

# Science Granting Councils in Sub-Saharan Africa

## Country Report

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### Senegal

Jacques Gaillard & Milandr  van Lill



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## List of Acronyms and Abbreviations

AAT	<i>Adoption Accélérée des Technologies</i> (Accelerated adoption of technology)
AfricaRice	Africa Rice Centre
ANAQ Sup	<i>Autorité Nationale d'Assurance Qualité de l'Enseignement Supérieur</i> (National Quality Assurance Authority for Higher Education)
AOF	<i>Afrique Occidentale Française</i> (French West Africa)
ARESA	<i>Agence Nationale de la Recherche Scientifique Appliquée</i> (National Agency for Applied Scientific Research)
ASIT	<i>Agence Sénégalaise de l'Innovation Technologique</i> (Senegalese Agency for Technological Innovation)
ASTII	African Science, Technology and Innovation Indicators
AU	African Union
BREDA	<i>Bureau Régional de l'Education de l'UNESCO à Dakar</i> (UNESCO Regional Bureau for Education) (Dakar)
CERER	<i>Centre d'Etudes et de Recherche sur les Energies Renouvelables</i> (Renewable Energy Research Centre)
CFAF	<i>Communauté Financière Africaine Franc</i> (African Financial Community Franc)
CIRAD	<i>Centre de Coopération Internationale en Recherche Agronomique pour le Développement</i> (Agricultural Research for Development) (France)
CNESRIST	<i>Conseil National de l'Enseignement Supérieur, de la Recherche, de l'Innovation, de la Science et de la Technologie</i> (National Council of Higher Education, Research, Innovation, Science and Technology)
CNRA	<i>Centre National de Recherche Agronomique</i> (National Centre for Agricultural Research)
CNRST	<i>Centre National de Recherche Scientifique et Technique</i> (National Centre for Scientific and Technical Research)
CPG	<i>Comité de Pilotage de la Gestion</i> (Management and Steering Committee)
CRAT	<i>Centre Régional Africain de Technologie</i> (Regional African Centre for Technology)
CSE	<i>Centre de Suivi Ecologique</i> (Ecological Monitoring Centre)
DAST	<i>Direction des Affaires Scientifiques et Techniques</i> (Direction of Scientific and Technological Affairs)

DDT	<i>Diffusion de la Technologie</i> (Diffusion of Technology)
DGRST	<i>Délégation Générale à la Recherche Scientifique et Technique</i> (Directorate for Scientific and Technical Research)
EISMV	<i>Ecole Inter Etats des Sciences et Médecine Vétérinaires</i> (Interstate School of Veterinary Science and Medicine)
FIARA	<i>Foire Internationale de l'Agriculture et des Ressources Animales</i> (International Fair for Agriculture and Animal Resources)
FIRST	<i>Fonds d'Impulsion de la Recherche Scientifique et Technique</i> (Fund to Promote Scientific and Technical Research)
FNRAA	<i>Fonds National de Recherches Agricoles et Agro-Alimentaires</i> (National Fund for Agriculture and Agri-food Research)
FNRI	<i>Fonds National de la Recherche et de l'Innovation</i> (National Fund for Research and Innovation)
FTE	Full Time Equivalent
GDP	Gross domestic product
GERD	Gross domestic expenditure on R&D
HDI	Human Development Index
IFAN	<i>Institut Fondamental d'Afrique Noire</i> (Fundamental Institute for sub-Saharan Africa) <sup>1</sup>
INP	<i>Institut National de Pédologie</i> (National Institute of Pedology)
IPD	<i>Institut Pasteur de Dakar</i> (Dakar Pasteur Institute)
IRD	<i>Institut de Recherche pour le Développement</i> (France) (Institute for Research and Development)
ISRA	<i>Institut Sénégalais de Recherche Agricole</i> (Senegalese Institute for Agricultural Research)
ITA	<i>Institut de Technologie Alimentaire</i> (Institute of Food Technology)
MESR	<i>Ministère de l'Enseignement Supérieur et de la Recherche</i> (Ministry of Higher Education and Research)

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<sup>1</sup> Originally the *Institut Français d'Afrique Noire* (IFAN) became the *Institut Fondamental d'Afrique Noire* in 1966 and kept its original acronym.

MRST	<i>Ministère de la Recherche Scientifique et Technologique</i> (Ministry of Scientific and Technological Research)
NEPAD	New Partnership for Africa's Development
OIC	Organisation of the Islamic Conference
ORSC	<i>Office de la Recherche Scientifique Coloniale</i> (Office of Colonial Scientific Research)
ORSTOM	<i>Office de la Recherche Scientifique et Technique Outre-Mer</i> (Office for Overseas Scientific and Technological Research)
PPAAO/WAAPP	<i>Programme de Productivité Agricole en Afrique de l'Ouest</i> (West African Agricultural Productivity Programme)
PSAOP	<i>Programme des Services Agricoles et Organisations de Producteurs</i> (Agricultural Services and Producer Organisations)
R&D	Research and development
S&T	Science and technology
SIGESR	<i>Système d'Information et de Gestion de l'Enseignement Supérieur et de la Recherche</i> (Information and Management System for Higher Education and Research)
STC	Scientific and Technological Commission
STI	Science, technology and innovation
UCAD	<i>Université Cheikh Anta Diop</i> (University Cheikh Anta Diop)
UIS	UNESCO Institute for Statistics
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USAID	United States Agency for International Development



# SENEGAL

The French colonies of Senegal and the French Sudan were merged in 1959 and granted their independence as the Mali Federation in 1960. This union broke up after only a few months. Senegal joined with The Gambia to form the nominal confederation of Senegambia in 1982. The envisaged integration of the two countries was never realised, and the union was dissolved in 1989. The Movement of Democratic Forces in the Casamance (MFDC) has led a low-level separatist insurgency in southern Senegal since the 1980s. Several peace talks have failed to resolve the conflict.

Nevertheless, Senegal remains one of the most stable democracies in Africa. It has a long history of participating in international peacekeeping and regional mediation.

Senegal was ruled by a Socialist Party for 40 years until Abdoulaye Wade was elected president in 2000. He was re-elected in 2007. During his two terms of office, he amended Senegal's constitution over a dozen times to increase executive power and to weaken the opposition. His decision to run for a third presidential term sparked a public backlash that led to his defeat in a March 2012 runoff election with Macky Sall.

Demographic Indicators	Source Year	Estimate
Population	2013	13 300 410
Annual population growth (%)	2013	2.51
Life expectancy at birth (in years)	2013	60.57
HIV adult prevalence rate (%)	2009	0.9
Percentage of urban population (% of total population)	2010	42%
GDP per capita (in USD)	2012	1 900
Unemployment rate (%)	2007	48
Population below poverty line (%)	2001	54
Human Development Index (HDI) ranking	2012	0.470

Source: CIA Factbook (2013)

Senegal is one of the 50 least developed countries in the world, with a total population of 13.3 million in 2013. It qualified for debt relief in April 2004 and submitted a request to the Millennium Challenge Corporation for support for the years 2004-2005. In May 2002, the country's Poverty Reduction Strategy Paper was finalised, providing a framework to address poor living conditions and other development related challenges. More than 50% of the Senegalese population live on less than one dollar per day (see table above).



Figure 1 Map of Senegal

## S&T Indicators

- ✓ Implemented ASTII Initiative
- ✓ 0.51 % GERD as % of GDP in 2011 (MESR, 2013a)
- ✓ 40.5% of R&D activities funded by foreign donors in 2011 (MESR, 2013a)
- ✓ 3 387 Scientific papers published between 1990-2009 (AU-NEPAD, 2010)
- ✓ Predominance in medical & Health Research and related fields: 43% (AU-NEPAD, 2010) with a marked speciality in agricultural sciences (Gaillard & Kane, 2009)
- ✓ One of the lowest number of scientific papers per FTE researcher in Africa: 0.06 (AU-NEPAD, 2010)
- ✓ Research output is largely dominated by UCAD followed by IRD, IPD and ISRA (Gaillard & Kane, 2009; AU-NEPAD, 2010)
- ✓ Senegal's total output has been steady at over 200 papers per year since 2002 (AU-

Source: African Innovation Outlook 2010

Note: The bibliometric data produced by AU-NEPAD (2010) uses SciVerse Scopus indexing 16,000 journals as a source

## 1. General overview

### 1.1. Brief historical overview of the development of scientific activities in Senegal

At the time that the colonial conquest was completed in 1885, the acquired West African lands were united under what became known as the French West Africa (AOF). Dakar became its capital in 1902. The privileged position of Dakar during the French colonial period is the reason that sub-Saharan Africa's first secondary school, the Lycee Faidherbe de Saint Louis, was established in Senegal in 1919. Dakar also became the site of the first French-speaking University in sub-Saharan Africa in 1957. Before independence, however, mostly French national students frequented Senegalese educational institutions.

#### **The first half of the twentieth century: Creation of the first scientific organisations and institutions for higher learning**

Problems encountered in land use and cultivation pushed the AOF government to gear technical services towards more immediate uses. This saw the creation of agricultural research stations (the first being created in Bambey in 1921), a meteorological service (revived in 1922), and a geological service (created in 1930).

The National Centre for Agricultural Research (CNRA) in Bambey, 120 kilometres east of Dakar, is Senegal's oldest agricultural research centre. Its present location has been the successive site of the Modern Agricultural Farm (from 1913 to 1921), the Groundnut Experimental Station (from 1921 to 1938), the Experimental Station for Sudanese Sector Agricultural Research (from 1938 to 1950) and the Federal Agricultural Research Centre (from 1950 to 1960). Up until the Second World War, research was almost exclusively centred on groundnut farming and, particularly, plant breeding. Research on food crops (millet, sorghum, cowpea, then cassava and soybeans) was only intensified after 1950. The creation of the Sudanese Sector of Agricultural Research and the establishment of the Centre in Bambey as a federal centre for agricultural research marked the regional focus on Bambey that began in 1950. The

1913-1921	Creation of first agricultural research stations, including the National Centre for Agricultural Research
1918	Dakar School of Medicine created
1921-1938	Groundnut Experimental Station
1924	Creation of Pasteur Institute in Dakar
1936	French Institute of sub-Saharan Africa (IFAN)
1938-1950	Experimental Station for Sudanese Agricultural Research
1943	Creation of Office of Colonial Scientific Research (which later became ORSTOM and more recently IRD)
1946	Establishment of ORSTOM Soil Research Centre in Dakar-Hann
1949	Creation of geographical observatory in M'Bour
1950	Institute of Higher Education
1957	The official foundation of the University of Dakar
1950-1960	Federal Agricultural Research Centre
1963	Creation of Institute of Food Technology (ITA)
1966	Establishment of an executive level Office of Scientific and Technological Affairs



transformation of the federal centre into a national centre after independence sparked the decline of this regional focus.

The Pasteur Institute of Dakar, successor to the Bacteriological Laboratory of Saint Louis (1896), was created in 1924 by an agreement between the general government of the AOF and the Pasteur Institute in Paris. Twelve years later, in 1936, the French Institute for sub-Saharan Africa (IFAN) was created. The idea for an institute of African studies was conceived in 1931, a time of revived French interest in the colonies and the year of the Vincennes Colonial Exhibit. The creation of the Institute of Higher Education in 1950 laid the foundation for the creation of the University of Dakar.

The Office of Colonial Scientific Research (the ORSC that would later successively become the ORSOM, the ORSTOM and more recently IRD) was created on 11 October 1943. Because of the central role of Senegal in the AOF, it was among the first countries, along with Côte d'Ivoire, to benefit from the first overseas centres. The project for a geophysical observatory in M'Bour was conceived in 1946 and finalised in 1949, which was also the year of the creation of ORSTOM's Soil Research Centre in Dakar-Hann. At the outset, ORSTOM was designed to cover the study of soils in the Sahelian, Sudanian and Sudano-Guinean zones. It would later reduce its focus with the creation of centres in Niamey and Ouagadougou. In 1960, it became the ORSTOM Centre of Dakar, increasing the number of disciplines it covered.

The Dakar School of Medicine, being the first unveiling of university education in West Africa, was created in 1918. In 1949, it began offering instruction in physics, chemistry and biology. The Institute of Higher Education was inaugurated in 1950. These were the principal steps that led to the official foundation of the University of Dakar on 24 February 1957.

### **The rise of University of Dakar and institutionalisation of research activities**

The creation of the University in 1957 and of the teaching and research institutions affiliated with the University during the 1960s was accompanied by an institutionalisation of research activities in the public sector and by the progressive creation of national bodies responsible for science policy.

1968	Interstate School of Veterinary Science and Medicine (EISMV) created
1968	Creation of the Directorate for Scientific and Technical Affairs
1970	Directorate of Scientific and Technological Affairs with secretariat at the prime minister in charge of planning
1971	Centre for Applied Economic Research (CREA) created under the auspices of the School of Law and Economics at UCAD
1973	Creation of the Délégation Générale à la Recherche Scientifique et Technique (DGRST)  Creation of the Senegalese Institute of Agricultural Research (ISRA).
1979	Délégation Générale à la Recherche Scientifique et Technique (DGRST) transformed into the Secretariat of State for Scientific and Technological Research (SERST)
1980	Lagos Plan of Action: countries of the OAU to devote at least 1% of GDP to research
1983	SERST became Ministry of Scientific and Technological Research (MRST)
1986	MRST was dissolved and replaced by Directorate of Scientific and Technological Affairs (DAST) within the Ministry of Planning and Co-operation
1990	Creation of the le Grand Prix du Chef de l'État pour les Sciences (CFAF 5 million)
1992	DAST moved to Ministry of National Education and then to Ministry of State Modernisation and Technology
2000	FNRAA budget of CFAF 3 billion
2002	Recreation of Ministry of Scientific Research (MRS)
2009	Creation of the Ministry of Higher Education and Research (MESR)
2013	Adoption of a strategic plan to develop Higher Education and Research in Senegal (2013-2017)

Agricultural research activities were directed by French institutes up until 1974, the year of the signing of a new agreement for scientific and technological cooperation with France. In accordance with the agreement, from 1975, all agricultural research (agriculture, livestock, forests, and fishing) formerly directed by French institutes was to be transferred to the Senegalese Institute for Agricultural Research (ISRA), except for the autonomous ORSTOM. The creation of ISRA was accompanied by a redeployment of research personnel in regional stations and by the accelerated 'Senegalisation' of agricultural research. In the agro-industrial sector, the creation of ISRA was preceded by that of the Institute of Food Technology (ITA), founded in February 1963.

### **The research landscape today: Institutions and R&D personal**

For over thirty years – up to the time of the opening of the University of Gaston Berger (UGB) in Saint Louis in 1990 – the University Cheikh Anta Diop (UCAD) of Dakar remained the only national public university in Senegal. The university landscape diversified in 2007 with the opening of three universities: Thiès, Ziguinchor and Bambey. Despite the creation of the three new universities, UCAD remains by far the main research university in Senegal, with more than 80% of all tertiary students in the country still enrolled there, leaving it over-subscribed. This situation creates a number of quality problems and leads, among other things, to problems of security on the campus and ultimately a low employability of the graduates. In addition to the universities, the University Hospital (CHU) of Dakar Hann and a number of high schools have visible and internationally recognised laboratories (such as the bacteriology and virology laboratories).

In addition to at the Institutes of Higher Education, public research is also conducted in several national research institutes. The most important research institutes are the Senegalese Institute for Agricultural Research (ISRA), the Food Technology Institute (ITA), the Renewable Energy Research Institute (CERER), the National Institute of Pedology (INP) and the Ecological Monitoring Centre (CSE). Research activities were started at the Ecotoxicological Research Centre for the Sahel (CERES) and of the Entomology and Nematology of the Directorate for Plant Protection of the Ministry of Agriculture. In addition, Senegal has created two agencies aiming at promoting applied research, the use of research results and technological innovation: the National Agency for Applied Scientific Research (ARESA) and the Senegalese Agency for Technological Innovation (ASIT).

In relation to bilateral and multilateral cooperation, Senegal hosts several African centres and regional representations of foreign or multilateral funding, as well as research programmes. Among the most important are the Dakar Regional Office of the World Bank, the UNESCO Regional Bureau for Education (BREDA) and the Regional African Centre for Technology (CRAT). Several international or foreign institutions carry out research activities in Senegal in partnership with Senegalese institutions. The most important of these are the French Research Institute for Development (IRD),

the French Agricultural Research for Development (CIRAD), the Pasteur Institute of Dakar (IPD)<sup>2</sup> and a research team of the Africa Rice Centre (AfricaRice) based in Saint Louis.

According to the latest available figures (MESR, 2012), the total number of R&D personal in Senegal is 10 648, of which 8 170 are researchers, 605 technicians and 1 869 support personnel<sup>3</sup>. Only one fifth of the researchers are PhD holders. The density of researchers is 635 per million inhabitants. In 2010, and in accordance with the recommendations of the Organisation of the Islamic Conference (OIC), Senegal subscribed to the objective of reaching 1 441 researchers per million inhabitants. Female participation in research activities is weak at 25% of R&D personnel. 99% of Senegalese researchers work in the public sector, of which 97% are in higher education institutions and 2% in research institutes. More than half of all researchers (57.1%) are working in the fields of social and human sciences (50.7% in social sciences alone), with 19.6% in health sciences and 18% in natural and exact sciences. Engineering, technology and agricultural sciences are significantly underrepresented.

## **1.2. Governance**

Since independence, Senegal has gradually put in place a governance system for science and technology. Since 1960, an office for the coordination of S&T research was established at the level of the Presidency. In 1966, an executive-level Office of Scientific and Technological Affairs was created. It was then supplanted in 1970 by the Direction of Scientific and Technological Affairs, which reported to the Secretariat of State to the Prime Minister in charge of the Planning. In 1973, the *Délégation Générale à la Recherche Scientifique et Technique* (DGRST) was created and linked to the office of the Prime Minister. In 1979, the DGRST was transformed into the Secretariat of State for Scientific and Technological Research (SERST), which became the Ministry of Scientific and Technological Research (MRST) in 1983. After the ministerial reconfiguration in 1986, MRST was dissolved and replaced by the new Directorate of Scientific and Technological Affairs (DAST) created within the Ministry of the Plan and of Cooperation. DAST was later moved, first to the Ministry of National Education and then to the Ministry of State Modernisation and Technology. With the nomination of a delegate in charge of S&T research in 1992, the situation regressed to what it was in 1970.

The establishment of Ministry of Scientific Research and Technology (MRST) in 1994 was a significant step on the part of government. This move was welcomed not only by the national scientific and

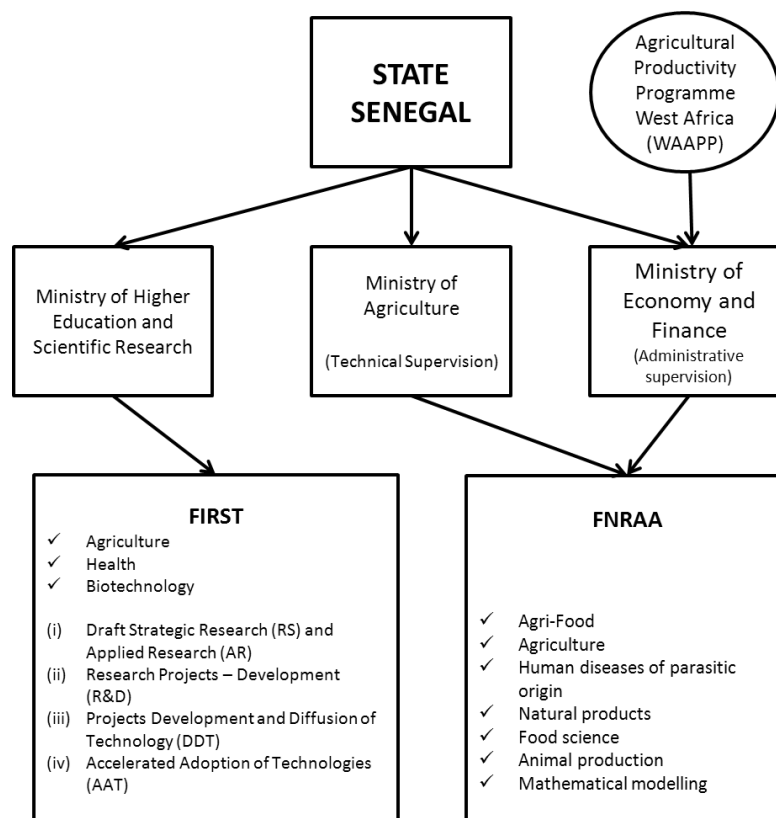
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<sup>2</sup> L'IPD has become a Foundation under Senegalese law since 29 September 2009.

<sup>3</sup> According to the same survey, the full time equivalent figure is estimated to be 5,646. Given the fact that most of them are working in higher education institutions and that the output of Senegalese science is rather low (around 300 indexed publications per year) this figure is probably overestimated.

technical community, but by all those who understand the major role that research plays in the process of economic and social development. Since the change, which took place in March 2000, the Ministry of Scientific Research has survived, being associated with higher education and other sectors such as bio fuels and renewable energy. Today, scientific and technical activities fall under the Ministry of Higher Education and Research (MESR). The Directorate General of Higher Education was created and a Directorate General of Research is in the process of being created.

**Figure 2: Organisation of Senegal's S&T system**



Source: Compiled by author

### 1.3. STI policies

In Senegal, political support for STI will was quickly affirmed with the implementation of numerous inter-ministerial councils (May 1981, September 1982, April 1984, January 1989) which have been especially devoted to this sector. However, several decisions or recommendations remain unimplemented. This is particularly the case regarding expenditure on R&D, which has not reached the targeted 1% of GDP.

The most recent consultation initiated by the government took place in 2013. This was entitled 'National dialogue on the future of higher education' and ran from January to April 2013. Although

the title does not indicate it, this dialogue also focused on issues relating to research. The results of this work have been documented in a report which was presented in Dakar in April 2013. The programme of reforms arising is recorded in a report entitled *Programme 2017 reform priorities 2013: Higher Education and Research in Senegal*. The key reforms that relate directly to research were as follows:

Reforms in favour of strengthening steering of the national system:

- Develop and adopt a framework law for higher education, research, innovation, science and technology presented as an act of structuring orientation with short-and long-term.
- Create National Council of Higher Education, Research, Innovation, Science and Technology (CNESRIST) as a consultative committee to the Minister of Higher Education and Research.
- Establish an Information and Management System for higher education and research (SIGESR).
- Establish a culture of results and continuous assessment
- Establish an appropriate system of performance indicators for the assessment of national research policy, innovation, science and technology.

Reforms to boost national research:

- Develop and adopt a decree on the creation and organisation of the Directorate for Research.
- Establish a National Fund for Research and Innovation (FNRI) to ensure the implementation of priority research.
- Define a strategic research agenda, enshrined in law and specifying research priorities for the next ten years.
- Delineate the functions of researcher and a teacher-researcher.
- Institutionalise evaluation of research through the National Quality Assurance Authority for Higher Education (ANAQ Sup).
- Implement short-term special laboratory equipment of higher education and research initiated by the President of the Republic schools programme.
- Review the decree for establishing and organising the CNRS to adapt to the new strategies
- Establish a National Centre for Scientific and Technical Research (CNRST) that will pool human resources and heavy equipment.
- Establish the status of Professor Emeritus to strengthen supervision for PhD students.

Reforms regarding mechanisms of funding research:

- Respect commitment to allocate 1% of GDP to research in 2017.

#### 1.4. Research funding: increasing national research effort and high foreign dependency

Until recently, Senegal had very limited capacity to produce R&D indicators particularly on research funding. The first official figures to be published on Senegal by the UNESCO Institute for Statistics (UIS) relate to the year 2005. Since 2008, Senegal has participated in the African Science, Technology and Innovation Indicators (ASTII) initiative coordinated by NEPAD. The most recent survey was conducted in 2012. It provides relatively detailed R&D indicators on the year 2011 compiled according to the guidelines of the OECD Frascati Manual.

**Table 1: Gross domestic expenditure on research and development (GERD) per million CFA Francs (2008)**

<b>Gross expenditures on R&amp;D (GERD)</b> <i>Million national currency</i>	<b>Total</b>	<b>Business sector</b>	<b>Government</b>	<b>Higher education</b>	<b>Non-profit organisations</b>
<b>GERD by sector and source of funds</b>	<b>22 080.5</b>	<b>189.4</b>	<b>7 393.6</b>	<b>8 976.6</b>	<b>5 520.6</b>
Business enterprises	892.0	177.4	714.6	0	0
Direct government	12 599.7	0	3 304.1	8 976.6	319.0
General university funds	0	0	0	0	0
Higher education	67.4	0	59.4	0	0
Non-profit organisations	59.4	0	59.4	0	0
Funds from abroad	8 449.7	0	3 248.1	0	5 201.6
<b>GERD by sector and type of costs</b>	<b>22 079.9</b>	<b>189.4</b>	<b>7 393.3</b>	<b>8 976.7</b>	<b>5 520.5</b>
Labour costs	9 685.4	75	2598.3	6 852.1	160
Other current costs	11 653.3	114.1	4 367.1	2 124.6	5 047.2
Land and buildings	31.3	0	31.3	0	0
Instruments and equipment	709.9	0	396.6	0	313.3

Source: UAP-NEPAD, 2010

#### R&D intensity

Expenditure on R&D as a share of gross domestic product (GDP) or R&D intensity is a key indicator of a country national research effort. In 2011, national R&D expenditure for Senegal was estimated to be 35 billion CFAF (USD<sup>4</sup> 71 960 000), or 0.51% of GDP (6 767 billion CFAF or USD 13 912. Although it is still below the recommended target of NEPAD and the Lagos Plan of Action of 1980 (being a target of 1%), it corresponds to a significant relative increase compared to the years 2005 and 2008, for which 0.09% and 0.37 respectively of GDP were estimated to have been spent on research activities.

<sup>4</sup> Currencies converted with exchange rate as was 1 September 2013

### **Funding structure of Senegalese research activities**

Funding of Senegalese research activities has always experienced a foreign dependence. It has been estimated (Fondeville, 1986) that during the 1970s and 1980s, foreign funding accounted for about two thirds of GERD. During that same period, there was a diversification of external financial resources and a relative decline in France's contribution from 59% in 1972 to 35.5% in 1986. This reduction can be attributed to the involvement of the United States (principally USAID) and the World Bank. These two sources accounted for almost one quarter (23.8%) of the funding devoted to research in Senegal, after being practically absent in 1975 (Fondeville, 1986; Gaillard, 1997).

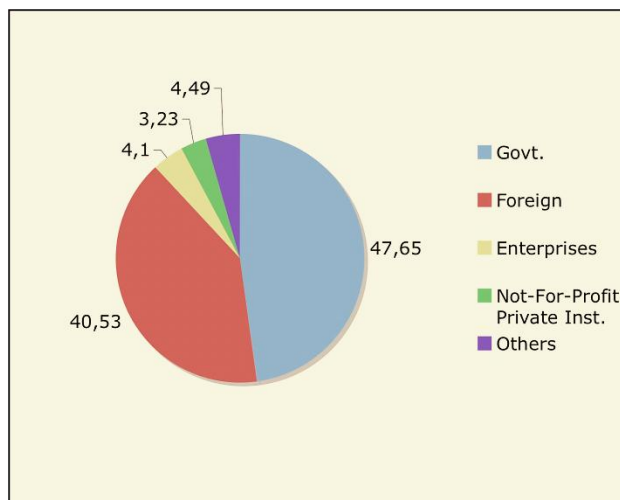
In 1986, the largest proportion of external contributions came from foreign nations (particularly France and the United States), followed (in decreasing order of importance) by the multilateral organisations (especially the World Bank), a group of foreign public organisations (4.3%), and regional organisations, which has made a relatively marginal contribution (0.8%) (Fondeville, 1986). The 1986 study, while not the most exhaustive, reveals no fewer than thirty-nine different sources of funding (*ibid.*)<sup>5</sup>. Private funding (mainly private enterprises not including NGOs) was then estimated to be approximately 1% of research funding (Fondeville, 1986).

The figures from 2011, as illustrated in Figure 3, show a different picture. With 16.5 billion CFAF (USD 33 924 000) and nearly 48% of the total, the Senegalese government's funding is estimated to be the main source of funding, despite a very weak contribution from the universities' budgets. This is followed by foreign funding at 40.53%. Given the difficulty of accessing information about foreign funding provided to different cooperation projects within the Senegalese universities, the total amount of foreign funding is probably underestimated (MESR, 2013a).

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<sup>5</sup> In a larger study comprising all African sub-Saharan countries, Gaillard and Tullberg identified in 2001 more than 300 foreign funding sources.

**Figure 3 Relative importance of funding sources in 2011 (in %)**



The share of government funding should increase further if Senegal is to be in full control of its research agenda. To contribute to this objective, the yet-to-be-launched National Fund for Research and Innovation could be called upon to play a larger role in funding research and innovation activities in Senegal in the future.

With respectively 4.10% and 3.23% of the total respectively, the share from enterprises and non-profit institutes (such as the Pasteur Foundation) has also significantly increased when compared with the reported figures from 1986.

## **2. National funds involved in funding research**

There is a multiplicity of actors involved in funding research activities in Senegal. In addition to foreign sources mentioned earlier, national higher education and research institutions receive an annual budget from the government. This state budget is, however, insufficient and marginally used for research activities, particularly within the higher education institutions.

The first national fund to be created was the Fund to Promote Scientific and Technical Research (FIRST) (*Fonds d'Impulsion de la Recherche Scientifique et Technique*) in 1973 by the Ministry in charge of Research. In the field of agricultural research, a fund was established in November 2008 under the supervision of the Ministry of Economy and Finance and the technical supervision of the Ministry for Agriculture: the National Fund for Agriculture and Agri-food Research (FNRAA) (*Fonds National de Recherches Agricoles et Agro-Alimentaires*). Both of them are presented below.



## **2.1. Fund to Promote Scientific and Technical Research (FIRST)**

### **2.1.1. Background, history and legal status**

Although it was established as early as 1973, FIRST only began to issue annual calls for proposals in 2007. Before that, it was mainly supporting research institutions through institutional grants. Organisational rules for FIRST and modes of operation are defined by a government decree (No. 89-570 signed on 16 May 1989). This decree was modified in 2002 (Decree No. 2002-935 dated 3 October 2002) in order to improve the management of the fund following several evaluation reports and audits carried out.

### **2.1.2. Management and Governance**

FIRST is managed by:

- A Scientific and Technical Commission in charge of reviewing and evaluating research proposals, as well as progress and final reports; and
- An administrative and financial monitoring body presided over by the Minister of Higher Education and Research in relation with the General Administration Service of the Ministry in charge of Research.

### **2.1.3. Objectives, functions and fields**

FIRST is one of the mechanisms created by the Ministry of Higher Education and Research to promote scientific and technological activities. It aims at supporting research projects elaborated by research teams from several institutions or individual research projects within the national priorities as defined by the Ministry of Higher Education and Research.

The main objectives of FIRST are to:

- Coordinate and structuring research activities at the national level
- Promote fundamental and applied research
- Support Senegalese research institutions
- Promote research activities falling within the national priorities
- Improve the quality and pertinence of research results; and
- To improve the research environment.

Research priorities vary from one year to the next. Table 2 summarises the results of the calls for proposals from 2007 to 2012 reveals the main research priorities.

**Table 2: Summary of results of FIRST calls for proposals between 2007 and 2012: Main research areas and number of submitted projects**

Research areas (total number of projects submitted)		Years			
		2007-2008	2009-2010	2011	2012
<b>Agriculture (agronomy)</b>	<b>(85)</b>	08	16	35	26
<b>Food &amp; food science</b>	<b>(22)</b>	04	04	08	06
<b>Bio-energy</b>	<b>(01)</b>	01	-	-	-
<b>Water (environment)</b>	<b>(14)</b>	-	-	-	14
<b>Energy</b>	<b>(26)</b>	-	08	09	09
<b>Environment</b>	<b>(70)</b>	-	26	44	-
<b>Animal products</b>	<b>(01)</b>	01	-	-	-
<b>Natural products</b>	<b>(07)</b>	07	-	-	-
<b>Parasitology</b>	<b>(04)</b>	04	-	-	-
<b>Mathematical &amp; informatics modelling</b>	<b>(23)</b>	04	-	03	16
<b>Health</b>	<b>(51)</b>	-	05	22	24
<b>Material science</b>	<b>(11)</b>	-	04	03	04
<b>Social science and humanities</b>	<b>(37)</b>	-	07	15	15
<b>Other areas</b>	<b>(19)</b>	19	-	-	-
<b>Total</b>	<b>(371)</b>	48	70	139	141

Agriculture and food (including animal products) account for the highest number of project submitted to FIRST during 2007-2012), despite the existence of the National Fund for Agriculture and Agri-food Research (FNRAA). It is also worth noting that the number of applications submitted in agriculture and food increased over the period 2007-2012. Agriculture is closely followed by environment. The third most important research area measured in number of submitted projects is health. These three areas correspond to the disciplinary emphasis of research in Senegal<sup>6</sup> and across Africa, being agriculture, natural resources and medical fields. This emphasis can, no doubt, be linked to the resources available, including trained researchers in these particular fields. If no more research areas were added to the list, it may be argued that these priorities may not necessarily be the best options for the country's development objectives. Other research areas such as energy, material science, and mathematical and informatics modelling are contributing to a diversification of research activities. Social sciences and humanities are also gradually strengthening their capacity to respond to calls for proposals

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<sup>6</sup> A relatively recent study (Gaillard & Kane, 2009) shows that Senegal displays a marked specialisation in agricultural research (with a slight decrease of indexed publications during the recent years), a constant specialisation in medical research and a specialisation in progress in biological sciences. For all other areas of research one can speak of under-specialisation (see figure 5 page 66 in Gaillard & Kane, 2009).

For 2013, the following priorities of FIRST were defined and announced:

- Health
- Natural resource management
- Digital economy
- Food security
- Mobility and sustainable urban systems
- Energy transition
- Agriculture (seeds); and
- Other.

Here again, agriculture, natural resources and health are clearly identified but other important fields of research for Senegal are also being given priority. Unsurprisingly, the highest number of applications has been received in the traditional research emphases for Senegal, such as health, natural resources and food and agriculture (seeds). Thus out of 66 eligible projects (excluding the projects submitted by junior scientists), 49 (or three quarters) were submitted in the above-mentioned areas, whereas five projects were submitted in the fields of digital economy, three on energy transition and three on climate changes. It should be noted that no projects at all were submitted in the field of mobility and sustainable urban systems, both sectors in which much work is required.

#### **2.1.4. Call for proposals, selection and peer review**

A call for proposals is currently made every six months (in November and in April). It is published on the website of the Ministry. Applicants have two months to apply. Application forms can be downloaded from the website or obtained at the Directorate for Scientific Research at the Ministry.

Application forms have to be submitted either by postal delivery at the Ministry postal address or at the e-mail address of FIRST. Only duly completed applications are processed.

Applications are reviewed and evaluated by the Scientific and Technological Commission (STC). The STC is composed of representatives from the Ministry of Research, the universities, institutes of research, the private sector and development services. Members of the STC are nominated by the Minister in charge of Research. The STC can call on external experts whenever necessary. The criteria described in Table 3 are used when evaluating proposals.

**Table 3: Criteria and notes to be applied when evaluating proposals submitted to FIRST**

Criteria	Points	Comments
Academic quality of the applicant (training, academic degrees, publications, participation to scientific meetings, actual situation)	/15	
Partnership quality (quality of the team and of the involved partners; multidisciplinary dimension)	10	
Scientific and technical quality (State of the Art, clarity of objectives and expected results, clarity and realism of work plan, feasibility of proposed methodology and inclusion of ethical aspects)	/40	
Relevance (project interest for science or development; identification of problems to be solved)	/20	
Project impact (social, economic, scientific and financial )	/10	
Budget (budget realism)	/5	
<b>Final mark</b>	<b>/100</b>	

Members of the STC are also involved in following up and evaluating progress reports, financial reports and final reports submitted by the beneficiaries. They are also expected to facilitate the implementation of research results. They should also call upon scientists or experts to facilitate the execution of the projects supported by FIRST. They meet twice a year to allocate research grants. The members of the STC provide a ranking of the submitted projects and the final decision is taken by the administrative and financial monitoring body presided over by the Minister in charge of Research.

For the 2012 year, 141 projects were submitted, of which 80% were found to be eligible. 72 projects were pre-selected and 13 approved for funding. The success rate has decreased significantly between 2007 (25.5%) and 2012 (9.2%). This trend is similar to that in several OECD countries. For instance, the French National Funding Agency has experienced a decrease of its success rate between 2005 and 2012 from 25% to slightly less than 20%. Although not as dramatic as Senegal, it has already begun to discourage French researchers from responding to calls for proposals. While it has been shown that decentralised funding systems may favour intellectual innovation (Whitney, 2003), competition that is too high may discourage potential applicants from applying, particularly where research projects are innovative or risky. The figures may also reflect the tendency of project evaluators' towards risk aversion.

Assuming that the project is relevant and that the requested budget is realistic, there is, in principle, no official maximum amounts for each project. Since 2007, the maximum amount awarded has been 20 119 000 CFAF (USD 41 364) and the minimum 1 481 000 CFAF (USD 3 044). The average amount per project is 12 million CFAF for the period 2007-2012, corresponding to around USD 25 000. This average amount per project has evolved from 9 million CFAF (USD 18 504) to 18 million CFAF (USD

37 000).

The bulk of approved project funding (close to 60%) is going to Senegal's main university: the University Cheikh Anta Diop (UCAD) based in Dakar. This is followed at a distance by the Senegalese Institute for Agricultural Research (ISRA) and two provincial universities (Ziguinchor and Gaston Berger in St Louis). At the end of the list of beneficiary recipients, the Pasteur Institute (IPD) has received two grants and a small-size enterprise received one. Measured in number of mainstream publications, UCAD is by far the leading research institution in Senegal; but other institutions active in the field of health research, such as Dakar University Hospital (CHU Dakar), Dakar Pasteur Institute (IPD) and the Ministry of Health are also productive and visible. The fact that specialised health research institutions (with the exception of UCAD) are receiving very little support from FIRST can be explained by the fact that they are not given priority by FIRST. FIRST consider that they can easily access other funding sources, particularly at the international level.

To prevent problems observed during 2011 (among other things problems related to payments directly to the individual beneficiary) a partnership contract between the Ministry, beneficiaries and their home institutions has been introduced. Since 2012, funds are transferred to the beneficiaries' institutes. Likewise, to allow more clarity and transparency in the use of public funds, all technical and financial reports are being sent to evaluators for comment prior to the disbursement of the remaining instalments.

Priority is also increasingly given to team projects rather than to individual projects. From 2013, junior researchers have also been excluded from the target population. This is an important change in policy since many projects were previously awarded to junior researchers. The fact that only established and senior researchers can apply currently may partly explain the drop in the number of applications submitted during 2013. 96 applications were submitted, with 30 being submitted by junior researchers, leading to 66 eligible applications submitted by senior scientists.

#### **2.1.5. Financing (sources and expenditure)**

FIRST's budget is entirely provided by the Ministry of Higher Education and Research. This budget has steadily increased from 100 million CFAF (USD 205 600) to 911 million CFAF (USD 1 873 016) in 2013. The latest increase is partly due to the fact that FIRST's budget has been merged with a budget of another programme (the Priority Themes Groups).

FIRST is soon to be replaced by a National Fund for Research and Innovation (FNRI). FNRI should be given a more autonomous status in order for it to be able to attract additional funding, in particular from other non-public sources.

### **2.1.6. Performance review**

The programme is subject to an annual financial audit by an external audit firm. All technical and financial reports are also subject to evaluation.

### **2.1.7. Partnerships**

International collaborations (which can be measured by the relative importance of international co-authored publications) have always been important in Senegal. At the end of the last decade, these represented 85% of all publications. Whereas France still keeps its primary position of privileged scientific partner, the United States progressed significantly during the recent past thus taking over the United Kingdom as second scientific partner. In addition to France, several other European countries are among the top ten scientific partners of Senegal: the United Kingdom, Belgium, Switzerland, Italy and Germany. A tangible increase in the number of publications co-signed with other African countries is also to be noted particularly with Burkina Faso.

It can be expected that many FIRST beneficiaries are involved in international collaboration activities with scientists from the above-mentioned countries.

## **2.2. National Fund for Agriculture and Agri-food Research (FNRAA)**

### **2.2.1. Background, history and legal status**

The National Fund for Agricultural Research and Agri-food (FNRAA) is a non-profit organisation. However, it is subject to administrative supervision by the Ministry of Economy and Finance and the technical supervision by the Ministry of Agriculture. FNRAA is partly financed by the Agricultural Productivity Programme in West Africa (PPAAO/PPAAO) and partly by the Senegalese government.

### **2.2.2. Management and governance**

The governance organs of the Fund are: a Steering and Management Committee (CPG), a Scientific and Technical Committee (STC) and a Director General (DG).

The CPG is a legal entity and the governing body FNRAA. It was established 10 November 2008 by Decree 2008.1259. It has the following purposes:

- Developing the overall strategy of the Fund
- Approving the internal regulations of the various committees, manuals, budgets and annual work programmes of the Fund; and

- Deciding on issues, tenders and funding research projects.

The CPG consists of thirty-two (32) members, including 20 voting members and 12 members in an advisory capacity. It is chaired by a representative of producers.

The primary tasks of the STC are:

- Screening and ranking of research proposals based on criteria of scientific quality; and
- Monitoring and evaluation of technical research projects.

It is made up of 15 members (nine national, two from the sub-region, two from the International Centre for Agricultural Research and two from northern countries). It also relies on a group of around one hundred experts, being evaluators from Senegal, the sub-region and the international scientific community.

The Director General's office implements the decisions of the CPG by:

- Preparing and submitting the CPG project budget and annual programme of activities of the Fund
- Providing research teams with the assistance they require for the proper preparation of bidding documents; and
- Implementing the decisions of the CPG.

### **2.2.3. Objectives, functions and fields**

FNRAA's vision is to create the conditions for diverse and sustainable funding for agricultural research in Senegal. It aims to support development partners and end-users of research results by financing agricultural research projects as prioritised by the state.

FNRAA funds four types of research:

- Strategic research and applied research
- Research and development (R&D) projects
- Development projects for the diffusion of technology (DDT); and
- Projects promoting the accelerated adoption of technology (AAT).

For each type of research and project, FNRAA uses different selection, funding and monitoring mechanisms. Funding is allocated either through unsolicited bids, tenders or joint submissions.

Proposals are submitted by research teams working within supervisory structures. The screening committee (TSA) conducts screening proposals with rigour, impartiality and

transparency. Following this process, the TSA issues a reasoned opinion to the CPG. Criteria for selection of projects address:

- The scientific and technical quality of the team and the proposal
- The relevance of the project
- Multidisciplinary approaches and cooperation between different institutions
- The reliability of the financial management of the supervisory structure of the research teams; and
- The proper management of land and sites of experimentation based in both physical locations and laboratories.

During its period of operationalisation, FNRAA has done the following:

- Between 2001 and 2011, 85 projects were funded.
- For Phase 1 of the Agricultural Services and Producer Organisations (PSAOP), it funded 30 research projects.
- With the second phase of PSAOP, seven new projects were funded under the first call and thirteen under the second call.
- Under the Agricultural Productivity Programme in West Africa (PPAAO / PPAAO 1), 35 projects were funded by the private sector, with three projects being funded by the European Union and the African Development Bank, and another three by USAID/ERA.

The FNRAA also sponsors relevant events, being:

- The Grand Prize of the President of the Republic of Science
- Conferences organised by the National Academy of Science and Technology of Senegal
- Scientific Renaissance Days
- International Fair for Agriculture and Animal Resources (FIARA)
- Scientific activities (ISRA, ITA ...)
- Output promotions (EISMV ...); and
- Study tours by universities, producers, research institutions.

Given the small pool of researchers and the lack of proposal writing skills, the FNRAA also invests in capacity building activities. FNRAA has hosted five training workshops on writing projects, five workshops on the development of research results, and a number of regional and sub-regional international scientific visits.

The FNRAA also allows for different national research actors within the agriculture sector to set priorities, allocating resources accordingly. It also encourages research entities to access and finance higher education and coordinate collaborative projects. A priority of the FNRAA is to improve the scientific and technical quality and relevance of research significantly through multi-disciplinary and multi-institutional teams.



#### **2.2.4. Monitoring and evaluation of projects**

Projects funded by the FNRAA are subject to monitoring and evaluation covering both technical and financial aspects. Technical monitoring is done internally on the basis of reports submitted to the Fund and externally by ad hoc FNRAA committees. All projects are subject to a financial audit and a final technical evaluation.

#### **2.2.5. Financing**

FNRAA resources come from various sources, including government grants, contributions from development partners and the private sector, donations and bequests. Most of these resources are used to fund projects. Senegal has received a credit from the International Development Association to finance the West African Agricultural Productivity Programme (WAAPP/PPAAO) Phase 2 (Financing Agreement No. 5135 - SN August 24, 2012). The FNRAA intends to use a portion of this credit to support a public procurement programme during 2013. FNRAA budget for 2013 amounts to 3500 million CFAF (approx. USD 7 million) of which the most important part is coming from a World Bank loan.

#### **2.2.6. Capacity building (training)**

In Africa, including Senegal, researchers involved at institutional level agricultural research and food acquired many results. However, they are undervalued. This is due to a lack of clear policy and proactive in information and communication science, but also a lack of information for researchers. Gaps exist in the following areas:

- Standards for structuring and drafting of various media (articles research, data sheets, catalogues, brochures and extension manuals)
- Insufficient knowledge of writing research proposals
- A lack of understanding of the characteristics of scientific writing; and
- A lack of information on various forms of media to disseminate the results of research.

To help overcome these constraints, the National Fund for Agricultural Research and Agri-food (FNRAA) organised a workshop on utilising the results of research for projects funded under the West African Productivity Programme (PPAAO) in 2012. This capacity building workshop ran over five days and covered development frameworks and extension mechanisms to improve the quality of results dissemination.

### **2.3. Additional funding strategies**

#### **2.3.1. External funding**

Although still heavily dependent on external funding, Senegal is on the verge of having a more balanced research funding structure, with the Senegalese government's funding share approaching 50%. This is a tangible improvement compared to the situation in the 1970s and 1980s when three quarters of the Senegalese budget was dependent on external funding. Foreign funding, although decreasing, remains high and probably exceeds the 40% estimated for 2011. This is based on the evidence inherent in the very high level of international co-authorships of Senegalese mainstream research supported by numerous foreign cooperation schemes, suggesting that many foreign contributions are not accounted in the latest survey on sources of funding for research.

France remains an important research partner and contributor, although its relative contribution has further decreased in recent years. The United States (principally USAID) and the World Bank continue to be important partners. Canada is also very active and present, despite the recent decision to close its regional office in Dakar. Other countries such as the United Kingdom, Belgium, Switzerland, Italy and Germany also partner Senegal but at a lower level. The African Bank for Development and the Islamic Bank for Development are also involved in a few projects.

### **3. Conclusion**

Senegal has at its disposal today a well-developed national system for research and innovation comprising of an extensive higher education sector with five universities, a number of specialised research institutes, a ministry in charge of higher education and research, a newly adopted strategic plan for research and innovation, and two agencies in charge of promoting the use of research results and technological innovation. Senegal also hosts several African centres and regional representations of foreign or multilateral funding, as well as research programmes.

With 635 researchers per million inhabitants, Senegal ranks second in Africa after South Africa. South Africa and Senegal have also one of the highest percentages of PhDs among their R&D staff scoring 32% and 26% respectively. But, despite tangible recent increases, the state budget for research and innovation is insufficient and marginally used for research activities, particularly within the higher education institutions. It is also still heavily dependent on external funding (approx. 40%) even if the Senegalese government's funding share is approaching 50%. The share of government funding and of the national private sector should increase further if Senegal is to be in full control of its research agenda. The 0.51% of GDP allocated to R&D expenditure in 2011, represents a significant increase compared with the previous years but it is still much below the targeted 1% and the overall efficiency of the system is low. This is, among other indicators, illustrated by the number

of scientific papers published by FTE researcher (0.06), which is one of the lowest among the Sub-Saharan African countries.

To become more competitive with respect to scientific and innovation output will require greater investment in funding research and innovation activities and enhanced steering capacities. This could be partly achieved by strengthening national funding programmes in Senegal and by increasing their research budgets. There are currently two national programmes which allocate funds for research activities: FIRST and FNRAA. An important challenge for FNRAA and FIRST is the lack of proactive researchers with a culture and capacity to respond efficiently and rapidly to calls for proposals. Research offices at the various universities and research institutes need to be more involved in preparing their students and staff members for writing successful proposals in preparation for annual calls for proposals. Across the board, there is thus a need for good proposal writing capacities as well as quality research.

FIRST is located within the ministry whereas FNRAA is an autonomous institution. There is little interaction between FIRST and FNRAA. There are, however, plans to establish a national research fund for Research and Innovation (FNRI) in Senegal to replace FIRST. This proposed fund should have a significantly greater chance of success if it is to be given an autonomous status similar to FNRAA and placed outside the ministry in charge of research. A non-public, more flexible status is highly advocated in order to be able to implement procedures more suitable for funding research projects. One of the specificity of FNRAA is that it is trying to position itself equally between the government, research activities performers and end users. A similar approach should be used by FNRI. Yet an important constraint for the effective functioning of the FNRAA is the partitioning between the functions of research, extension and education. If Senegal wishes to enhance S&T and R&D activities, it will be useful to emphasise the synergy of these functions. Specific calls for proposal could be instrumental in enhancing synergies between these functions.

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