Statistical Brief

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Statistical Brief on the National Agricultural Research System

of

MALI

Valentina Mazzucato

ISNAR INDICATOR SERIES PROJECT: PHASE II

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ISNAR INDICATOR SERIES PROJECT PHASE II

Decision making in the agricultural research policy area in either domestic, regional, or international fora can only be aided by access to reliable and comprehensive data on these systems. It is for this reason that ISNAR initiated its Indicator Series Project in 1986. The major objective of this project is to collect, process, and analyze reliable and comprehensive time-series data on national agricultural research systems (NARSs) throughout the world in order to identify and report on major trends and emerging policy issues with regard to the development of NARSs. To this end a database has been developed that contains time-series data on agricultural research expenditures and personnel for more than 150 developing and developed countries. These data provide a quantitative basis for more in-depth research policy studies by ISNAR and others.

During the first phase of the project (1986-91), the Indicator Series project team produced two major publications published by Cambridge University Press, namely:

Pardey, P.G., and J. Roseboom. (1989) *ISNAR Agricultural Research Indicator Series: A Global Data Base on National Agricultural Research Systems*, 547 pp.; and

Pardey, P.G., J. Roseboom, and J.R. Anderson, eds. (1991) *Agricultural Research Policy: International Quantitative Perspectives*, 462 pp..

The first publication is a statistical reference volume that provides system-level data on agricultural research personnel and expenditures for 154 countries. The second publication draws on the database to report on the major policy dimensions of agricultural research, with a primary focus on less-developed countries.

Phase II of the Indicator Series Project was initiated in 1992 and seeks to update the database and the policy analyses that accompany it. New ISNAR survey data are being used in conjunction with a large variety of published and "informal" reports in order to produce reliable as well as up-to-date information and statistics about the NARSs.

The country-level data are being published in a series of NARS Statistical Briefs. These briefs include more detailed descriptive information about the institutional structure of the NARS as well as a more comprehensive set of statistics than were reported in the 1989 Indicator Series volume. It is envisaged the country-level data will be assembled and analyzed in a series of regional research reports.

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Acronyms

AgGDP	Agricultural Gross Domestic Product
CEEMA	Centre d'Enseignement et d'Experimentation du Machinisme Agricole
CFA	Franc de la Communauté Financière Africaine
CFRZ	Centre Fédérale de Recherche Zootechnique de Sotuba
CILSS	Comité Permanent Inter-états de Lutte Contre la Sécheresse dans le Sahel
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CNRA	Comité National de la Recherche Agronomique
CNRST	Centre National de Recherche Scientifique et Technique
CNRZ	Centre Nationale de Recherche Zoo-technique de Sotuba
CRAE	Centre pour la Recherche Agricole et de l'Expérimentation
DAAF	Direction d'Affaires Administratives et Financières
DMA	Division du Machinisme Agricole
DRFH	Division de Recherches Forestières et Hydrobiologique
DRSPR	Division de Recherche sur les Systèmes de Production Rurale
DRZ	Division de Recherche Zootechnique
ENS	Ecole Normale Superieure
FAO	Food and Agriculture Organization
FTE	Full-Time Equivalent
GDP	Gross Domestic Product
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
IDRC	International Development Research Centre - Canada
IEMVT	Institut d'Elevage et de Médecine Véterinaire Tropicale
IER	Institut d'Economie Rurale
IFAN	Institut Français d'Afrique Noire
IFDC	International Fertilizer Development Center
ILCA	International Livestock Center for Africa
INRZFH	Institut National de la Recherche Zoo-technique Forestière et Hydrobiologique
INTSORMIL	International Sorghum/Millet Research
IPR	Institut Polytechnique Rurale
IRAT	Institut de Recherches Agronomiques Tropicales et des Cultures Vivrières
IRFA	Institut de Recherches sur les Fruits et Agrumes
IRCT	Institut de Recherche du Cotton et des Textiles Exotiques
ISH	Institut des Sciences Humaines
ISFRA	Institut Supérieure de Formation pour la Recherche Appliqué
ISNAR	International Service for National Agricultural Research
LCV	Laboratoire Central Vétérinaire
MAEE	Ministère de l'Agriculture, de l'Elevage et de l'Environnement
MDR	Ministère du Développement Rural
NARS	National Agricultural Research System
OICMA	Organisation Internationale Contre le Criquet Migrateur Africain
OMBEVI	Office Malien du Bétail et de la Viande
OMVS	Senegal Valley Development
ONDY	Opération N'Dama Yanfolila
SAFGRAD	Semi-Arid Food Grain Research and Development
SERZ	Station d'Elevage et de Recherche Zoo-technique (Mopti Nord, Sahel, Toronké)
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USAID	United States Agency for International Development
WARDA	West-African Rice Development Association

1. Introduction

The primary purpose of this brief is to provide statistical and institutional details on the development and current status of the public agricultural research system in Mali. This information has been collected and presented in a systematic way in order to inform and thereby improve research policy formulation with regard to the Malian NARS. Most importantly, these data are assembled and reported in a way that makes them directly comparable with the data presented in the other country briefs in this series. And because institutions take time to develop and there are often considerable lags in the agricultural research process, it is necessary for many analytical and policy purposes to have access to longer-run series of data.

NARSs vary markedly in their institutional structure and these institutional aspects can have a substantial and direct effect on their research performance. To provide a basis for analysis and cross-country, over-time comparisons, the various research agencies in a country have been grouped into five general categories; government, semi-public, private, academic, and supranational. A description of these categories is provided in table 1.

Table 1: *Institutional Categories*

Category	Description	Examples
Government	Agencies directly administered by government.	Research department within a ministry
Semi-public	Agencies not directly controlled by government and with no explicit profit making objective.	Research institute under a commodity board
Private	Agencies whose primary activity is the production of goods and services for profit.	Agricultural machinery or chemical company
Academic	Agencies that combine university-level education with research.	Faculty of agriculture
Supranational	Agencies whose mandate covers more than one country.	CGIAR institutes

Note: Adapted from OECD (1981).

The concept of a NARS used throughout this report includes only those institutes that can be classified as government, semi-public, and academic agencies. Where it is useful to do so, private and supranational research agencies have been discussed, but for reasons of comparability they are not included in the NARS data reported here. More detailed information on the definitions and concepts used in this brief is provided in appendix 2.

Section 2 provides a brief description of the institutional development and current structure of the NARS. Section 3 presents a statistical overview of the longer-run investment trends in agricultural research along with a more detailed look at contemporary investment orientations. The appendices provide further descriptive details and present the basic research personnel and expenditure data in disaggregated fashion. For general background information and statistics on Mali we refer to appendix 1.

2. Agricultural Research Institutions

2.1 Historical development[1]

Mali was brought under colonial rule by France in 1893. Two years later the country was integrated into the French West African Federation (Afrique Occidentale Française). The Federation comprised all of France's West African colonies and had its administrative headquarters in Dakar (Europa Publications 1992).

Agricultural research in Mali can be categorized into four distinct phases between the late 1800s and the present, each distinguished by a major reorganization of the agricultural research system.

Late 1800s - 1960

Agricultural research in Mali began with the creation of the Centre pour la Recherche Agricole et de l'Expérimentation in the 1890s. In 1896 the station moved from Kati to Katibougou. For many years it was the only agronomic research and training station in the country. Other agricultural research activities began in the early 1930s when the Office du Niger, which was set up to implement a major irrigation project on the Niger river, established a station for cotton research at Kayo. Prior to 1960, most agricultural research in Mali was conducted or supervised by the Bambey (Senegal) Federal Center for Agronomic Research and the Office du Niger.

Livestock research began in Mali in 1906 when a sheep research station was built near Niafunke. The station undertook sheep breeding for wool production, and its success led to the creation of other such stations at El Houaladji, Gao, Mopti, Nara, and Nioro. In 1927 cattle breeding began at the Sotuba station. In 1950 the Sotuba farm became the Centre Fédérale de Recherche Zootechnique de Sotuba (CFRZ). This center acted as headquarters for livestock research throughout the French West African colonies and supported sub-stations in Senegal and Côte d'Ivoire. In 1939 a small veterinary research unit was created under the livestock service. It was later incorporated into the George Courasson Federal Veterinary Laboratory in Dakar, which opened in 1952.

After World War II, local agricultural research activities were augmented through the creation of specialized French research institutes that operated throughout the various French colonies in the region. In Mali, the Institut de Recherche du Cotton et des Textiles Exotiques (IRCT) conducted cotton research through its research stations at Kogoni (replacing the one at Kayo) and N'Tarla, while the Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux (IEMVT) conducted livestock research at CRFZ de Sotuba.

1960 - 1979

Mali became independent and assumed its present name in 1960. It was one of the few French African colonies that immediately upon independence created a national agricultural research structure which sought to take control of and coordinate agricultural research activities in the country. In 1961 the Institut d'Economie Rurale (IER) was created as an agency within the Ministère de l'Agriculture. It was charged with coordinating the different research organizations as well as all the agencies implementing development projects and conducting

1 This section draws largely from material in Khan (1989) and Institut du Sahel and DEVRES (1984).

evaluation studies of these projects. It did not have a mandate to conduct its own program of research. In order to carry out its coordinating role IER had five sections: research, technical studies, studies on rural development, inspection and information, and documentation. All research structures present in the country at this point in time came under the control of IER. In 1968 IER's mandate was broadened by ministerial decree to include the execution as well as the coordination of research. It was restructured into seven divisions: the Division Administrative, the Division des Etudes Techniques, the Division de la Recherche Agronomique, the Division de la Recherche Zootechnique, the Division d'Enseignement Technique et de l'Enseignement Professionnelle, the Division des Recherches Forestières Piscicoles, and the Division de la Documentation et de l'Information. In addition, IER established a Unité d'Evaluation des Programmes et Projets de Développement in 1975 which became the Unité de Planification et d'Evaluation in 1979. In that same year IER established a new division, the Division de Recherche sur les Systèmes de Production Rurale (DRSPR) that added production systems research to IER's research program. Notably IER was not an autonomous institution but a ministerial department. Its finances were controlled by the Direction d'Affaires Administratives et Financières (DAAF) of the ministry in charge of agriculture.

Although attempts were made to form an organization to oversee research activities at the level of the Presidency through the creation of a Conseil Supérieur de la Recherche Scientifique in 1962 which was replaced by a Conseil National de la Recherche Scientifique et Technique in 1967. This oversight body ceased to function in 1970 for budgetary reasons. IER remained the only agency at the ministerial level coordinating agricultural research.

An agreement with France enabled the existing French research institutions to collaborate with IER after the country gained political independence. IRCT continued to do research in the country under the new system of collaboration. In 1962 another French research institute, the Institut de Recherches Agronomiques Tropicales et des Cultures Vivrières (IRAT) began conducting crops, oilseeds, and legumes research at Sotuba, and rice research at Kogoni in collaboration with IER. In 1963 the Institut de Recherche sur les Fruits et Agrumes (IRFA) began collaborative research on fruits, vegetables, and cash crops at Bamako in 1963 and Farako-Sikasso in 1969.

At independence CFRZ became the Centre Nationale de Recherche Zootechnique de Sotuba (CNRZ) and specialized in cattle breeding for milk production and poultry breeding. About this time IEMVT apparently ceased its program of livestock research in Mali and full responsibility for the execution of livestock research was taken up by CNRZ under IER. In 1966 the Station d'Elevage et de Recherche Zootechnique du Sahel (SERZ/S) was created at Niono and in 1977 another livestock station, called the Station d'Elevage et de Recherche Zootechniques du Toronké (SERZ/T), was established. The livestock research conducted at these IER stations were complemented by an additional three livestock research facilities established independently of IER.

In 1969 the Office Malien du Bétail et de la Viande (OMBEVI) was established to conduct research on the socioeconomic aspects of livestock production, establish overall development strategies for the livestock sector, and enforce quality standards for meat production. The Opération N'Dama Yanfolila (ONDY) began work in 1975 to improve the N'Dama breed of cattle but this project is no longer operational. The Laboratoire Central Vétérinaire (LCV) was created in 1979, with financial and administrative autonomy (établissement public à caractère industrial et commercial), in an effort to increase the national production of livestock vaccines.

LCV took over the operation of a vaccine laboratory that was developed with USAID support soon after independence.

Research on agricultural mechanization was initiated within the Division du Machinisme Agricole (DMA) in 1970 with the establishment of the Centre d'Enseignement et d'Experimentation du Machinisme Agricole (CEEMA) at Samanko. In 1979 the division also opened two regional substations at Kayes and Sikasso, which focus mainly on extension.

In the late 1970s, various international research agencies became active in the country. ICRISAT initiated work in Mali in 1975, concentrating on sorghum research. In 1978 ILCA established a unit in Mali to conduct livestock research. WARDA and IFDC began research on rice and fertilizer respectively in the late 1970s. During this period, the Organisation Internationale Contre le Criquet Migrateur Africain (OICMA) also set up a unit in Mali. A number of regional organizations also conducted research in the country, including SAFGRAD's work on maize research and CILSS's work on integrated pest management, maize, millet, sorghum, and cowpeas. All these regional or international organizations worked in association with IER. In 1976 the West African Farming Systems Research Network was established and was based in the Sikasso and Bougouni regions. Subsequently, USAID established a similar program in Bamako. Furthermore, the USAID-funded INTSORMIL collaborative project and the Tropsoils consortium of American universities conducted research on sorghum and millet. Both the EEC and The World Bank funded large projects on fisheries and groundnut research, respectively, which have subsequently ended. A large component of donor involvement in agricultural research has consisted of farming systems research. Beginning in 1977, this area of work has been primarily funded by USAID, Ford Foundation, the Netherlands, and IDRC. By 1985 over half the donor funding for agricultural research supported farming systems research activities (World Bank 1985).

1980 - 1989

In 1980 the Ministère du Développement Rural (MDR) was partitioned into two ministries: the Ministère de l'Agriculture and the Ministère des Ressources Naturelles et de l'Elevage. IER remained an agency within the ministry in charge of agriculture but in 1981 its animal production, forestry, and fisheries research were placed under a new institution called the Institut National de la Recherche Zootechnique Forestière et Hydrobiologique (INRZFH) which was administered by the Ministère des Ressources Naturelles et de l'Elevage. As a consequence of this restructuring, IER was left with six divisions, of which DRA and DRSPR were the only divisions conducting agricultural research. Thus, IER continued to have dual functions, conducting research as well as coordinating and evaluating research activities. Additionally, in 1981 a Comité National de la Recherche Agronomique (CNRA) was created within IER to review IER's research activities and to set future research priorities within IER. IER currently has seven major stations and numerous substations.

In 1987 the newly created Centre National de Recherche Scientifique et Technique (CNRST) under the Ministère de l'Education Nationale assumed IER's role as coordinator of all research activities in the country.

After it was formed, INRZFH set about reorganizing all research facilities and activities relating to livestock research, except for those of OMBEVI, ONDY, and LCV which were maintained as semi-autonomous institutions under the Ministère des Ressources Naturelles et de l'Elevage. INRZFH had two research divisions: the Division de Recherche Zootechnique (DRZ) and the

Division de Recherches Forestières et Hydrobiologique (DRFH). Each division had four stations although DRZ was much larger in terms of human resources. The pre-existing CNRZ, SERZ/S, and SERZ/T came under the supervision of DRZ. In 1982 a new station was created under DRZ called the Station de Recherche Fourragère de Mopti Nord (SERZ/MN).

During the 1980s IER and INRZFH intensified their collaboration with various international and regional agricultural research organizations. These organizations had expatriate researchers located at a significant number of Mali's research stations, with each organization concentrating on a particular aspect of agricultural research. Some of these stations have now considerably scaled back their operations or ceased to exist after donor support was withdrawn. For example, the station for Senegal Valley Development (OMVS) at Samé conducted research on irrigation and dryland crops as a collaborative venture between Mali, Senegal, and Guinea but it is no longer functioning. The US-funded CILSS laboratory for plant pathology and entomology at Sotuba conducted research on disease and weed control in millet, sorghum, and soybeans but has also drastically reduced its activities since USAID ceased funding CILSS. WARDA financed a rice research station at Mopti but withdrew its funding and personnel in the late 1980s. IER took over the station's management and it is now operated as one of the six regional centers of IER. The Sahelian station for zootechnology at Niono was supported by ILCA between 1976-88 and was subsequently incorporated into IER. It is currently one of IER's six regional centers. Finally, the Cinzana research station, established in 1983 with support of Ciba-Geigy and subsequently also USAID, conducts research on millet and secondary crops. When USAID and ICRISAT ceased funding the station, continued support was provided by Ciba-Geigy and the national government. The station is still operating and is now fully integrated into IER.

Although increased collaboration with regional and international organizations meant that IER and INRZFH had more resources with which to conduct research, it also created a number of different financial management systems within the same institute. At times this led to the perverse situation in which a head of station had the power to disburse funds while the Director General, directly responsible to the administrative office of the ministry, did not. This made managing the research system unduly complicated.

1990 - present

In 1990 the government merged the Ministère de l'Agriculture and the Ministère du Développement Rural into one ministry called the Ministère de l'Agriculture, de l'Elevage et de l'Environnement (MAEE). With this merger came the re-integration of INRZFH into IER. Although IER kept its name, its internal structure was changed (see section 2.2).

In 1992 MAEE was divided into the Ministère de l'Agriculture et de l'Elevage and the Ministère de l'Environnement. But in 1993 these ministries were again merged into the Ministère du Développement Rural et de l'Environnement. Throughout this period IER remained under the ministry in charge of agriculture. There is now an intention to make IER an autonomous institution with its own financial management authority although this has not yet occurred.

Although Mali has no national university, several academic institutions offering education in the agricultural and related sciences were established in Mali during the 1960s under the Ministère de l'Education. Prior to this time CRAE provided some agricultural training and operated the Rural Teachers' Training School of Katibougou. Neither of these two institutions,

however, provided graduate training. In 1962 the Ecole Normale Superieure (ENS) was created in Bamako. It provides training to the BSc level in natural resources, biology, and geography but it does not conduct any applied agricultural research. In 1965-66 the Institut Polytechnique Rurale (IPR) at Katibogou was created under the auspices of UNESCO to train agricultural technicians and scientists. It only very recently (1991) began to provide training at the MSc level. IPR conducts some agricultural research. In addition to IPR, the Institut Supérieure de Formation pour la Recherche Appliqué (ISFRA) was established in 1981 under the Ministère de l'Education Nationale as part of a bilateral agreement between the governments of Mali and The Netherlands. It replaced the pedagogical center of the ENS. Its main purpose is to train teachers for IPR and ENS.

2.2 Present structure

Table 2 presents an overview of the present structure of the national agricultural research system of Mali. IER is by far the dominant component of the system and accounts for over 80% of the FTE researchers working in the Malian NARS.

IER's mandate is (a) to design, manage, and carry out agricultural research programs, (b) to plan and evaluate agricultural development projects, (c) to supervise and coordinate organizations and authorities that conduct research in Mali, and (d) to create, conserve, and protect national scientific assets.

IER now has five departments: the Département de Recherche Agronomique, the largest department, conducts research on food crops, oilseeds, cotton, horticulture, tobacco, and wheat; the Département de Recherche Zootechnique that conducts livestock research; the Département de Recherches Forestières et Hydrobiologiques that is responsible for forestry and fisheries research; the Département de la Recherche sur les Systèmes de Production, which specializes in the adaptation and diffusion of new technologies produced by the DRA; and the Département de la Plannification Agricole et d'Economie Rurale, which plans and evaluates development projects of the MAEE and conducts rural economics research (appendix 3).

Additionally, IER has a Bureau des Services Généraux that is responsible for personnel and financial management, coordinating the training of IER researchers, organizing the distribution of scientific documents, and providing technical, computer, and statistical assistance to IER's departments. It has six Centres Regionaux de Recherche Agricole that were formed by regrouping the experiment stations in the various regions. These centers are Niono, Mopti, Sikasso, Sotuba, Gao, and Kayes. IER also does collaborative research with CIRAD,ICRISAT, and SAFGRAD.

Other government institutions that conduct agricultural research are LCV, which develops and sells livestock vaccinations, diagnoses and does research on animal diseases, and protects human health against animal diseases; OMBEVI, which undertakes livestock research; and the Division du Machinisme Agricole (DMA), which promotes agricultural mechanization and tests and develops new agricultural equipment. All these agencies are under the Ministère du Développement Rural et de l'Environnement.

Not included in table 2 is the Institut des Sciences Humaines (ISH) under the Ministère de la Culture. ISH was established in 1962 as the successor of the Centre de Bamako of the Institut Français d'Afrique Noire (IFAN) and covers areas such as history, geography, linguistics, and ethno-sociology. The geography department may conduct some research that is of relevance to agriculture but no relevant time-series data could be obtained.

Table 2: *Overview of Present Structure of NARS (1991)*

Institutional category	Supervising agency	Executing agency		Research focus	Staffed research sites	Number of researchers			
		Name	Acronym			National	Expats	Total	FTEs
Government	Ministère du Développement Rural et de l'Environnement[a]	Institut d'Economie Rurale	IER	crops, livestock, soils, socio-economics, forestry	7 (7)	234	34	268	268.0
		Division du Machinisme Agricole	DMA	agricultural machinery	3 (3)	10	0	10	6.0
		Laboratoire Central Vétérinaire	LCV	vaccines, animal health, disease diagnosis, protection of human health against animal diseases	1 (1)	23	0	23	11.5
		Office Malien du Bétail et de la Viande	OMBEVI	socio-economics of livestock production, quality and norms of meat production	3 (3)	14	0	14	9.8
Academic	Ministère de l'Education	Institut Polytechnique Rural de Katibogou	IPR	crop and livestock sciences	1 (1)	125	12	137	10.9
		Institut Supérieur de Formation en Recherche	ISFRA	crop and livestock sciences	1 (1)	14	2	16	2.2
Total					*16 (16)*	*420*	*48*	*468*	*308.4*

Source: 0999; appendix 5.
[a] As of 1993.

IPR and ISFRA continue to be the only two institutions in the academic sector that are engaged in any agricultural research. IPR provides training in the applied agricultural sciences including agricultural economics, botany, physiology, entomology, microbiology, environmental sciences, and geography.

International and bilateral donors continue to play an important role in agricultural research in Mali. In 1985 approximately 40% of the country's total agricultural research expenditures were financed by USAID/SAFGRAD/ICRISAT, World Bank, FAO, IFDC, IDRC, The Netherlands, and CIRAD. In addition, ICRISAT continues to provide one sorghum breeder and one agronomist to IER, while farming systems research continues to receive substantial donor support.

3. NARS Statistics

Data between 1985-91 were obtained from questionnaires filled out by DMA, LCV, OMBEVI, and ISFRA. Data prior to 1985 for these institutions, were taken from secondary sources listed in the data sources section of the bibliography. Data pertaining to IER (and INRZFH for the years 1980-90 when it was a separate institution) were taken from the respective institute's annual reports since 1976. Prior to 1976 data were not available for IER. For the remaining institutes data were obtained from personal interviews and follow up with the heads of the various institutions and from secondary sources listed in the bibliography.

The expenditure data presented in this brief are based on the actual expenditures as reported by the various institutes. However, institutes systematically underestimate the degree of donor support to the degree they only have information about the donor support that is channeled through their accounting system. Most importantly they often underreport or fail to report the salaries and supplements paid directly to expatriate researchers. To correct for this problem an implicit cost series was constructed for expatriate researchers (see appendix 2) and, where necessary, this was added to the expenditures reported by the various institutes.

3.1 Long-term Development

Mali differs from most francophone countries in West Africa in that it created a national agricultural research institute, IER, immediately after independence. This means that it is not enough to consider only data from the French tropical research institutes, as is done for other francophone West African countries, to estimate the total amount of human and financial resources devoted to research during the 1960s and early 1970s. Many research activities were conducted by IER separate from the French institutes. Unfortunately, human and financial resource data from the first 15 years of IER's existence are not available. What is known is that the French tropical research institutes that had a permanent presence in the country were IRAT, IRCT, and IFAC. By 1972 these three institutions were spending approximately US$5 million in 1985 PPP terms and collectively had an average of seven researchers in the country between 1961-65 which grew to an average of 16 researchers between 1971-75 (CARIS 1973).

Mali has a relatively large number of researchers compared with other countries in francophone West Africa, second only to Côte d'Ivoire. This high number of researchers translates into a high researcher per farmers ratio (table 3). The number of researchers continued to grow steadily between 1976-90 but declined in 1991 as a result of the merger of IER and INRZFH.

Table 3: *NARS Researcher and Expenditure Series, 1976-91*

	1976-80	1981-85	1986-90	1991	annual growth rate[a]
					%
Researchers (FTEs)[b]	175.6	261.2	325.6	308.4	5.9
Expenditures (million 1985 CFA per year)	2,781	3,333	2,765	2.937	-0.2
Expenditures (million 1985 PPP dollars per year)[c]	21.009	25.186	20.890	22.194	-0.2
Expenditures per researcher (1985 PPP dollars per year)[c]	123,000	98,000	64,000	72,000	-5.8
Number of farmers (millions)	1.9	2.1	2.3	2.4	1.9
Researchers per million farmers	93.2	127.1	142.9	127.7	3.9
AgGDP (million 1985 PPP dollars)[c]	1,818	1,699	2,092	2,205	1.5
Expenditures as a % of AgGDP	1.00	1.27	1.02	1.04	-0.1

Source: Appendices 5 and 6.
[a] Least squares growth rate for the period 1976-91.
[b] Full-time equivalent. [c] For definition of PPP dollars see appendix 2.

The financial support to research has not been commensurate with the substantial number of researchers so that the amount of support per scientist in Mali is low compared with other West African countries. Furthermore, expenditures per researcher declined rapidly after 1976 at an average rate of 5.8% per year.

Agricultural research expenditures as a percentage of AgGDP have been around 1% over the past two decades. In 1983 they peaked at about 1.5% because of relatively high research expenditures in that year in combination with a low AgGDP as result of severe droughts. Lately, however, the intensity ratio has leveled off to about 1%.

3.2 Human Resources

Degree and Nationality Status of Researchers

Table 4 disaggregates researchers according to their educational status and nationality. The research institutions are partitioned into academic and governmental agencies. Within the governmental organizations there is a further differentiation between IER/INRZFH and research staff from other governmental agencies. IER/INRZFH categorize their research personnel by salary levels (catégorie A, B, C) which do not necessarily correspond to educational status.

Overall, Malian institutions have had a few number of expatriate personnel relative to national personnel compared with other francophone countries in West Africa. This cannot be attributed to a lack of donor support, as financially Mali has benefitted from donor-funded projects as much as other countries in the region. One explanation may be that Mali was one of the first countries to establish a national agricultural research system and therefore has had more time to develop its national human resource capacity than most other NARS in the region. Given the lack of local training capacity, most Malian researchers have been trained overseas, mainly in Europe and the United States.

Table 4: *Educational and Nationality Status of Researchers, 1976-1991*

Institutes	Researcher status	1976-80	1981-85[a]	1986-90	1991
			(full-time equivalent)		
IER (incl. INRZFH)	Nationals				
	PhD	na	na	na	na
	MSc	na	na	na	na
	BSc	na	na	na	na
	Subtotal	121.4	199.0	258.8	234.0
	Expatriates	27.6	23.6	31.4	34.0
	Total	*149.0*	*222.6*	*290.2*	*268.0*
DMA, LCV, and OMBEVI	Nationals				
	PhD	na	4.9	6.0	7.3
	MSc	na	3.1	9.7	12.0
	BSc	na	6.3	8.5	8.0
	Subtotal	na	14.3	24.2	27.3
	Expatriates	na	1.5	1.4	0.0
	Total	*7.4*	*15.8*	*25.6*	*27.3*
IPR and ISFRA	Nationals				
	PhD	na	na	na	na
	MSc	na	na	na	na
	BSc	na	na	na	na
	Subtotal	na	4.8	8.0	10.5
	Expatriates	na	1.0	0.8	1.0
	Total	*3.6*	*5.7*	*8.8*	*11.6*

Source: See appendix 6.
Note: Disaggregated personnel data for ISH were not available.
[a] Figures for DMA, LCV, and OMBEVI are for 1985 only.

The number of national researchers working for IER/INRZFH peaked during the late 1980s but has since declined in line with the reduced funding for research.

In the early 1980s a majority of DMA, LCV, and OMBEVI personnel held BSc degrees. By the late 1980s the staff composition had changed with most researchers now trained to the MSc-level.

The academic sector institutions support few FTE researchers as their main mandate is to teach. All ISFRA research personnel hold PhD degrees.

Gender

Women researchers have not had a large presence in the Malian NARS. In 1990 there were 11 female researchers in IER, constituting less than 5% of the total number of researchers. It is noteworthy that most of the female researchers are below 35 years of age. This gives reason to believe that the share of female researchers may continue to rise in the future. The only other institutions that reported having female researchers were LCV and OMBEVI. Both institutes currently have two female researchers, LCV since 1985 and OMBEVI since 1988. Data for IPR were not available while DMA and ISFRA had no female researchers.

Staff Composition

The number of technicians at IER has kept pace with the growing number of researchers to yield a relatively stable technician per researcher ratio of 0.67 between 1976-91 (table 5). The institute's "other" support category, representing agricultural laborers, watchmen, drivers, and so on, has always been substantial. With the merger of IER and INRZFH in 1990, the administrative and other categories were reported jointly. Staff in all categories declined in 1991.

Table 5: *Staffing Structure, 1976-91*

Institute	Staff category	1976-80	1981-85[a]	1986	1987	1988	1989	1990	1991
					(number of personnel)				
IER	Research	149	153	187	181	172	200	278	268
	Technical	77	107	134	143	138	135	206	200
	Administrative	19	24	28	27	26	27	0	0
	Other[b]	625	297	377	355	354	329	498	424
	Total	*870*	*581*	*726*	*706*	*690*	*691*	*982*	*892*
INRZFH	Research	-	84	102	106	110	115	-	-
	Technical	-	47	45	47	49	51	-	-
	Administrative	-	6	9	9	10	10	-	-
	Other	-	201	192	200	208	216	-	-
	Total	-	*339*	*348*	*362*	*376*	*391*	-	-
DMA	Research	4	5	6	9	10	10	11	10
	Technical	na	na	35	40	40	42	39	34
	Administrative	na	na	6	6	7	7	7	8
	Other	na	na	30	30	30	30	25	25
	Total	*na*	*na*	*77*	*85*	*87*	*89*	*82*	*77*
LCV	Research	4	19	20	24	25	24	23	23
	Technical	na	8	9	10	10	10	10	10
	Administrative	na	12	12	12	12	12	12	13
	Other	na	28	28	28	28	28	28	29
	Total	*na*	*67*	*69*	*74*	*75*	*74*	*73*	*75*
OMBEVI	Research	4	9	11	13	12	16	14	14
	Technical	na	32	35	35	35	32	34	34
	Administrative	na	8	6	6	6	6	11	8
	Other	na	30	10	11	9	8	8	6
	Total	*na*	*79*	*62*	*65*	*62*	*62*	*67*	*62*

Source: 0999.
[a] 1985 for LCV and OMBEVI.
[b] Includes administrative personnel for the years 1990 and 1991.

INRZFH's technician per researcher ratio was a little lower than IER's, averaging 0.5 during its period of existence (1981-89). The ratio of "other" support to researcher, however, was considerably larger than for IER during the 1980s. DMA and OMBEVI have had technician per researcher ratios averaging four and three technicians per researcher, respectively, which is high by local standards. This may reflect the fact that both institutes also undertake extension and some disease prevention work, which is performed by technicians rather than research staff. OMBEVI has reduced its staff in the "other" category. In contrast, LCV's work is more heavily

oriented towards research rather than extension and has a lower technician per researcher ratio than either DMA or OMBEVI.

3.3 Financial Resources

Expenditures

The government sector accounts for the overwhelming majority of research expenditures in Mali, although recently the share of total expenditures going to the academic sector has grown (table 6). Between 1981-84 IER experienced a large increase in donor-funded projects. Some of the largest such projects include the renovation of the rice research station at Kogoni with Dutch financing amounting to approximately 300 million FCFA, and the establishment of the Cinzana research station with support from USAID and Ciba-Geigy. Both of these projects involved sizeable capital investments and thus an increase in IER's overall amount of expenditures.

Table 6: *Agricultural Research Expenditures, 1976-1991*

Institutional category	1976-80	1981-85	1986	1987	1988	1989	1990	1991
				(millions 1985 CFA)				
Government	2,723	3,260	2,863	2,503	2,659	2,825	2,575	2,812
Academic	57	74	69	61	81	85	103	125
Total	2,781	3,333	2,932	2,564	2,740	2,910	2,678	2,937
				(millions 1985 PPP dollars)				
Total	21.009	25.186	22.154	19.374	20.703	21.984	20.234	22.194

Source: See appendix 6.

Factor Mix

Personnel costs account for the largest share of expenditures for all institutions (table 7). Notably, OMBEVI spends up to 90% of its total expenditures on personnel except in years when large capital investments are made.

IER currently commits over 30% of its total expenditures to operating and maintenance costs. This reflects the fact that it was created in the early 1960s and has already undergone a period of heavy capital and infrastructural investments. Reported training expenditures for IER are relatively low due in part to the different accounting systems used by various donor-funded projects which sometimes treat training expenses as capital costs.

DMA built new facilities in 1986 and spent 63% of its total expenditures on capital in that year, otherwise most of its expenses are personnel costs. Capital expenditures have accounted for a significant share of LCV's expenses in the late 1980s. Notably, DMA and LCV are the institutes that invest the largest share of resources into training personnel.

Table 7: *Cost Categories*

Institute	Cost category	1976-80	1981-85[a]	1986	1987	1988	1989	1990	1991	1992
						(percentages)				
IER	Personnel	50	42	40	42	42	37	42	37	39
	Operating	34	37	43	36	38	30	38	30	32
	Training	0	0	1	1	1	1	1	1	1
	Capital	16	21	16	21	19	32	19	32	28
	Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*
INRZFH[b]	Personnel	-	59	na	na	na	na	na	na	-
	Operating	-	14	na	na	na	na	na	na	-
	Training	-	0	na	na	na	na	na	na	-
	Capital	-	27	na	na	na	na	na	na	-
	Total	-	*100*	*na*	*na*	*na*	*na*	*na*	*na*	-
DMA	Personnel	na	na	29	72	72	68	49	66	57
	Operating	na	na	3	15	15	19	14	21	20
	Maintenance	na	na	2	6	4	5	7	7	8
	Training	na	na	3	2	2	2	3	3	8
	Capital	na	na	63	5	7	7	27	4	8
	Total	*na*	*na*	*100*	*100*	*100*	*100*	*100*	*100*	*100*
LCV	Personnel	na	51	18	18	32	40	41	35	na
	Operating	na	24	28	11	22	23	33	16	na
	Maintenance	na	3	2	4	7	8	5	4	na
	Training	na	22	16	3	2	6	3	0	na
	Capital	na	0	35	64	37	23	18	45	na
	Total	*na*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*na*
OMBEVI	Personnel	na	53	61	83	91	83	68	40	na
	Operating	na	5	7	5	4	4	4	2	na
	Maintenance	na	8	6	4	3	3	3	3	na
	Training	na	0	0	0	0	0	0	0	na
	Capital	na	34	26	9	2	9	26	55	na
	Total	*na*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*na*

Source: 0999 and IER.
[a] 1982-83 for INRZFH and 1985 for LCV and OMBEVI.
[b] Although IER and INRZFH were merged in 1990, financial data continued to be reported separately until 1991.

Source of Funds

Donors play a major role in funding Mali's agricultural research institutions. The donor share of total funds going to IER increased during the 1980s with a corresponding decline in the government's share of funding. Available data for INRZFH indicates that its funding came mainly from government sources (table 8).

Table 8: *Source of Funding*

Institute	Source of funding	1976-80	1981-85	1986	1987	1988	1989	1990	1991	1992
						(percentages)				
IER	Government	49	43	36	35	33	30	33	30	38
	Donor	51	57	64	65	67	70	67	70	62
	Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*
INRZFH	Government	-	83	na	na	na	na	53	na	-
	Donor	-	17	na	na	na	na	47	na	-
	Total	-	*100*	*na*	*na*	*na*	*na*	*100*	*na*	-
DMA	Government	na	na	18	56	56	58	39	66	47
	Sales & Taxes	na	na	9	29	29	30	20	34	24
	Donor	na	na	73	14	14	12	41	0	29
	Total	*na*	*na*	*100*	*100*	*100*	*100*	*100*	*100*	*100*
LCV	Government	na	17	6	7	14	15	31	23	na
	Donor	na	83	94	93	86	86	69	77	na
	Total	*na*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*na*
OMBEVI	Government	na	66	74	91	84	91	74	45	na
	Donor	na	34	26	9	16	9	26	55	na
	Total	*na*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*na*
ISFRA	Government	-	na	73	81	60	50	54	54	24
	Donor	-	na	27	19	40	50	46	46 76	
	Total	-	*na*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: 0999 and IER.

Of all the institutes, LCV receives the largest share of its funding from donors while OMBEVI had the largest share of its funds coming from government sources. DMA also receives a portion of its funding from sales and taxes.

ISFRA's funding sources vary markedly according to the resources that faculty are able to obtain from foreign institutions. Donor support has fluctuated from 19% of total funding in 1987 to 76% in 1992.

3.4 Research Focus

IER accounts for the largest number of Malian FTE researchers and most of its, and therefore the country's, researchers focus on crop production problems. The second largest research focus is livestock with 32.3% of total FTE researchers. Forestry receives fewer resources and fisheries still less. The other category, which accounts for 19.8% of the country's FTE researchers, includes research that could not otherwise be allocated to a specific commodity or commodity group. For IER this category includes mainly farming systems research which is especially relevant for crops and livestock.

Table 9: *Research Focus, 1991*

Research focus	IER	DMA	LCV	OMBEVI	IPR[a]	ISFRA	Total FTE	Total Share
			(full-time equivalents)					*%*
Crops	112.6	2.8		1.5	4.5		120.7	39.1
Livestock	75.0	1.4	12.0	8.5	3.7		99.5	32.3
Forestry	18.8	2.1			0.8		21.4	6.9
Fisheries	5.4				0.2		5.6	1.8
Other	56.2	0.7			2.7	2.6	61.2	19.8
Total	*268.0*	*7.0*	*12.0*	*10.0*	*12.0*	*2.6*	*308.4*	*100*

Source: 0999.
Note: The other category include research that could not otherwise be allocated to a specific commodity or commodity group.
[a] Since no information was available other than that IPR covers all aspects of agricultural production, the breakdown of the IPR research focus has been constructed on the basis of the breakdown of the other institutes.

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Appendix 1: Country background information

Geography

Area: 1,24.0 million ha
Location: land-locked West-African country, in the south bordered by Ivory Coast and Burkina Faso, in the west by Niger, towards the north by the Algerian desert, and in the west by Mauritania, Senegal and Guinea.

Agroecological features: the northern desert portion is almost totally bare of vegetation; the sub-desert (Sahel zone) taken in by the loop of the Niger and the central Delta has a low rainfall (300-500 per annum); there is some sparse vegetation which makes it a livestock area. The rest of the area is divided between the central or Sudan zone (dry savanna) with average rainfall of 600-1,000 mm per annum and the southern or Guinea zone (humid savanna) with average rainfall of about 1,300 mm per annum.

Population

Total (1991): 8.7 million
Annual growth rate (1981-90)[a]: 2.6%
Literacy (1990): 32.0%
Life expectancy (1991): 48 years

Economy *(values reported in 1985 PPP dollars)*

Gross Domestic Product (1991): 4,832 million dollars
Per capita GDP (1991): 555 dollars

Agricultural GDP (1991): 2,205 million dollars
Share of agriculture in GDP (1991): 45.6%

Annual growth rates (1981-90)[a]
GDP: 2.8%
GDP per capita: 0.3%
AgGDP: 3.1%

Trade *(values reported in current dollars)*

Net surplus total trade (1991): -180 million dollars
Net surplus agricultural trade (1991): 153 million dollars
Percentage of agricultural imports in total imports: 28.2%
Percentage of agricultural exports in total exports: 91.7%
Major agricultural import commodities (1991)[b]: rice (41%), refined sugar (23%), wheat (9%), concentrated milk (9%) and dry milk (8%)
Major agricultural export commodities (1991)[b]: cotton lint (67%), bovine cattle (20%) and sheep & goats (9%)

Agriculture

Agricultural land (1990): 32.1 million ha
Annual growth rate (1981-90)[a]: 0.02%
Percentage arable: 6.5%
Percentage permanent crop: 0.0%
Percentage permanent pastures: 93.5%
Percentage irrigated arable and permanent cropland: 9.8%

Economically active agricultural population (1991): 2.4 million
Annual growth rate (1981-90)[a]: 2.1%
Percentage in total economically active population: 80.3%

Fertilizer use per ha arable land (1990): 7.3 kg
Annual growth rate (1981-90)[a]: 1.4%

Major crops (in order of importance): cotton lint, millets, sorghum, paddy rice and groundnuts

Sources: Europa Publications (1992), FAO (1993), and World Bank (1992).
[a] Least squares growth rate.
[b] Bracketed percentages represent value share of the respective total.

Appendix 2: Definitions and concepts

NARS

The construction of quantitative and internationally comparable expenditure, personnel, and related measures of a national agricultural research system (NARS) requires a precise idea of what, in fact, is being measured. Since the term NARS is subject to a variety of interpretations, it is necessary to define rather precisely the NARS concept used here. Our approach adheres, wherever possible, to the internationally accepted statistical procedures and definitions developed by the OECD and UNESCO for compiling R&D statistics (OECD 1981 and UNESCO 1984). For statistical purposes a NARS is defined in terms of the following characteristics:

(a) *National*. The concept of a "national" system used in this report refers to domestically targeted research activities funded and/or executed by the *public* sector of a particular country. A relatively broad concept of the public sector is taken to include government, semi-public, and academic research institutes. However, private, for-profit research as well as the research activities of supranational research agencies that are not executed through national institutes are excluded. Also excluded is research undertaken by short-term development projects.

(b) *Agricultural*. Agricultural research, as defined here, includes crop, livestock, forestry, and fisheries research, as well as research on agricultural inputs, the natural resource base, and socio-economic aspects of primary agricultural production. It excludes, where possible, research concerning the off-farm storage and processing of agricultural products, commonly referred to as post-harvest research and food-processing research. This delineation corresponds with the national accounts definition of the agricultural sector.

(c) *Research*. Research is often performed in conjunction with other activities such as extension, education, and production. To the extent possible, research activities (in terms of expenditures and staff) are differentiated from these other activities. However, if non-research activities were an integral part of an institute's research activities and accounted for less than 20% of the resources of the institute, it was expedient to classify all the activities of the institute as being research-related.

Full-Time Equivalent (FTE)

A full-time equivalent researcher year is taken to be a person who holds a full-time position as a researcher during the whole year. Adjustments to full-time equivalents have only been made when: (a) a research position was part-time; (b) a research position was not filled for the whole year; and (c) if the position explicitly involved tasks other than agricultural research. In the latter case an estimate was made of the time spent on agricultural research. No adjustments were made, however, for vacation or sick leave nor for time spent on administration, meetings, travel or other activities that form part of the normal duties required to support a research endeavor. Following this line of reasoning, professional staff in management positions were classified as researchers.

The degree status of researchers is determined on the following basis: 3-4 years full-time university education (BSc), 5-6 years (MSc), and more than 6 years plus doctorate thesis (PhD). The following is the equivalence between degrees from a French and Unites States system: Diplôme d'Ingénieur des Travaux, des Sciences Appliquées = technician; Licence, Maîtrise = BSc; Diplôme d'Etudes Approfondies, Diplôme d'Ingénieur (Agronome, Vétérinaire, etc) = MSc; Doctorat (de IIIème Cycle, d'Ingénieur, de Thèse Unique ou d'Université), Doctorat d'Etat = PhD.

Expatriate Researcher Costs

Many expatriate researchers working on donor-supported projects in NARSs are paid their salaries and living expenses directly by the donor agency. All (or some substantial fraction) of these costs do not get included in the financial reports of the agricultural research organizations. To calculate these *implicit* costs we took the average cost per researcher in 1985 to be 167,000 "1985 PPP dollars". This figure represents the costs of expatriate researchers working in Niger under USAID contracts as estimated by Mazzucato and Ly (1993) using detailed USAID expense accounts. It includes the costs of salaries and benefits such as housing, shipping, travel to and from country, an so on. This approximation makes the assumption that the personnel-cost for expatriates in Niger is a reasonable proxy for the cost of internationally recruited staff working in the NARSs throughout Francophone West Africa.

Deflators and Exchange Rates

All expenditure figures were first compiled in current local currency units (appendix V). In order to facilitate comparisons over time and across countries these figures are deflated with a local GDP deflator to base year 1985, and then converted to a common currency (US dollars) using the 1985 purchasing power parity (PPP) over GDP. PPPs are synthetic exchange rates that attempt to reflect the purchasing power of a country's currency. The PPPs used here are derived from the Penn World Table (Mark 5), which is based on the benchmark studies of the International Comparison Project (Summers and Heston 1991). For additional information on currency conversion methods in this context see Pardey, Roseboom, and Craig (1992).

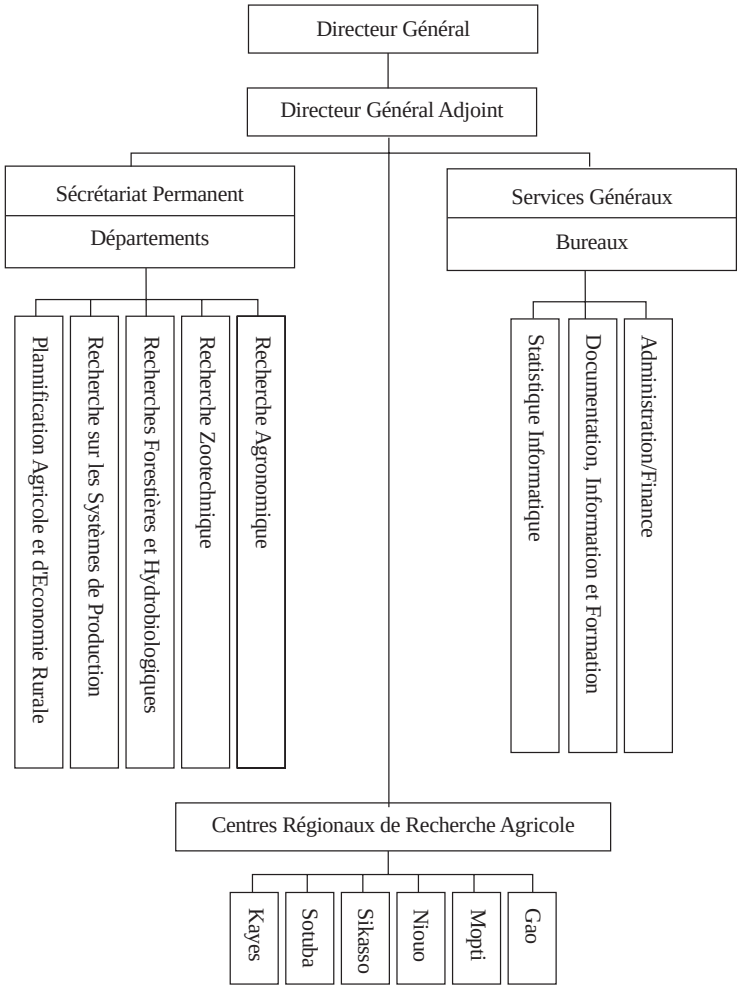
Nomenclature for tables in text

A zero indicates an actual observation of zero, a dash indicates an observation is not relevant (due to institutional mergers, closures, and so on), while “na” indicates an observation that is not available.

In the text we note any marked deviations from these data compilation norms and include points of clarification if warranted.

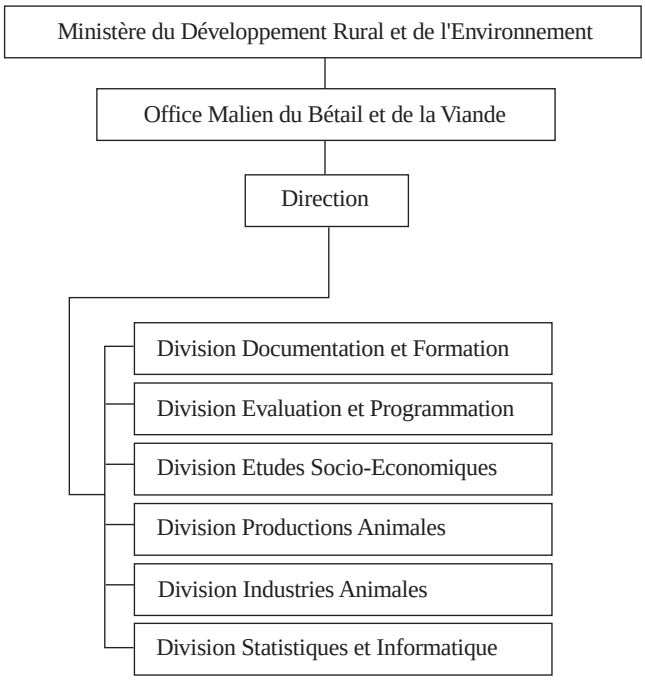
Appendix 3: Organizational charts of the agricultural research institutes

Institut d'Economie Rural (1992)

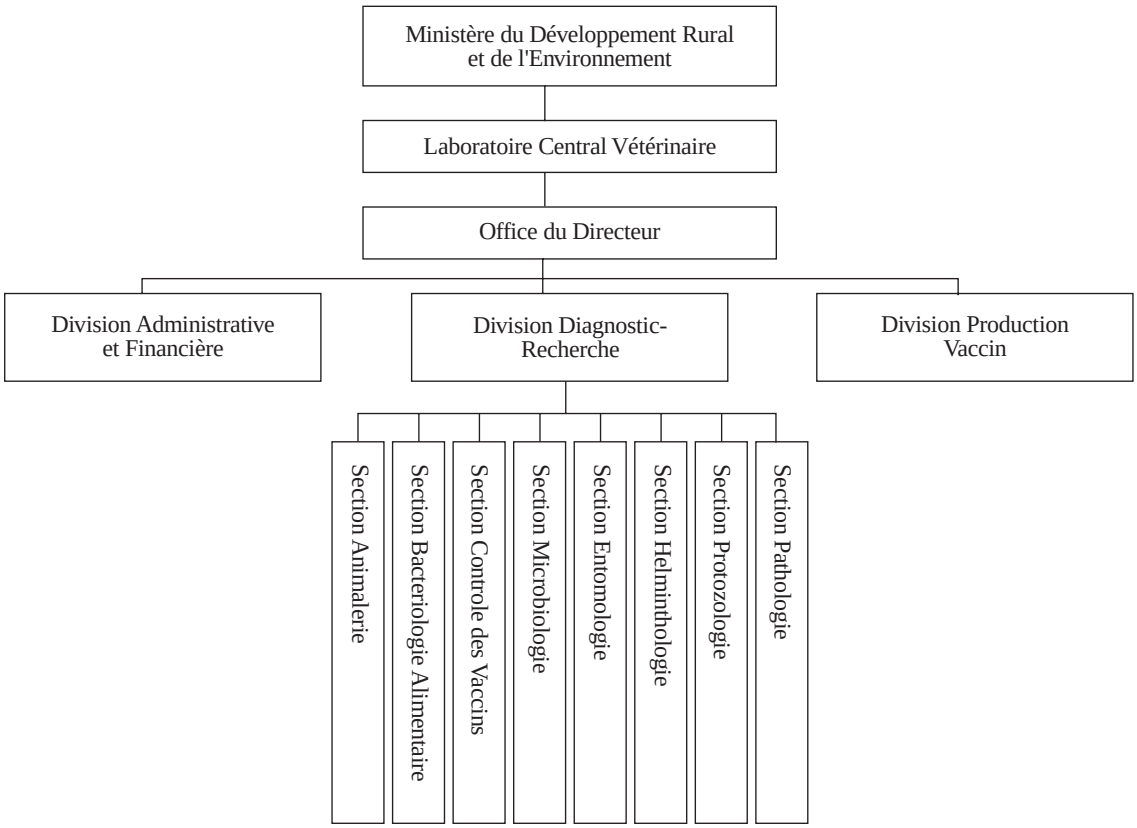


Appendix 3: Organizational charts of the agricultural research institutes (contd.)

OMBEVI (1992)

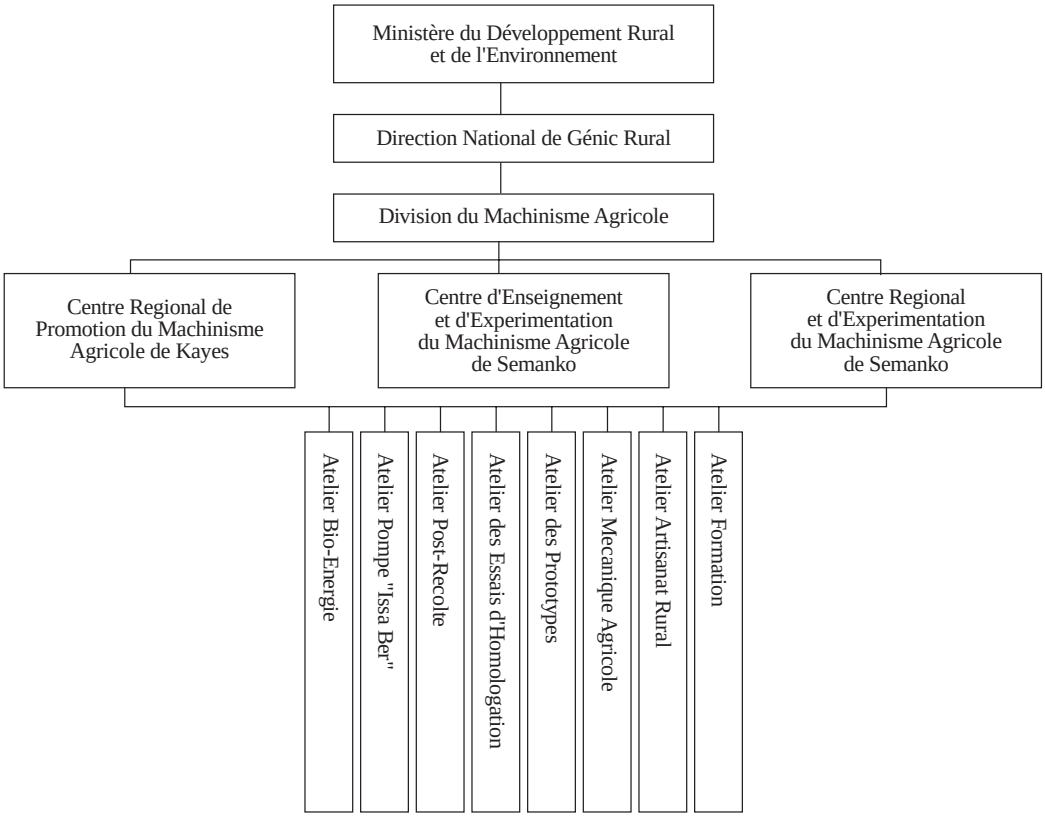


LCV (1992)

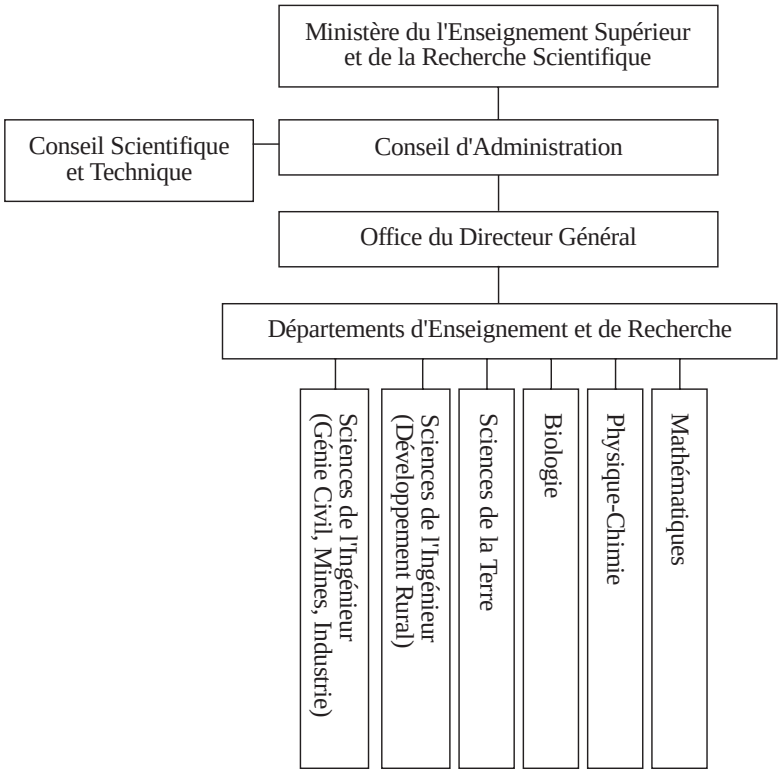


Appendix 3: Organizational charts of the agricultural research institutes (contd.)

DMA (1992)



ISFRA (1992)



Appendix 4: Addresses of the agricultural research institutes

Directeur Général
Institut d'Economie Rural (IER)
B.P. 258
Bamako
MALI

Directeur Général
CNRST
Ministère de l'Education Nationale
B.P. 3052
Bamako
MALI

Directeur Général
LCV
Ministère du Développement Rural et de l'Environnement
B.P. 2295
Bamako
MALI

Directeur Général
OMBEVI
Avenue de la Liberté
B.P. 1382
Bamako
MALI

Chef
Division du Machinisme Agricole (DMA)
Direction Nationale du Génie Rural
Ministère du Développement Rural et de l'Environnement
B.P. 155
Bamako
MALI

Institut des Sciences Humaines (ISH)
Ministère des Sports, des Arts et de la Culture
B.P. 159
Bamako
MALI

Directeur
Institut Polytechnique Rural (IPR)
B.P. 6
Koulikoro
MALI

Directeur
Institut Supérieur de Formation et de Recherche Appliquée (ISFRA)
B.P. 241
Bamako
MALI

Appendix 5a: Researcher totals, 1961-92

Total Number of FTE Researchers

Category	Name institute	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Government	IER																140
	INRZFH (a)																
	DMA																*2.2*
	LCV																
	OMBEVI																*2.1*
Subtotal government																	144.3
Academic	IPR																*2.8*
	ISFRA																
Subtotal academic																	2.8
TOTAL																	147.1
Sources:																	1258
Category	Name institute	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Government	IER	132	149	195	129	128	155	164	153	163	187	181	172	200	278	268	*268*
	INRZFH (a)				*66*	*69*	65	89	93	103	102	106	*110*	*115*			
	DMA	*2.3*	*2.4*	*2.5*	*2.6*	*2.8*	*2.9*	*3.1*	*3.2*	*3.4*	4.5	5.4	5.0	4.5	4.4	6.0	7.0
	LCV			*11.5*	*11.5*	*11.5*	*11.5*	11.5	*10.5*	9.5	10	12	12.5	12	11.5	11.5	*11.5*
	OMBEVI	*2.5*	*2.8*	*3.1*	*3.5*	*4.0*	*4.4*	*5.0*	*5.6*	6.3	7.7	9.1	8.4	11.2	9.8	9.8	*9.8*
Subtotal government		136.7	154.2	212.1	212.7	215.2	238.9	272.6	265.4	285.2	311.2	313.5	308.1	342.3	303.7	295.3	296.3
Academic	IPR	*3.1*	*3.5*	*4.0*	*4.5*	*5.0*	5.8	5.0	*5.5*	*6.3*	7.3	*7.5*	*8.2*	*9.0*	*9.9*	*10.9*	*12.0*
	ISFRA					*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	0.2	0.2	1.2	1.2	2.2	2.2	2.2
Subtotal academic		3.1	3.5	4.0	4.5	5.2	6.0	5.2	5.7	6.5	7.5	7.7	9.4	10.2	12.1	13.1	14.2
TOTAL		139.9	157.7	216.1	217.1	220.4	244.8	277.8	271.1	291.8	318.7	321.2	317.6	352.6	315.8	308.4	310.5
Sources:		1258	1258	1258	1258	1258	979	44	1257	999	741	999	999	999	999	999	999
							1257	1257	1258	1257	1258	1258	1258	1258	1259	1259	
							1258	1258		1258	1260	1260					

Note: Italicized figures represent data that are either constructed or interpolated
(a) For years other than 1980-89, INRZFH data are included within IER..

Appendix 5b: Expenditure totals, 1961-92

Research expenditures — units: millions of current CFA francs

Category	Name institute	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Government	IER																1031.6
	INRZFH (a)																
	DMA																*13.5*
	LCV																
	OMBEVI																*10.6*
Subtotal government																	1055.8
Academic	IPR																*20.5*
	ISFRA																
Subtotal academic (b)																	20.5
TOTAL																	1076.3
GDP deflator		17.7	18.3	18.9	19.8	19.5	19.6	20.9	25.4	26.6	28.1	29.8	31.9	33.5	35.4	42.7	47.4
Constant 1985 FCFA																	2271.8
Constant 1985 PPP dollar																	17.165
Sources:																	1258

Category	Name institute	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Government	IER	1344.7	1553.5	1748.6	1438.5	1882.8	2270.0	2393.7	1534.3	1403.8	1585.6	1509.2	1757.6	2014.2	2536.0	*2760.8*	2961.1
	INRZFH (a)				*273.1*	*308.1*	431.8	449.3	*557.1*	664.9	*649.8*	*704.2*	*742.0*	*792.2*			
	DMA	*15.3*	*17.7*	*20.7*	*23.7*	*26.9*	*29.7*	*33.7*	*39.2*	*45.3*	237.3	78.2	65.4	47.5	58.6	43.7	88.9
	LCV			*118.3*	*128.8*	289.0	289.0	289.0	*202.3*	115.6	265.3	222.1	129.7	108.3	84.0	99.0	na
	OMBEVI	*13.5*	*16.7*	*20.8*	*25.5*	*30.9*	*36.3*	*44.1*	*54.6*	87.7	87.7	62.1	77.3	61.6	69.3	137.2	na
Subtotal government		1373.6	1588.0	1908.3	1889.6	2537.8	3056.8	3209.8	2387.5	2317.3	2825.7	2575.7	2772.0	3023.8	2747.8	3040.7	na
Academic	IPR	*31.6*	*36.4*	*35.7*	*39.6*	*59.1*	*73.7*	*59.3*	*49.6*	*51.5*	*66.1*	*61.5*	*74.0*	*79.9*	*89.9*	*112.4*	na
	ISFRA	*0.0*	*0.0*	*0.0*	*0.0*	*2.4*	*2.6*	*2.4*	*1.8*	*1.6*	*1.8*	*1.6*	*10.8*	*10.6*	*19.9*	*22.7*	na
Subtotal academic (b)		31.6	36.4	35.7	39.6	61.4	76.3	61.7	51.4	53.1	67.9	63.2	84.8	90.5	109.8	135.1	na
TOTAL		1405.2	1624.3	1944.0	1929.2	2599.2	3133.0	3271.5	2438.9	2370.4	2893.6	2638.8	2856.8	3114.3	2857.6	3175.8	na
GDP Deflator		51.0	56.1	62.2	67.7	73.0	76.4	82.6	91.1	100.0	98.7	102.9	104.3	107.0	106.7	108.1	109.3
Constant 1985 FCFA		2755.9	2898.0	3127.5	2849.7	3558.3	4099.8	3961.4	2677.3	2370.4	2932.2	2564.2	2740.1	2909.6	2678.0	2937.4	na
Constant 1985 PPP dollar		20.822	21.896	23.630	21.531	26.885	30.977	29.931	20.228	17.909	22.154	19.374	20.703	21.984	20.234	22.194	na
Sources:		1258	1258	1258	1258	44 1258	44 1257 1258	44 1257 1258	1258	1257 1258	999 1258	999 1258	999 1258	999 1258	999 1070	999	999 1258

Note: Italicized figures represent data that are either constructed or interpolated.
(a) For years other than 1980-89, INRZFH data are included within IER.
(b) Since no reliable estimates of research expenditures were available for the university sector we have assumed that expenditures-per-researcher were indentical to the government sector's average in each year.

Appendix 6: Research staff development by institute

Institute: Institute d'Economie Rurale (IER)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																	
PhD															41		
MSc															32		
BSc															171		
Subtotal	109	104	125	163	106	110	134	141	130	140	156	158	146	174	244	234	
Expatriates	31	28	24	32	23	18	21	23	23	23	31	23	26	26	34	*34*	
Total	140	132	149	195	129	128	155	164	153	163	187	181	172	200	278	268	*268*
Source	1258	1258	1258	1258	1258	1258	1258	1258	1258	1258	1258	1258	1258	1258	1259	1259	

Institute: INRZFH

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																	
PhD											24						
MSc											14						
BSc											60						
Subtotal							63	87	90	100	98	102	*106*	*110*			
Expatriates							2	2	3	3	4	4	*4*	*5*			
Total					*66.0*	*69.0*	65	89	93	103	102	106	*110*	*115*			
Source							1257	1257	1257	1257	1260	1260					

Institute: LCV

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																	
PhD										7	9	9	9	9	9	9	
MSc										2	2	5	5	5	5	5	
BSc										7	7	9	10	9	9	9	
Subtotal										16	18	23	24	23	23	23	
Expatriates										3	2	1	1	1	0	0	
Total				*23.0*	*23.0*	*23.0*	*23.0*	23	*21*	19	20	24	25	24	23	23	
FTE Research				*11.5*	*11.5*	*11.5*	*11.5*	11.5	*10.5*	9.5	10	12	12.5	12	11.5	11.5	
Source								44		999	999	999	999	999	999	999	

Note: Share of time spent on research is estimated at 50%.

Appendix 6: Research staff development by institute (contd.)

Institute: OMBEVI

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																	
PhD										2	1	1	1	4	4	4	
MSc										3	4	6	5	6	5	5	
BSc										4	6	6	6	6	5	5	
Subtotal										9	11	13	12	16	14	14	
Expatriates										0	0	0	0	0	0	0	
Total	*3.0*	*3.5*	*4.0*	*4.5*	*5.0*	*5.6*	*6.3*	*7.1*	*8.0*	9	11	13	12	16	14	14	
FTE research	*2.1*	*2.5*	*2.8*	*3.1*	*3.5*	*4.0*	*4.4*	*5.0*	*5.6*	6.3	7.7	9.1	8.4	11.2	9.8	9.8	
Source										999	999	999	999	999	999	999	

Note: Share of time spent on research is estimated at 70%.

Institute: Division du Machinisme Agricole (DMA)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																	
PhD											0	0	0	0	0	0	0
MSc											4	7	8	9	10	10	9
BSc											0	0	0	0	0	0	0
Subtotal											4	7	8	9	10	10	9
Expatriates											2	2	2	1	1	0	1
Total	*3.6*	*3.8*	*4.0*	*4.2*	*4.4*	*4.6*	*4.9*	*5.1*	*5.4*	*5.7*	6	9	10	10	11	10	10
FTE Research	*2.2*	*2.3*	*2.4*	*2.5*	*2.6*	*2.8*	*2.9*	*3.1*	*3.2*	*3.4*	4.5	5.4	5.0	4.5	4.4	6.0	7.0
Source											999	999	999	999	999	999	999

Note: Share of time spent on research is estimated at 60% for the years prior to 1986.

Institute: Institut Polytechnique Rural (IPR)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																	
PhD							12										
MSc							36				25						
BSc							12										
Subtotal						*52.2*	60	53	*58*	*67*	83	*85*	*94*	*103*	*113*	*124*	*137*
Expatriates						*10.4*	12	10	*11*	*13*	8	*8*	*9*	*10*	*11*	*12*	*13*
Total	*35.0*	*39.3*	*44.2*	*49.6*	*55.7*	*62.6*	72	63	*69*	*79*	91	*94*	*103*	*113*	*124*	*136*	*150*
FTE research	*2.8*	*3.1*	*3.5*	*4.0*	*4.5*	*5.0*	5.8	5.0	*5.5*	*6.3*	7.3	*7.5*	*8.2*	*9.0*	*9.9*	*10.9*	*12.0*
Source							979	44			741						

Note: Share of time spent on agricultural research is estimated at 8%.

Appendix 6: Research staff development by institute (contd.)

Institute: ISFRA

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Nationals																	
PhD											5	8	9	12	14	14	14
MSc											0	0	0	0	0	0	0
BSc											0	0	0	0	0	0	0
Subtotal											5	8	9	12	14	14	14
Expatriates											1	1	2	2	2	2	2
Total											6	9	11	14	16	16	16
FTE research						*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	0.2	0.2	1.2	1.2	2.2	2.2	2.2
Source											999	999	999	999	999	999	999

Other statistical briefs published in this series are:

1. *Statistical Brief on the National Agricultural Research System of Rwanda*, September 1993, by J. Roseboom and P.G. Pardey.

2.* *Statistical Brief on the National Agricultural Research System of Niger*, September 1993, by V. Mazzucato and S. Ly.

3. *Statistical Brief on the National Agricultural Research System of Malawi*, September 1993, by J. Roseboom and P.G. Pardey.

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13. *Statistical Brief on the National Agricultural Research System of Namibia*, September 1994, by N.M. Beintema, P.G. Pardey, and J. Roseboom.

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20. *Statistical Brief on the National Agricultural Research System of Zimbabwe*, March 1995, by J. Roseboom, P.G. Pardey, N.M. Beintema, and G.D. Mudimu.

21. *Statistical Brief on the National Agricultural Research System of Zambia*, August 1995, by J. Roseboom and P.G. Pardey.

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** Also available in French.*