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# SENEGAL

## PRIVATE AGRICULTURAL RESEARCH AND INNOVATION

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### PRIVATE INVESTMENT TRENDS

**A**gricultural research and development (R&D) in Senegal has historically been spearheaded by the public sector. In 2008 the private sector accounted for just 14 percent of the country's total agricultural R&D investments. The reasons for limited private-sector involvement are manifold. Many private companies operate with limited competition, which reduces their incentive to invest in research, and many rely on new technologies from the public sector or from abroad. The picture is not entirely bleak, however. While the public sector dominates research on food crops in Senegal, the private sector makes an important contribution to R&D related to export commodities. Private companies are major innovators in the groundnut and cotton subsectors, Senegal's principal export crops. In fact, they play a more crucial role than the public sector in releasing new varieties of these two crops and in providing high-quality and timely solutions to related crop diseases.

The Senegalese government has taken various measures to stimulate innovation in the private sector in recent years. Regional seed, fertilizer, pesticide, and livestock regulations have been harmonized to reduce trade barriers and increase market opportunities for competitive firms. Additional national initiatives have provided private-sector opportunities and enhanced public-private partnerships. Despite these efforts—and some notable successes—privately provided agricultural R&D has much room to grow.

### AGRICULTURE IN SENEGAL: A CHANGING LANDSCAPE

Most of Senegal lies within the drought-prone Sahel, characterized by irregular rainfall and relatively poor soils. Despite generally poor conditions, in 2008 agriculture employed roughly three-quarters of the country's workforce. The vast majority of farmers are smallholders, combining cash crops (cotton and groundnuts), subsistence crops (maize, millet, rice, and sorghum), and some livestock. In recent years, large-scale horticulture has become more prominent in the coastal zone between Dakar and Saint Louis and the irrigated lands along the Senegal River, where rice cultivation is also highly developed.

After Mauritania, Senegal is the West African country most dependent on food imports, which include 70 percent

of its cereal needs and most of its dairy products, vegetable oil, and processed foods. Despite recent domestic production increases, Senegal remains Africa's second-largest net importer of rice. Production of millet, rice, and sorghum, Senegal's staple crops, rarely meets the country's demand. With the exception of maize and rice, production, yields, and acreage of most cereal crops have stagnated or declined since the late-1960s. This underperformance can be explained by an unfavorable international context (declining cotton and groundnut prices), poor control of water resources, and degradation of land and agricultural inputs (seed and fertilizer).

Groundnut production occupies roughly 40 percent of the land under cultivation and employs an estimated one million farmers, whereas cotton covers close to a third of cultivated land. Both groundnut and cotton production levels have fallen markedly in recent years, and Senegal is increasingly losing its competitive edge. Exports of fruits and vegetables to Europe (mostly green beans, cherry tomato, mango, and melon) have increased in recent years, however. In 2005, Senegal's estimated head of cattle was more than three million, and sheep and goats numbered more than four million each. Despite a significant livestock population, Senegal remains a net importer of meat, and the country's milk production is also below domestic needs. Poultry production, on the other hand, has increased since 2005. Senegal's fisheries have historically been one of the country's largest sources of foreign currency. Seafood represents close to a quarter of the country's total exports, and the fishing industry is a key employment sector.

### AGRICULTURAL POLICY REFORMS

In recent years the Senegalese government has launched various initiatives to revive the country's agricultural sector. The three initiatives that feature most prominently are discussed below.

#### ***The Agriculture, Forestry, and Livestock Act (LOASP).***

Adopted in 2004, LOASP defines broad guidelines for developing the agricultural sector and reducing poverty. Specific objectives include increasing the quality and quantity of agricultural exports. The Act establishes a system of incentives for private investment in agriculture and rural areas, and in addition to strengthening farmers' land-use rights, it establishes their legal status to receive increased social security and to participate in a vocational training program tailored to their needs. The State's role in agricultural

research and sustainable soil management is also strengthened under LOASP. It should be noted, however, that the Act has been criticized by some farmer organizations, public interest groups, and donors ; many contend that it fails to set realistic targets and confers too much power on the government.

**The Great Push Forward for Agriculture, Food, and Abundance (GOANA).** Senegal launched GOANA in 2008 after two consecutive rainy seasons with low rainfall, which led to high food prices and ensuing food riots. GOANA's objective is to achieve food self-sufficiency for Senegal by 2015. To this end, the plan set ambitious yearly production targets for the country's main food and export crops, as well as for dairy and meat. Rice production was targeted to grow by more than 250 percent in a single year, cassava production set to grow nearly tenfold within this timeframe, and groundnut production was slated to triple.

**Return to Agriculture (REVA).** In response to increasing rural migration and emigration, in 2006 the Senegalese government launched REVA with the objective of developing agricultural infrastructure (constructing rural roads, rehabilitating wells, and connecting electricity) and providing training, production tools, and equipment to both young farmers and female farmers, especially former clandestine emigrants who have returned to Senegal. This plan is gaining increasing support from donors.

In recent years, the Senegalese government has also undertaken various policy reforms to improve agricultural productivity and stakeholder participation in the value chain. Key among these are market liberalization reforms, which removed excessive government control and paved the way for increased private-sector participation. As a result, the State's role is increasingly a regulatory one, limited to public service objectives. Despite a lack of R&D coordination at the ministerial level, linkages between the country's public agricultural R&D agencies and private companies are close. The establishment of the National Agricultural and Agro-Alimentary Research Fund (FNRAA) in 2000 as Senegal's principal funding mechanism for public agricultural research projects has successfully promoted cooperation among the country's agricultural R&D agencies. The government has also undertaken numerous reforms in agricultural subsectors. Of particular note are various preferential fishing treaties with the European Union and Japan. Though economically successful in the short run, these treaties have had negative long-term effects. Stocks of high-value, coastal deep-sea fish are now either fully or over-exploited, precipitating serious risk of local market shortages. In 2006 Senegal developed a fisheries and aquaculture action plan to reduce over-fishing and protect the resources of artisanal fishers.

## ASTI Website Interaction

 More details on trends in investments, capacity, and policies in private-sector agricultural research and innovation in Senegal are available at <http://www.asti.cgiar.org/pdf/Senegal-Private-Sector-Report.pdf>.

 More information on recent trends in public-sector agricultural research investments and capacity in Senegal is available at <http://www.asti.cgiar.org/pdf/Senegal-Note.pdf>.

[www.asti.cgiar.org/senegal](http://www.asti.cgiar.org/senegal)

## METHODOLOGY

Although data on public R&D capacity and investments are widely available, comprehensive information on private-sector R&D is not regularly documented. For this study, 15 sample companies were identified and selected to participate. They were classified under six subsectors: plantation crops, horticulture, agrochemicals, fisheries, livestock and fodder, and agricultural machinery (Table 1). The sample covers approximately 70 percent of private agricultural R&D investments and staffing in Senegal. Of the 15 companies, 10 are Senegalese-owned and headquartered, 3 are completely foreign-owned, and 2 are jointly owned by the government and domestic and foreign private interests.

## THE SCOPE OF PRIVATE INVESTMENT

The public sector has traditionally dominated agricultural R&D in Senegal, but reduced support by donors and the Senegalese government has led to a gradual decline in the country's overall agricultural R&D expenditure in recent decades. In 2008, Senegal's public sector spent 6.5 billion CFA francs or 25.9 million dollars on agricultural R&D (both figures in 2005 purchasing power parity price, or PPP, exchange rates).<sup>1</sup> In contrast, private agricultural R&D investments grew by 40 percent during 2001–08. In 2008, the 15 surveyed companies spent a combined \$3.2 million or 807 million CFA francs on R&D (both figures in 2005 PPP prices) (Table 2). Consequently, the private-sector share of investments in Senegal's

**Table 1—Number of organizations surveyed, by type of organization and primary activity**

Type of private organization	Sample size	R&D focus
Plantation crops	3	Varietal development, plant breeding, cultivar improvement, bioethanol production, disease and drought resistance, and food processing
Horticulture	3	Seed production, postharvest processing, and production methods
Agrochemicals	2	Varietal development, disease and drought tolerance, and pesticide and fertilizer development
Livestock and fodder	2	Dairy production, fodder and fruit production, and importation of exotic livestock breeds
Fisheries	4	Postharvest processing, and production methods
Agricultural machinery	1	Cultivation machinery, postharvest machinery, and production methods

Source: Compiled by authors from survey data.

**Table 2—Absolute levels of in-house agricultural R&D spending and staffing by the private sector, 2001 and 2008**

Type of private organization	Staffing levels		Spending levels			
	Full-time equivalents		2005 CFA francs (millions)		2005 PPP dollars (millions)	
	2001	2008	2001	2008	2001	2008
Plantation crops (3)	8.1	13.4	254.2	230.8	1.0	0.9
Horticulture (3)	3.7	5.0	153.7	357.2	0.6	1.4
Agrochemicals (2)	3.3	5.3	131.1	102.3	0.5	0.4
Livestock and fodder (2)	1.6	8.1	19.1	90.3	0.1	0.4
Fisheries (4)	9.9	9.5	14.1	17.1	0.1	0.1
Agricultural machinery (1)	0.9	0.9	7.7	9.9	—	—
<b>Total (15)</b>	<b>27.5</b>	<b>42.2</b>	<b>579.9</b>	<b>807.6</b>	<b>2.3</b>	<b>3.2</b>

Source: Compiled by authors from survey data.

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

total (public and private) agricultural R&D increased from 12 percent in 2001 to 14 percent in 2008.

The boundaries between public and private R&D investments are not always clear, however, as many companies outsource all or part of their research needs to public-sector institutes on a contract basis. The public Institut sénégalais de recherche agricole (ISRA) conducts demand-driven research for many private companies. In 2008, direct funding from the private sector accounted for 13 percent of ISRA's budget. In addition, the government's Institut de technologie alimentaire (ITA) plays a leading role in providing demand-driven storage, conservation, and processing solutions for agro-industrial companies. ITA has launched a variety of new products and actively seeks companies to commercialize them.

As noted, Senegal has become increasingly competitive in exporting fruits and vegetables to Europe. A direct link may exist between the increase in exports and the doubling of R&D investments by horticultural companies between 2001 and 2008. In 2001, the plantation crop companies dominated private R&D investments, but by 2008 the horticultural companies contributed more than 40 percent of Senegal's private R&D investments in agriculture.

Sales figures were only available for 10 of the 15 sample companies. For these, an average of 0.3 percent of total sales was allocated to R&D in 2008. Large differences existed across subsectors, ranging from 0.08 percent in the plantation crop subsector to more than 1.00 percent at the agrochemical companies. The horticultural companies also spent a relatively high share of their sales on R&D (0.94 percent).

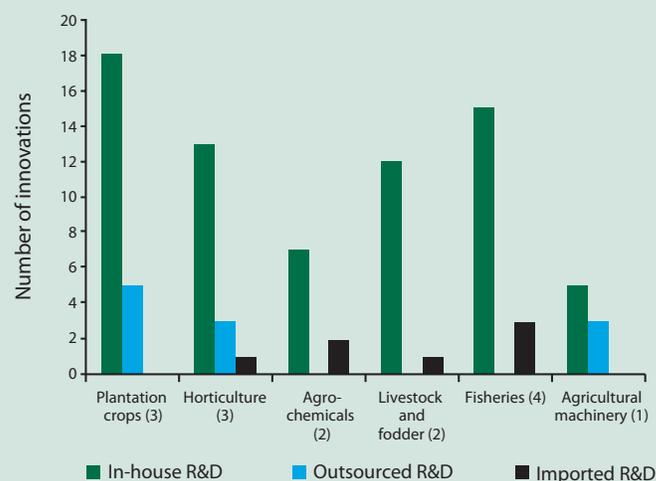
Since private companies do not have extensive R&D infrastructure in terms of laboratory facilities and scientists, only a few firms employ research staff, typically in small numbers. In 2008, the 15 surveyed companies employed a total of 38 full-time equivalent (FTE) agricultural researchers. More than a third of these researchers were employed at one of the three plantation crop companies. The four fisheries companies employed a combined total of 10 FTE researchers, and, together, the two livestock and fodder companies employed 8 FTEs. Private R&D capacity in the remaining subsectors amounted to fewer FTEs.

Figure 1 provides a summary of the main innovations in terms of new products or new manufacturing technologies reported by

the surveyed firms during 2004–09. The number of innovations reported was highest among the plantation, fisheries, and horticultural companies (23, 18, and 17 innovations, respectively). Overall, reported innovations resulting from in-house R&D accounted for 80 percent of the total; innovations through research outsourced to third parties accounted for 13 percent; and innovations through the importation of foreign technologies accounted for the remainder. More than three-quarters of the innovations from the livestock and fodder subsector and two-thirds of those from the agrochemical subsector were patented/protected. Patenting or intellectual property protection in the plantation crops and fisheries subsectors is less common.

Important collaborative linkages exist between private companies and between the public and private sectors, both at national and international levels. The 14 Senegalese companies for which data were available reported widespread collaboration with a large number of national and foreign public and private agencies. Eleven companies said they collaborated with ISRA or ITA or both. Most of the plantation crop and agrochemical

**Figure 1—Major innovations, 2004–09**



Source: Compiled by authors from survey data.

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

companies reported joint R&D programs with ISRA, whereas the fisheries and livestock companies maintained closer linkages with ITA. In addition, most companies (with the exception of those in the horticulture and agrochemical sectors) worked closely with national universities.

## POLICY RECOMMENDATIONS

While the surveyed companies supplied a long list of recommended policy changes to foster greater investment in R&D and innovation, actionable and well-evidenced recommendations included the following.

**For plantation crops:** In-house and outsourced R&D could be enhanced were the government to consider (1) increasing the involvement of the private sector in setting research priorities at ISRA and ITA and (2) establishing a sustainable, competitive fund that stimulates privately performed R&D and interactions with the public sector.

**For horticulture:** Stricter enforcement of variety protection would bolster in-house innovation. Reducing taxes on fertilizer, pesticide, and vegetable seed imports would support the importation of new technologies. To enhance in-house and outsourced R&D, the government might (1) shorten administrative procedures related to the importation of seed and pesticide, (2) modernize subsidy policies on the importation of agricultural inputs, and (3) eradicate unfair competition caused by foreign companies selling unapproved seed in Senegal.

**For agrochemicals:** The government could enhance in-house innovation with stricter enforcement of environmental and health rules to prevent unapproved or banned agrochemical products from entering the market. Granting subsidies to buy new technologies generated elsewhere would promote the importation of new technologies. The government could enhance in-house and outsourced R&D with (1) increased private-sector involvement in FNRAA-funded projects, (2) increased private-sector involvement in setting public R&D priorities, and (3) tax exemptions according to the size of a company's R&D budget.

**For livestock and fodder:** In-house innovation could be enhanced were the government to cut the subsidies on livestock imports, which cause unfair competition. To support the importation of new technologies, the government might (1) create subsidies on imports of high-quality livestock semen and (2) enhance information access and training on livestock technologies available in developed countries. To enhance in-house and outsourced R&D, the government could consider (1) involving the private sector in setting public research priorities, and (2) reducing Senegal's dependence on cereal imports, which could eventually increase locally conducted R&D on fodder.

**For fisheries:** The government could provide (1) tax cuts to stimulate R&D, and (2) stricter enforcement of laws against overfishing to enhance in-house innovation. To support the importation of new technologies the government could lower taxes on technology imports and maintain a closer watch on available technologies to enable Senegal's fisheries to become more competitive. Increased involvement of fisheries companies in setting public-sector R&D priorities would enhance in-house and outsourced R&D.

**For agricultural machinery:** Reducing taxes on R&D equipment could enhance innovation. Enhancing international cooperation in the field of agricultural machinery could support the importation of new technologies.

## NOTE

<sup>1</sup> PPPs reflect the purchasing power of currencies more effectively than do standard exchange rates because they compare the prices of a broader range of local—as opposed to internationally traded—goods and services.

## FURTHER READING

Stads, G. J., and L. Sène. 2011. Private-Sector Agricultural Research and Innovation in Senegal: Recent Policy, Investment, and Capacity Trends. Case Study Report. Washington, DC, and New Brunswick, NJ: International Food Policy Research Institute and Rutgers University.



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Rutgers, the State University of New Jersey, is a leading national public research university and the state's preeminent, comprehensive public institution of higher education. Rutgers has strong research programs with internationally recognized scholars focused on policy and management issues in three key areas: technology and innovation, food and agricultural systems, and land use.

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