

SENEGAL

RECENT DEVELOPMENTS IN PUBLIC AGRICULTURAL RESEARCH

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LONG-TERM INVESTMENT AND CAPACITY TRENDS IN PUBLIC AGRICULTURAL R&D

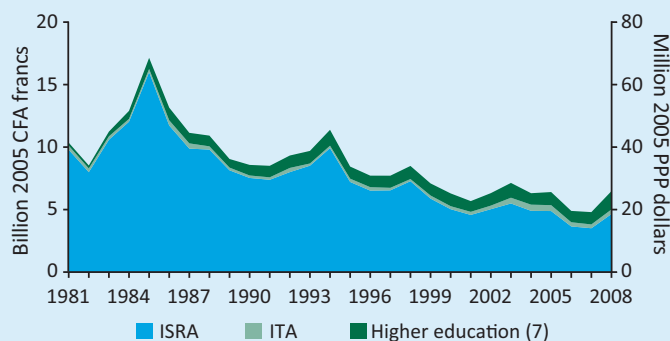
Public agricultural research and development (R&D) in Senegal has been negatively affected by contractions in funding and capacity since the mid-1980s.¹ In 2008, the country employed 141 full-time equivalent (FTE) agricultural researchers and spent 6.5 billion CFA francs or 25.9 million PPP dollars on agricultural R&D (both in constant 2005 prices), which is well below the levels recorded in the 1980s and 1990s (Figure 1 and 2; Table 1). Unless otherwise stated, expenditures in this brief are expressed in purchasing power parity (PPP) prices. PPPs are synthetic exchange rates used to reflect the purchasing power of currencies; they typically compare prices among a broader range of goods and services than do conventional exchange rates.

The Senegalese Agricultural Research Institute (ISRA) accounted for roughly 70 percent of total agricultural R&D staff and spending in 2008, making it largely responsible for the fall in national agricultural R&D capacity and expenditures. A steady decline in donor funding, and growing inability to secure funding through the National Agricultural and Agro-Processing Research Fund (FNRAA), contributed to these declines. Even though investments increased somewhat in 2008, in real terms ISRA's spending levels were about a third of those recorded in the mid-1980s when the institute benefitted from large-scale capital inflows through a World Bank loan. Total research staff

Key Trends Since 2000

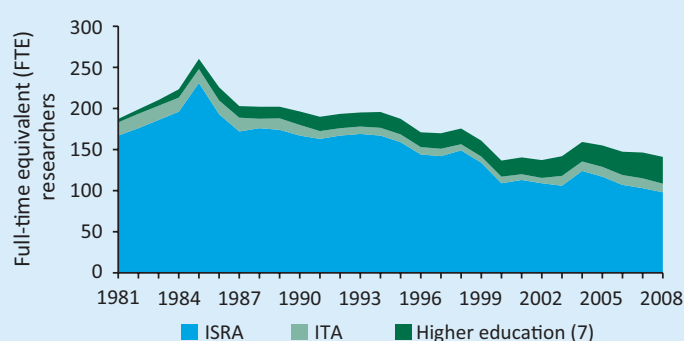
- Overall, public agricultural research and development (R&D) expenditures in Senegal have fallen gradually due to reduced donor support and cuts in government funding.
- Despite large investments in research capacity in recent years, both the Senegalese Agricultural Research Institute and the Food Technology Institute have reported significant attrition in their PhD-qualified research staff since 2004; the aging pool of well-qualified researchers, many of whom will retire in the next decade, is a major area of concern.
- The higher education sector is playing an increasingly important role in agricultural R&D in Senegal.
- The National Agricultural and Agro-Processing Research Fund has transformed the funding of agricultural R&D in Senegal in that all public and private agricultural R&D agencies now compete equally, and this has promoted demand-driven research and the rationalization of operations.

Figure 1—Public agricultural R&D spending adjusted for inflation, 1981–2008



Sources: Calculated by authors from IFPRI-ISRA 2008/09 and Stads and Sène 2004.
Notes: Figures in parentheses indicate the number of agencies in each category. For more information on coverage and estimation procedures, see the Senegal country page on ASTI's website at asti.cgiar.org/senegal.

Figure 2—Public agricultural research staff in full-time equivalents, 1981–2008



Sources: Calculated by authors from IFPRI-ISRA 2008/09 and Stads and Sène 2004.
Notes: Figures in parentheses indicate the number of agencies in each category. Research staff include six French expatriates employed at ISRA.

Table 1—Overview of 2008 levels of public agricultural R&D spending and research staff

Type of agency	Agricultural R&D spending			Total research staff	
	CFA francs	PPP dollars	Shares	Number	Share
	(million 2005 prices)		(%)	(FTEs)	(%)
ISRA	4,642.0	18.4	71	98.0	69
ITA	369.5	1.5	6	10.5	7
Higher education (7)	1,505.8	6.0	23	32.6	23
Total (9)	6,517.2	25.9	100	141.1	100

Source: Compiled by authors from IFPRI-ISRA 2008/09.

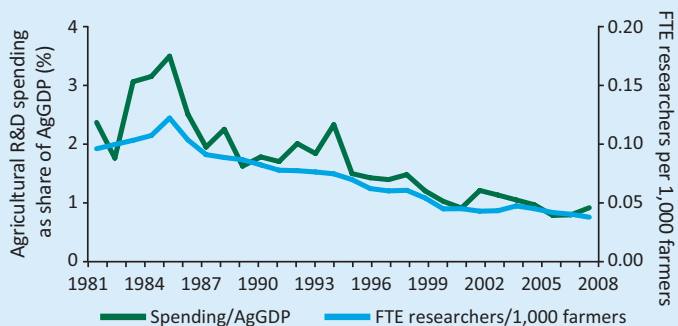
Notes: Figures in parentheses indicate the number of agencies in each category. Total research staff numbers and spending include six French expatriates employed at ISRA and their salaries, respectively.

levels at ISRA exhibited a similar decline: by 2008, the institute employed 98 FTE researchers (including six French expatriates), representing just over half the levels recorded in the mid-1980s. Furthermore, many senior scientists at ISRA have retired over the past five years and have not been replaced. Still others departed to take advantage of more lucrative opportunities at universities, nongovernmental organizations, and international R&D agencies. Of major concern, 59 percent of ISRA's researchers are over 50 years old, indicating that capacity is at further risk of deterioration in the coming decade (ASTI-AWARD 2008). In addition to the 98 FTE researchers mentioned above, ISRA employed a total of 105 FTE BSc holders in 2008. These BSc holders do not have an official researcher status and are categorized as technicians.

Agricultural R&D staff and expenditure levels at the Food Technology Institute (ITA) have exhibited a more erratic trend over the past 25 years. World Bank support has played a prominent role, allowing the institute to expand its capacity somewhat in recent years. In 2008, ITA employed 10.5 FTE agricultural researchers (and 2 FTE technicians with BSc degrees).

The role of the higher education sector has steadily grown since the early 1980s. The country's main agricultural higher education agencies—the University Cheikh Anta Diop (UCAD), the

Figure 3—Intensity of agricultural research spending and capacity, 1981–2008



Sources: Calculated by authors from IFPRI-ISRA 2008/09; Stads and Sène 2004; FAO 2009; and World Bank 2009.

Advanced National School of Agriculture (ENSA), and the University Gaston Berger (UGB)—all reported growth in their agricultural R&D capacities. ENSA, in particular, accelerated its research activities after becoming part of the University of Thiès in 2006.



In 2008, only 10 percent of Senegalese agricultural researchers were female, and this share was even lower at ISRA (just 9 percent). Despite an overall decline in the number of FTE agricultural researchers at ISRA during 2001–08, the number of research support staff grew due to large-scale recruitment efforts. In 2008, the institute employed 482 technicians, administrative, and other support staff, compared with only 349 in 2001. As a result, the support-staff-per-researcher ratio rose from 3.1 to 5.2 during this period. In contrast, support-staff-per-researcher ratios at ITA and the higher education agencies declined over the same timeframe.

Total public spending as a percentage of agricultural output (AgGDP)—a comparative indicator of agricultural R&D spending across countries—steadily declined in response to dwindling R&D investments throughout most of the 1990s and 2000s. In 2008, Senegal invested \$0.91 in agricultural R&D for every \$100 of agricultural output (Figure 3). For most of the 1980s and 1990s, Senegal had one of the highest research intensity ratios in West Africa, but more recently this ratio has fallen to levels more typical of neighboring countries. In keeping with this trend, the number of agricultural researchers (in FTEs) per 1,000 farmers gradually decreased from 0.10 in 1981 to 0.04 in 2008.

INSTITUTIONAL STRUCTURE OF PUBLIC AGRICULTURAL R&D

The institutional structure of Senegal's agricultural research has changed little since 2000. ISRA and ITA continue to dominate, though the role of the higher education sector (most notably UCAD and ENSA) has grown gradually over time. ISRA was restructured under Phase I of the World Bank-led Agricultural Services and Producer Organizations Project (PSAOP), leading to a consolidation of its activities into five regional research centers, five national centers and laboratories, and one subregional center specializing in plant adaptation to drought. In addition, ISRA's board of trustees has been opened to representatives from producer organizations, local governments, and the private sector.

ASTI Website Interaction

-  More details on institutional developments in agricultural research in Senegal are available in the 2004 country brief at asti.cgiar.org/pdf/Senegal_CB26.pdf.
-  Underlying datasets can be downloaded using ASTI's data tool at www.asti.cgiar.org/data.
-  This brief presents aggregated data; additional graphs with more detailed data are available at asti.cgiar.org/senegal/datatrends.

www.asti.cgiar.org/senegal

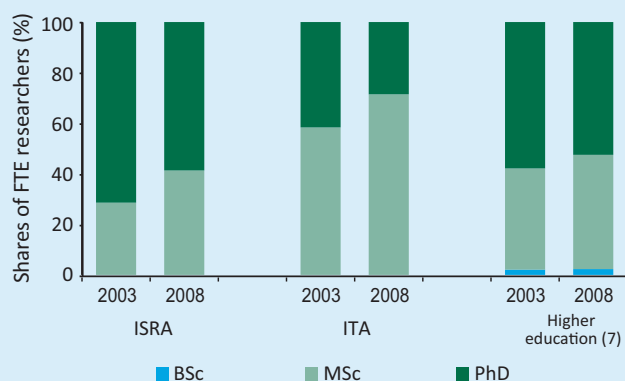
ISRA is administered by the Ministry of Agriculture, whereas ITA falls under the Ministry of Mining and Industry. Some believe that Senegal lacks clear vision and prioritization in terms of its scientific research agenda. Research coordination is said to be too dispersed across ministries, and linkages between ministries are generally seen as weak. The coordination of scientific research at the ministerial level underwent significant restructuring in recent years. For a short time, scientific research fell under the Ministry of Biofuels, Renewable Energy and Scientific Research, after which it was moved to the Ministry of Higher Education, Universities and Scientific Research.

The establishment of FNRAA in 2000 as Senegal's principal funding mechanism for agricultural research projects has successfully promoted cooperation among the country's agricultural R&D agencies. The fund mandates collaboration by a minimum of two institutions, but more than 80 percent of projects approved during the first phase of PSAOP had at least three partners. The involvement of the private sector has also been significantly promoted with the introduction of FNRAA.

RESEARCH STAFF QUALIFICATIONS AND TRAINING

In 2008, 99 percent of Senegal's agricultural research staff were trained to the postgraduate level, and 55 percent held PhD degrees (Figure 4). Consistent with the overall gender trend, PhD-qualified women are underrepresented. In 2008, of all the PhD-qualified agricultural researchers, only 4.9 FTEs were female, whereas 69.2 FTEs were male. The overall share of scientists with PhD degrees was higher at ISRA and the higher education agencies than at ITA, and although many of ISRA's researchers received funding for PhD training in the 1990s and early 2000s through the United States Agency for International Development (USAID) and two World Bank-funded projects—the Agricultural Research Project (ARP) and PSAOP—capacity has been significantly eroded since then (Stads and Sène 2004). In 2003, ISRA employed 70 PhD-qualified scientists compared with 54 in 2008. Some of these scientists left ISRA to take advantage of opportunities in the higher education and private sectors, where salaries are reported to be up to three times higher than in the public sector;² as mentioned earlier, many of the more





Figure 4—Qualifications of researchers by institutional category, 2003 and 2008



Source: Calculated by authors from IFPRI-ISRA 2008/09.

Notes: Figures in parentheses indicate the number of agencies in each category. Research staff exclude expatriate staff employed at ISRA.

ASTI Website Interaction

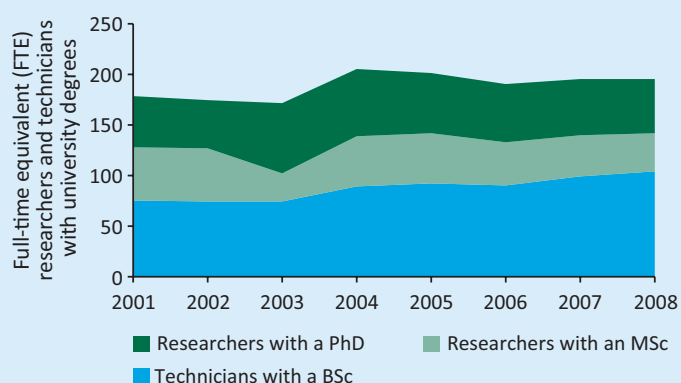
-  A list of the two government and seven higher education agencies included in this brief are available at asti.cgiar.org/senegal/agencies.
-  Detailed definitions of PPPs, FTEs, and other methodologies employed by ASTI are available at asti.cgiar.org/methodology.
-  The data in this brief are predominantly derived from surveys. Some data are from secondary sources or were estimated. More information on data coverage is available at asti.cgiar.org/senegal/datacoverage.
-  More relevant resources on agricultural R&D in Senegal are available at asti.cgiar.org/senegal.

www.asti.cgiar.org/senegal

senior researchers simply retired. With its researchers averaging well over 50 years, ISRA has one of the oldest pools of scientists in West Africa. This reality will pose a major challenge to capacity and funding in the coming years, as the institute endeavors to attract well-qualified replacement staff and offer degree-level training to existing staff. As previously mentioned, ISRA does not classify its staff holding BSc degrees as researchers, but as technicians instead. While the institute's PhD- and MSc-qualified research staff totals showed a steady decline in recent years, the number of BSc-qualified technicians increased from 76 FTEs in 2001 to 105 in 2008 (Figure 5).

ITA has seen a similar loss in PhD-qualified staff capacity in recent years. Between 2004 and 2008, the total number of

Figure 5—Trends in ISRA's FTE researchers and technicians, 2001-08



Source: Calculated by authors from IFPRI-ISRA 2008/09.

Note: Research staff exclude expatriate staff employed at ISRA.

PhD-qualified scientists dropped from 13 to only 6. While some scientists retired, others departed the institute upon receiving their PhD qualification. In contrast, the higher education sector reported steady increases its numbers of MSc- and PhD-qualified scientists in the years following major donor-financed training initiatives, in part because of its ability to attract well-qualified scientists away from ISRA and ITA.

Capacity strengthening at ISRA and ITA was actually an important component of PSAOP despite the subsequent losses these two institutes experienced. The project's first phase (2000–05) stressed the importance of strengthening ISRA's scientific and managerial capacities. ISRA staff benefited from an extensive training program through which 36 staff members received degree-level training, 116 undertook training modules, and 6 were sent on study tours (World Bank 2006a). Most of the researchers were trained at the University of Wageningen in the Netherlands or at a number of U.S. universities. In addition, close to 60 of ITA's researchers benefited from PSAOP-financed training programs, mostly at Belgian universities. Though degree training plays a less prominent role in Phase II of PSAOP, the project still includes targeted funding for training in areas like biotechnology and participatory research (World Bank 2006b). It is disappointing that ISRA and ITA have failed to maintain their research capacities despite considerable investments in training during the 1990s and early 2000s. Ironically—given the salary disparities previously discussed—these investments have actually prompted staff departures through the new opportunities they provide. On a positive note, ISRA's and ITA's losses have often translated into gains for the country's higher education and private sectors. Nonetheless, this trend is worrisome.

INVESTMENT TRENDS

Expenditures

Since the allocation of research budgets across salaries, operating costs, and capital expenses affects the efficiency of agricultural R&D, detailed cost category data were collected from the government agencies as part of this study. In 2006–08, ISRA spent half of its budget on salaries, 42 percent on operating costs, and 8 percent on capital expenses. ITA also spent about half of its budget on salaries, combined with 32 percent on

operating costs and 18 percent on capital expenditures (Figure 6). Phase I of PSAOP provided substantial funding for scientific and technical materials and equipment, as well as upgrades to ISRA's and ITA's research facilities. Although capital allocations are somewhat lower under Phase II of PSAOP, many of ISRA's and ITA's locations are slated to be upgraded and equipped to conduct research.

ISRA's operating and program expenditures have declined since 2000, in part due to the introduction of FNRAA. Given the competitive nature of the fund, ISRA has become less successful in securing funding for its research programs. On average, about 30 percent of ISRA's submissions to FNRAA are declined, and this has understandably had a negative impact on staff morale and motivation.

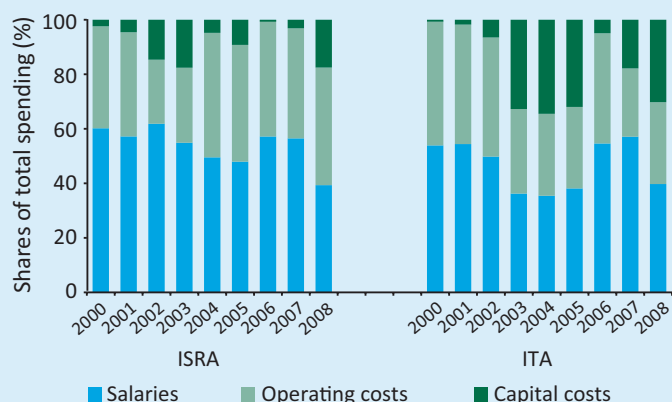
Funding Sources

Agricultural R&D in Senegal derives funding from a variety of sources, including the national government, donor contributions, development bank loans, and the sale of goods and services. During 2006–08, the national government directly funded 61 percent of ISRA's and 65 percent of ITA's expenditures (Figure 7). Donor contributions and development loans accounted for about a quarter of each institute's total funding, whereas the sale of goods and services accounted for 12 and 9 percent of ISRA's and ITA's funding, respectively.

Total donor support to ISRA has contracted significantly since the early 1990s in absolute terms. While donors and development banks funded an average of 2.6 billion CFA (in 2005 prices) per year during 1991–95, they funded just 0.8 billion annually during 2006–08. Rather than redressing this gap, government support also diminished during this period, from an average of 2.8 billion CFA per year in 1991–95 to 1.7 billion in 2006–08. ISRA's most important donors during the period 2000–08 included the World Bank, the European Union, the African Development Bank, USAID, the Government of France, and various international agricultural research centers supported by the Consultative Group on International Agricultural Research (CGIAR). ITA's most important contributor since 2000 has been the World Bank, through Phases I and II of PSAOP.

The World Bank has been involved in the development of Senegal's agricultural research sector for most of the 1980s,

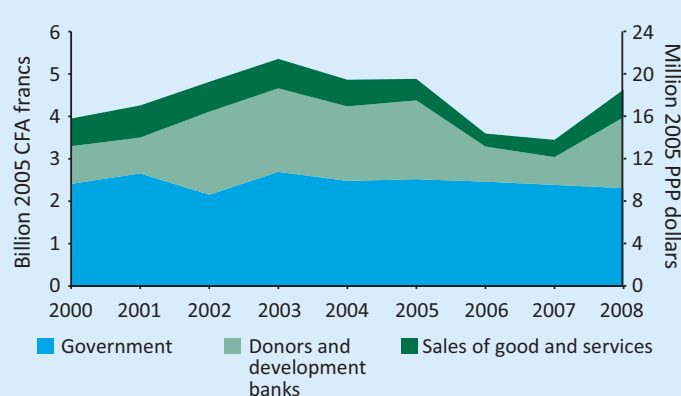
Figure 6—Cost category shares of ISRA and ITA, 2000–08



Sources: Calculated by authors from IFPRI–ISRA 2008/09 and Stads and Sène 2004.

Note: Salaries exclude those of expatriate staff employed at ISRA.

Figure 7—Funding sources of ISRA and ITA, 2000–08



Sources: Calculated by authors from IFPRI–ISRA 2008/09 and Stads and Sène 2004.

Note: Donor funding includes the salaries of expatriate staff employed at ISRA.

1990s, and 2000s. Since its inception in 2000, PSAOP has focused on substantially increasing smallholder productivity, production, and incomes through technological change. Specifically, the project promotes (a) institutional reforms to ensure that agricultural services are more accountable, demand-driven, and cost-efficient, and to increase the participation of the private sector in performing a number of functions previously executed by the public sector; (b) the generation and transfer of technologies to sustainably improve agricultural productivity; and (c) the empowerment and capacity-building of producer organizations (World Bank 2006a). The project comprises three phases at a total cost of US\$174.0 million. Phase I (2000–05) had a total cost of US\$41.1 million, US\$13.5 of which was funded by the Senegalese government and included the establishment of FNRAA (US\$3.7 million) and disbursements of US\$3.2 million to ISRA and US\$0.9 million to ITA. Other components of Phase I included the strengthening of producer organizations, agricultural extension services, and public services more generally (World Bank 2006a).

Since Phase I of PSAOP was rated satisfactory, Phase II (2006–10) was established to build on its success. Phase II has a total budget of US\$47.0 million, US\$20.0 million of which is funded by the Senegalese government and US\$1.0 million by beneficiaries. US\$10.0 million was allocated at the onset of Phase II to strengthening ISRA's and ITA's human resource capacity and to supporting the evolution of FNRAA as the national funding mechanism for agricultural research (World Bank 2006b).

In addition to providing a unified funding mechanism and promoting competition and cooperation among Senegal's research agencies, FNRAA promotes farmer and private-sector interests in setting agricultural R&D priorities. A rigorous selection process has been established based on reviews by peers and a scientific and technical committee. The participation of producer organizations is encouraged at all stages of the process to ensure that programs are relevant. FNRAA received 92 proposals during Phase I of PSAOP, of which 30 were approved. Nineteen projects were funded under ISRA's leadership (63 percent) and 5 under ITA's leadership (16 percent). As previously noted, ISRA has become less successful in attracting FNRAA funding over time, whereas the higher education agencies (notably UCAD), the private sector (for example, SODEFITEX, a cotton firm), and producer organizations have secured increasing shares. The relative role of FNRAA will be strengthened under Phase II of PSAOP, and the African Development Bank and the European Union have expressed interest in contributing (World Bank 2006a). The World Bank's contribution to FNRAA will contract over time as it is intended that the government, donors, and the private sector will progressively increase their contributions to both the fund's endowment and its operating costs. Donors cannot fund fixed costs through FNRAA, so ISRA and ITA will need to further rationalize their operations and develop alternative funding sources, such as through the sale of products and services.

ALLOCATION OF RESEARCH ACROSS THEMES AND COMMODITIES

Given that the allocation of resources across various lines of research is a significant policy decision, detailed information was collected on the number of researchers working in specific commodity and thematic areas (in FTEs).

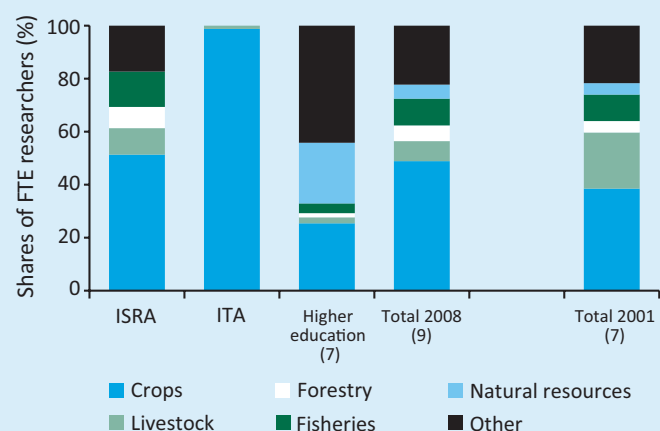
In 2008, close to half of Senegal's 141 FTE researchers in agriculture were involved in crop research (Figure 8). Fisheries research accounted for 10 percent, livestock research for 8

percent, forestry research for 6 percent, and natural resources research for 5 percent. The remaining researchers concentrated their efforts on socioeconomic research, postharvest research, or other matters. Notably, a quarter of Senegal's agricultural researchers conducted livestock research in 2001 compared with just 7 percent in 2008. ISRA is largely responsible for this shift, given that it employed 26 FTEs focusing on livestock in 2001 and only 10 FTEs focusing on livestock in 2008.

Commodity Focus

The most researched crops in Senegal in 2008 were rice and millet, representing 17 and 12 percent of crop researchers in FTEs, respectively (Table 2). Other important crops included

Figure 8—Research focus by major commodity area, 2001 and 2008



Sources: Calculated by authors from IFPRI–ISRA 2008/09 and Stads and Sène 2004.

Notes: Figures in parentheses indicate the number of agencies in each category. 2001 data are shown for the purpose of comparison and exclude 2 small units under the University Gaston Berger. Research staff exclude expatriate staff employed at ISRA.

Table 2—Crop and livestock research focus by major item, 2008

Crop items	ISRA	ITA	Higher education (7)	Total (9)
	Shares of FTE researchers (%)			
Rice	22.8	—	0.9	17.3
Millet	8.7	12.3	36.0	12.3
Maize	8.7	12.3	6.7	9.0
Vegetables	4.3	24.7	1.4	6.7
Cotton	4.3	18.5	1.4	5.9
Bananas and plantains	6.5	6.2	5.3	6.3
Groundnuts	6.5	18.5	4.5	7.9
Cassava	6.5	6.2	1.4	5.9
Other crop	15.2	—	34.4	15.4
Livestock items				
Beef	6.1	—	1.6	4.8
Dairy	6.1	—	1.2	4.8
Poultry	3.3	1.2	2.0	2.9
Other livestock	0.8	—	3.3	1.0
Total crop and livestock	100	100	100	100

Source: Calculated by authors from IFPRI–ISRA 2008/09.

Note: Figures in parentheses indicate the number of agencies in each category.

vegetables, maize, cotton, bananas and plantains, groundnuts, cassava, and sorghum. The Senegalese government overtly prioritizes research on food crops over export crops due to the importance of food security. The country's livestock researchers concentrated primarily on beef (38 percent), dairy (38 percent), and poultry (21 percent).

CONCLUSION

Over the past few decades, agricultural R&D in Senegal has relied heavily on donor funding, including consecutive projects led by the World Bank. Reduced support by donors and the Senegalese government has led to a gradual drop in the country's overall agricultural R&D spending. The World Bank-led project PSAOP has supported substantial institutional change at the main public agricultural agencies, ISRA and ITA, and introduced a competitive funding body (FNRAA), which has transformed agricultural R&D funding and promoted the involvement of the higher education and private sectors in national agricultural research. Given that FNRAA regulations prevent donors from funding fixed research costs, and the national government has been unable to fill a growing funding gap, both ISRA and ITA will need to further rationalize their operations and develop alternative sources of funding.

Despite significant investments in human resource capacity under PSAOP, ISRA and ITA have experienced serious losses in their research capacity over the past five years. Key factors of concern are the aging population of scientists at ISRA and ITA, and disparities in salary levels at these two agencies compared with those of the higher education and private sectors, which make it difficult for the public agencies to retain well-qualified staff despite substantial training initiatives.

On a positive note, despite the erosion of R&D funding levels and human resource capacity, Senegal's agricultural researchers remain among the most highly qualified in Africa, and the country's agricultural research intensity levels remain well above the average for Africa.

NOTES

- ¹ Note that a separate ASTI brief on private-sector involvement in Senegalese agricultural research is forthcoming.
- ² Despite the high salaries, social benefits are reported to be worse in the higher education and private sectors compared with the public sector.

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

ISRA is Senegal's principal government institute charged with agricultural research. The institute was established in 1974 and falls under the administrative coordination of the country's Ministry of Agriculture. The institute holds a broad mandate covering crop, livestock, forestry, fisheries, and socioeconomic research. To learn more about ISRA visit www.isra.sn.

The Agricultural Science and Technology Indicators (ASTI) initiative compiles, analyzes, and publishes data on institutional developments, investments, and human resources in agricultural R&D in low- and middle-income countries. The ASTI initiative is managed by the International Food Policy Research Institute (IFPRI) and involves collaborative alliances with many national and regional R&D agencies, as well as international institutions. The initiative, which is funded by the Bill & Melinda Gates Foundation with additional support from IFPRI, is widely recognized as the most authoritative source of information on the support for and structure of agricultural R&D worldwide. To learn more about the ASTI initiative visit www.asti.cgiar.org.

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