indicators (ASTI) initiative of the International Food Policy Research Institute (IFPRI).

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AGRICULTURAL R&D IN TOGO

An Assessment of the Togolese Agricultural Research Institute

Kokou Edoh Adabe and Gert-Jan Stads

Summary Note • July 2014

OVERVIEW OF NATIONAL AGRICULTURAL R&D

Six public agencies conduct agricultural research in Togo. The Togolese Agricultural Research Institute (ITRA) is the largest by far, accounting for more than 70 percent of Togo's full-time equivalent (FTE) agricultural researchers in 2011.[1] ITRA conducts research on crops, livestock, fisheries, natural resource management, and food technology. In addition to its headquarters and stations in Lomé, the institute operates research centers in each of the country's four agroecological zones: the coast, forest, humid savannah, and dry savannah. In addition to ITRA, the Plant Protection Directorate (DPV) and Agricultural Statistics, Information, and Documentation Directorate (DSID) are the only other government entities that conduct agricultural R&D, albeit at very limited levels. The three higher education agencies that conduct agricultural R&D—the Advanced School of Agronomics (ESA), Faculty of Science, and Advanced School of Biological and Food Technology (ESTBA)—all fall under the University of Lomé (UL) and together employed 32 FTE agricultural researchers in 2011. ESA is the largest of the three (22 FTEs in 2011) and conducts research on plant virology, biotechnology, soil fertility management, farm mechanization, postharvest. conservation, and socioeconomics. No nongovernmental organizations or private-sector companies were identified as conducting in-house R&D; some, however, do outsource their research to ITRA and UL.

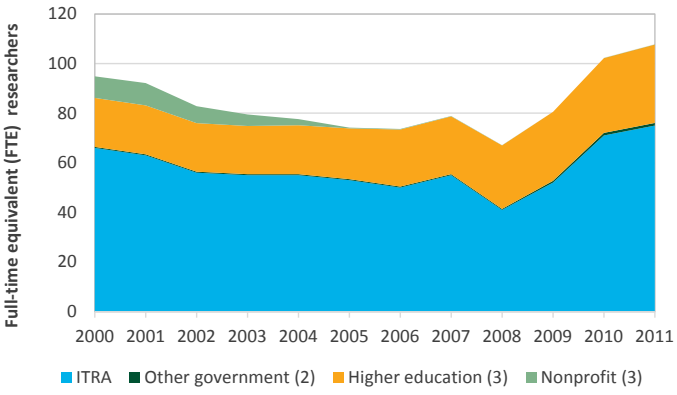
After a period of steady decline, the national number of agricultural researchers in Togo increased rapidly in response to a general public-sector recruitment competition in 2009, which prompted the influx of a large number of researchers (Figure 1). Total agricultural R&D spending in Togo fell by nearly half during 2000–2011 (Figure 2). The country's 2011 intensity ratio (at 0.42 percent) was well below the 1-percent minimum investment target recommended by the New Partnership for Africa's Development and the United Nations.

ITRA'S CURRENT STATUS

Institutional Issues

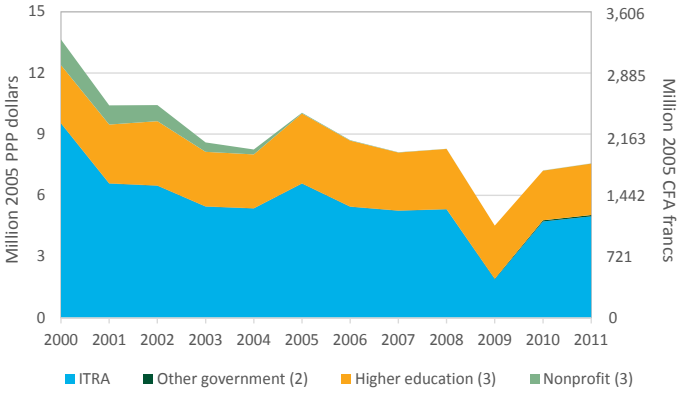
- Unlike their university-based counterparts, ITRA's researchers are not given official status but are instead categorized as public servants. This means that their salaries are significantly lower, which makes it extremely difficult for ITRA to attract and retain well-qualified researchers.

Figure 1. Agricultural researchers by institutional category, 2000–2011



Source: Compiled by authors from ASTI–ITRA data.
Notes: Other government comprises DPV and DSID; Higher education comprises ESA, ESTBA, and the Faculty of Science, all under the University of Lomé; Nonprofit comprises APAF, GLOBE, and UCJG. For full details of the agencies included in the dataset, see www.asti.cgiar.org/togo.

Figure 2. Agricultural research spending by institutional category, 2000–2011



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- The Ministry of Agriculture can second experienced researchers to other ministerial departments at will. ITRA loses one or two highly qualified researchers this way each year.
- Linkages with the Institute of Consulting and Technical Support (ICAT), the country's main agricultural extension agency, are weak, and effective communication mechanisms between farmers and researchers are lacking.
- Private-sector linkages are also weak; new technologies are not adopted (or commercialized) by the private sector.

Human Resources

- Just 6 of ITRA's 78 researchers (8 percent) hold PhD degrees, and 4 of these PhD-qualified researchers are approaching retirement age.
- Training opportunities have been limited, but the recent launch of the West Africa Agricultural Productivity Program (WAAPP) is set to change that. In 2012, 30 researchers were proposed to receive grants for MSc- and PhD-level training under WAAPP, taking into account existing skill gaps, and where researchers should be trained (some in Togo, and others in other West African countries). Some of the training has already begun.
- ITRA lacks a critical mass of well-qualified researchers in a number of key research areas. There are no maize, rice, or sorghum breeders, and the last researcher in the soil fertility program retired in 2013. The programs on legumes, livestock and animal biotechnology, water management, and forest seeds only have two researchers each. The animal health research program employs only one researcher (Table 1).
- Women constitute the majority of farmers but represent only 9 percent of ITRA's researchers. Of the 34 researchers recruited during 2008–2012, only 2 were female.

Table 1. ITRA's researchers by degree and discipline, 2012

	FTE researchers by degree qualification			
Discipline	**PhD**	**MSc**	**BSc**	**Total**
Crop protection and plant biotechnology	3	6	2	11
Livestock and aquaculture	0	9	0	9
Cereals (maize, rice, sorghum, and millet) and horticulture	0	8	0	8
Socioeconomics and technology transfer	1	7	0	8
Nutrition and food technology/ quality	0	7	0	7
Coffee, cocoa, cola, and fruits	1	5	0	6
Cotton	1	4	0	5
Soils and fertility	0	5	0	5
Roots and tubers (cassava, yams)	0	4	0	4
Plant genetic resources	0	3	0	3
Sheep and goats	0	3	0	3
Cattle and animal biotechnology	0	2	0	2
Water and forestry management	0	2	0	2
Legumes (cowpeas, groundnuts, soybeans, and beans)	0	2	0	2
Seeds and plants	0	1	1	2
Animal health	0	1	0	1
Share (%)	*8*	*88*	*4*	*100*
TOTAL FTEs	**6**	**69**	**3**	**78**

Source: Compiled by authors from ASTI/IFPRI–CORAF/WECARD survey data.

Financial Resources

- Government funding to ITRA is insufficient, and barely enough to cover the institute's salary bill. As a result, ITRA is highly dependent on funding from donors and development banks.
- CORAF/WECARD and AfricaRice accounted for 70 percent of ITRA's external funding during 2009–2012, although considerable yearly fluctuations in contributions from both these sources have caused some financial uncertainty.
- Similarly, private funding for cotton research from the Nouvelle Société Cotonnière du Togo (NSCT) fluctuates widely from year to year.
- WAAPP will be the main source of external funding in the coming years; however, only very limited funding for actual research is earmarked under this World Bank loan–funded program. Most of the funds target the (much-needed) rehabilitation of R&D infrastructure and staff training.

R&D Infrastructure

- ITRA's entomology, phytopathology, and virology laboratories, as well as its animal research unit, are not operational due to dilapidated equipment and infrastructure. The remaining laboratories (with the exception of the biosecurity laboratory in Lomé) also have extremely outdated equipment (Table 2).

Table 2. The condition of ITRA's research laboratories

Research station	Laboratory/ location	Condition
Direction Scientifique (1)	• Crop protection and biosecurity, Lomé	• Recently renovated and equipped with state-of-the-art technology
Direction des laboratoires (3)	• Food quality control, Lomé	• Operational with fairly adequate equipment
	• Food technology, Lomé	• Operational with inadequate equipment
	• Soil, Lomé	• Operational, but most of the equipment is derelict
Forestry zone agricultural research center (1)	• Plant pathology and virology, Kpalimé	• Nonfunctional due to derelict facilities
Humid savanna zone agricultural research center (2)	• Entomology, Kolokope	• Nonfunctional due to derelict facilities
	• Animal health, Sotouboua	• Nonfunctional due to derelict facilities

Source: Compiled by authors from ASTI/IFPRI–CORAF/WECARD survey data.

- The biosecurity laboratory has recently been renovated and equipped with state-of-the-art technology with grant funding provided by the West African Economic and Monetary Union (UEMOA). Unfortunately, researchers and technicians received no training on how to operate the new equipment, so much of it remains idle.
- ITRA's livestock and poultry stations will be upgraded under WAAPP, although rehabilitation has yet to begin.
- ITRA also lacks office space: at the Dryland Savanna Agricultural Research Center (CRASS) and the Coastal Agricultural Research Center (CRAL), up to four researchers can be required to share a single office.
- Power cuts are frequent, and Internet access outside Lomé is unreliable.

Research Outputs

- The number of new varieties released by ITRA in recent years is extremely low compared with other countries in West Africa. ITRA released one new cotton variety (STAM129) in 2002 and adapted two new AfricaRice rice varieties (ARICA1 and ARICA2) in 2012.

Table 3. ITRA's scientific publications, 2008–2012

Publications	2008	2009	2010	2011	2012	Yearly average
National publications						
Journal articles	4	4	2	1	1	2.4
Books	0	0	1	0	0	0.2
Book chapters	0	0	0	0	0	0.0
Scientific articles/ publications	0	0	0	1	3	0.8
Papers and posters presented at conferences	2	0	1	0	0	0.6
Nonscientific publications (such as newspaper/ magazine articles)	1	0	0	0	1	0.4
Other (theses)	0	0	0	5	0	1.0
Total	**7**	**4**	**4**	**7**	**5**	**5.4**
Average per researcher per year						*0.07*
International publications						
Journal articles	0	0	0	0	0	0.0
Books	0	0	0	0	0	0.0
Book chapters	0	0	0	0	0	0.0
Scientific articles/ publications	1	2	2	6	1	2.4
Papers and posters presented at conferences	0	0	0	0	1	0.2
Nonscientific publications (such as newspaper/ magazine articles)	0	0	0	0	0	0.0
Total	**1**	**2**	**2**	**6**	**2**	**2.6**
Average per researcher per year						*0.03*

Source: Compiled by authors from ASTI/IFPRI–CORAF/WECARD survey data.

- ITRA did release a number of new technologies in recent years, none of which were patented.
- ITRA's number of scientific publications is extremely low compared with other countries. ITRA's researchers are insufficiently encouraged to publish in national or international journals (Table 3).

CONCLUSIONS AND POLICY RECOMMENDATIONS

In order to more effectively accomplish its mission, ITRA was restructured in 2008 to become a semiautonomous public institution, giving it greater institutional freedom and autonomy in setting its research agenda, but not in terms of financial or human resource management. As previously mentioned, ITRA has a number of challenges in terms of its financial resources, human resources, and infrastructure. Government funding only covers staff salaries, so additional funding to operate research programs and maintain facilities needs to be raised through external sources. The fact that ITRA's researchers lack official status and hence are paid significantly less than their university-based counterparts means that ITRA will continue to struggle to recruit, retain, and motivate well-qualified and experienced researchers. Similarly, the overall rundown state of the institute's research infrastructure makes it extremely challenging for researchers to work effectively. In addition to the general lack of PhD-qualified researchers, the degree of secondment of highly qualified personnel to other departments further exacerbates the lack of expertise within the institute.

WAAPP is being implemented with a view to addressing these problems to some degree, with a focus on relevant infrastructure and training, but not so much on actual research programs themselves. As a means of ensuring the institute fully benefits from the training initiatives under WAAPP, upon completing their training, researchers who are awarded scholarships will be required to return to employment at the institute for a minimum of 10 years.

The government is advised to guide ITRA in instituting strategies to attract, retain, and motivate researchers focusing on

- increasing government funding levels to enable ITRA to operate more competitively, both in terms of researcher salaries and benefits, and facilities and equipment (other than those slated to be upgraded under WAAPP);
- developing new strategies and mechanisms for raising funding from a variety of sources, including the private sector;
- overcoming the current public servant status of ITRA's researchers to enable salary levels to be raised to competitive rates;
- exploring other incentive measures to attract and retain researchers, including better employment benefits, improved working conditions, greater promotional opportunities, and so on.

- maintaining and continuing to build research capacity, capitalizing on advances that will be made under WAAPP
- training junior researchers to the MSc- and PhD-degree levels;
- strengthening the capacity of senior researchers to conceive, structure, and run research programs; lead and mentor staff; generate additional sources of funding; and so on; and
- increasing the amount of funding available for research grants.

FOR FURTHER READING

www.asti.cgiar.org/pdf/factsheets/togo-factsheet.pdf

NOTES

1. FTEs only take into account the time researchers actually spend on research, as opposed to other activities like teaching or time spent on secondment to other agencies.

ABOUT THE ASSESSMENT

Given the importance of agriculture in West Africa, the Economic Community of West African States (ECOWAS) asked the West and Central African Council for Agricultural Research and Development (CORAF/WECARD) to undertake an in-depth assessment of agricultural research capacity in the region focusing on key institutional, human resource, and financial resource issues. The assessment is a critical input into the development of national and regional agricultural policy recommendations, which will in turn feed into a regional agricultural research strategy for West Africa.

To accomplish the assessment, CORAF/WECARD requested the support of the Agricultural Science and Technology Indicators (ASTI) initiative of the International Food Policy Research Institute (IFPRI). ASTI facilitated the assessment in six countries—Benin, Burkina Faso, Ghana, Senegal, Sierra Leone, and Togo—which included a quantitative survey on human and financial resources, R&D infrastructure, and R&D outputs; a series of interviews with selected research and managerial staff; and a staff motivation survey distributed to a selected group of researchers and managerial staff.

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ABOUT ASTI, IFPRI, AND CORAF/WECARD

Working through collaborative alliances with numerous national and regional R&D agencies and international institutions, **Agricultural Science and Technology Indicators (ASTI)** is a comprehensive and trusted source of information on agricultural R&D systems across the developing world. ASTI is led by the **International Food Policy Research Institute (IFPRI)**, which—as a CGIAR member—provides evidence-based policy solutions to sustainably end hunger and malnutrition and reduce poverty.

The **West and Central African Council for Agricultural Research and Development (CORAF/WECARD)** is a nonpolitical organization of the national agricultural research systems of 23 countries of West and Central Africa. It aims to increase the efficiency of agricultural research in the region in order to facilitate economic growth, food security, and export competitiveness through productive and sustainable agriculture.

ASTI/IFPRI and CORAF/WECARD gratefully acknowledge ITRA's managerial and research staff for their contributions to the data collection and preparation of this summary note. ASTI also thanks CORAF/WECARD for its financial support of the assessment; the Bill and Melinda Gates Foundation for its generous support of ASTI's work in Africa South of the Sahara; and Mary Jane Banks, Lang Gao, Wilmer Gutierrez, and Léa Vicky Magne Domgho for their contributions to the assessment. This note has been prepared as an ASTI output and has not been peer reviewed; any opinions are those of the authors and do not necessarily reflect the policies or opinions of IFPRI or CORAF/WECARD.