AGRICULTURAL SCIENCE AND TECHNOLOGY INDICATORS

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MADAGASCAR

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This brief reviews the major investment and institutional trends in Madagascan public agricultural research since the early 1990s, drawing directly on a new set of survey data collected through the Agricultural Science and Technology Indicators (ASTI) initiative.[1]

INSTITUTIONAL DEVELOPMENTS

Madagascar is a relatively large island located in Southern Africa. Eighty percent of its population derives their income from the agricultural sector; hence agriculture, and by inference agricultural research and development (R&D), are fundamental to the prosperity of the country's economy. In 2000, the 15 agencies involved in agricultural research in Madagascar employed a total of 206 full-time equivalent (fte) researchers and spent a combined 16 billion 1999 malagasy on agricultural R&D—equivalent to 8 million 1993 international dollars (Table 1).[2, 3]

The National Center of Applied Research and Rural Development (FOFIFA) is the largest research agency in Madagascar, responsible for more than half the total agricultural research spending.[4] It was created in 1974 as a semi-autonomous institute under the Ministry of Rural Development (see *Short History of Government-Based Agricultural Research in Madagascar* on page 2). Over the course of its history, FOFIFA reported to different ministries, but since 1983 it has reported to the Ministry of Scientific Research and Technology for Development (MRSTD). FOFIFA's

Table 1—Composition of agricultural research expenditures and total researchers, 2000

Type of agency	Spending		Researchers[a]	Share		Agencies in sample[b]
	1999 magalasy	1993 international dollars		Spending	Researchers	
	(*millions*)		(*fte's*)	(*percent*)		(*number*)
Public agencies						
FOFIFA	8,842.0	4.4	128.5	55.2	62.3	1
Other government[c]	4,432.7	2.2	49.5	27.7	24.0	6
Nonprofit agencies[c, d]	1,563.1	0.8	15.4	9.8	7.5	3
Higher education[c, e]	656.3	0.3	8.8	4.1	4.3	4
Subtotal	*15,494.1*	*7.7*	*202.2*	*96.8*	*98.1*	*14*
Business enterprises	515.9	0.3	4.0	3.2	1.9	1
Total	**16,010.0**	**8.0**	**206.2**	**100**	**100**	**15**

Sources: Compiled by authors from ASTI survey data (IFPRI –ISNAR–ASARECA 2001–02).
[a] Includes national and expatriate staff.
[b] See note 2 for a list of the 15 agencies included in the sample.
[c] Expenditures for IREDEC and the higher-education sector are estimates based on the average expenditures per researcher of the government agencies combined.
[d] Excludes Ramilamina, which halted its research activities in 1999.
[e] The 32 faculty staff employed in the 4 higher-education agencies spent between 10 and 80 percent of their time on research, resulting in the 8.8 fte researchers.

KEY TRENDS

- Funding for agricultural research decreased severely in the 1990s in real prices (adjusted for inflation) resulting from the high inflation rates of the mid-1990s and the completion of the National Agricultural Research Project (NARP) in 1999.
- The National Center of Applied Research and Rural Development (FOFIFA) is the main agricultural research agency in Madagascar and accounted for more than half of the country's total agricultural research spending and staff in 2000.
- FOFIFA made considerable advances in its infrastructure through NARP, which included establishing a network of regional centers and training its staff. In addition, research staff numbers—mainly affecting nontechnical staff—were more than halved.
- In 2000, agricultural research conducted by the nonprofit sector amounted to nearly 10 percent of total investments in Madagascar, which is high compared with most African countries.

ABOUT ASTI

The Agricultural Science and Technology Indicators (ASTI) Initiative consists of a network of national, regional, and international agricultural R&D agencies managed by IFPRI and ISNAR. The initiative compiles, processes, and makes available internationally comparable data on institutional developments and investments in public and private agricultural R&D worldwide, and analyses and reports on these trends in the form of occasional policy digests for research policy formulation and priority setting purposes.

Primary funding for the ASTI initiative was provided by the CGIAR Finance Committee/World Bank with additional support from the Australian Centre for International Agricultural Research (ACIAR), the European Union, and the U.S. Agency for International Development (USAID).

infrastructure consists of six scientific departments, eight regional centers, and satellite stations throughout the country. As the main agricultural research agency in Madagascar, FOFIFA has an important role in establishing agricultural research policy and conducting research across a wide variety of themes, including crops, livestock, forestry, natural resources, fisheries, postharvest, and social sciences. It also plays a role in training and developing research and technical staff.

Institutional changes—such as the increased participation of the private sector in research and the shift from a supply-driven to demand driven priority-setting research approach to improve the effectiveness of national agricultural policies—led to the instigation of the National Agricultural Research Project (NARP), which was funded through a World Bank loan.[5]

Six other government agencies also perform agricultural research in Madagascar, working on a variety of themes. All these agencies fall also under MRSTD's administrative responsibility. The larger of these, after FOFIFA, are the National Center of Environmental Research (CNRE), the National Center of Applied Pharmaceutical Research (CNARP), the National Center of Oceanographic Research (CNRO), and the National Center of Industrial and Technological Research (CNRIT).

CNRE is responsible for all the research programs that deal with the environment, including biological, social, and economic issues. Its mandate includes applying its research results in ways that support sustainable development. CNARP's mission is to contribute to the health policy by improving access to indigenous medicines, as well as encouraging private-sector development by supporting producers of essential oils. CNRO takes the lead in the establishment, development, and dissemination of a national policy on oceanographic research, directing national oceanographic research programs, and training research personnel. CNRIT's mandate is to contribute to and implement national policy on industrial and agro-industrial development

Two smaller but important government research agencies are the Center of Rural Development and Applied Research (FIFAMANOR) and the Malagasy Institute of Veterinary Vaccines (IMVAVET). FIFAMANOR was established in 1972 as a result of a bilateral agreement between Norway and Madagascar and is the only other government agency under the Ministry of Agriculture and Livestock. Its mission is to promote tubers, dairy products, and wheat, and to establish a social program involving women in several activities such as crop improvement, in-vitro culture, seed production, and artificial insemination. IMVAVET was officially established in 1995 with the goal of diminishing animal diseases and increasing animal productivity through research and vaccines.[6]

Nonprofit organizations, such as the Institute of Research and Application of Communal Development Methods (IREDEC), *Tany sy Fampandrosoana* (TAFA), Fafiala, and Ramilamina are relatively new in Madagascar but have achieved a sizeable combined share of total agricultural research, employing 15 fte researchers in 2000. TAFA, Fafiala, and Ramilamina were established during the 1990s with encouragement from the government given that government funding to agricultural research was becoming increasingly limited and these nonprofit organizations were funded mainly by donors. IREDEC was created in 1986 and its research focuses on methodological approaches to rural development, rural structuring, and communal development. Fafiala conducts research related to the problems of agriculture and natural resources in the central highlands of Madagascar (including forestry), while TAFA mostly conducts soil research and soil-crop management at its various regional locations throughout the country. Ramilamina's research focused mainly on the use of azolla (little plants with nitrogen nodules attached in the roots) for livestock and crops, but research activities ceased in 1999 because the Food and Agriculture Organization of the United Nations (FAO) and other foreign partners preferred that Ramilamina concentrate on technology dissemination only.

The higher-education sector plays only a small role in agricultural research. In 2000, the University of Antananarivo's School of Agronomic Sciences (ESSA) was responsible for more than two-thirds of the research activities in the higher-education sector, employing 25 faculty staff or—adjusted to reflect time spent on research—6 fte researchers. Three

A Short History of Government-Based Agricultural Research in Madagascar

Agricultural research in Madagascar began with the establishment of experimental gardens (*jardins d'essais*) in several parts of the country between 1896 and 1905. After World War I, the gardens evolved into experiment stations, some of which, over time, began to specialize in the country's primary crops, including rice, cassava, coffee, and vanilla. These stations reported directly to the local colonial government After World War II, however, France adopted a more centralized approach to its overseas research activities and established tropical commodity research institutes, which had their headquarters in France and which operated a network of research stations across the French colonies and overseas territories. Several of these tropical commodity research institutes also established themselves in Madagascar and took over the responsibility for agricultural research from the local colonial government. Madagascar attained independence in 1960, but, through several bilateral agreements, France continued to operate the agricultural research stations that were considered part of the French tropical commodity research institutes for another 14 years.

Veterinary research followed a similar trajectory. Veterinary services were established in 1907, and the first veterinary laboratory was founded in the 1920s. Additional research stations were created between 1925 and 1950, and then in the 1960s, all livestock research was transferred to the Livestock and Veterinary Medicine Institute for Tropical Countries (IEMVT). Fisheries and forestry research was initiated in the early 1950s, which was relatively late.

In 1974, agricultural research was nationalized. FOFIFA was established to take over the activities of the local French research centers. This transfer did not happen easily because of strained relations between Madagascar and France at that time. Nonetheless, some collaboration between FOFIFA and the French research centers was maintained. With the creation of the Ministry of Scientific Research in 1983, FOFIFA was restructured. Its mission was revised and administrative and research councils and regional offices were created to strengthen FOFIFA's overall research capacity.

Sources: Roseboom and Pardey (1994); Rasolo (2002); and FOFIFA (2003).

university laboratories that are independent from ESSA also undertake some agricultural research: the Laboratory of Radio-Isotopes, the Laboratory of Vegetable Biology, and the Laboratory of Vegetable Physiology.

We identified two private companies in Madagascar engaged in agricultural research. The Hasy Malagasy was created in 1978 to undertake cotton research, and the Technical Horticulture Center of Tamatave (CTHT) began a research program in 2001 (beyond the scope of our dataset, which runs through 2000 only).

There is a considerable amount of ongoing collaboration among national institutes and international organizations. For example, FOFIFA collaborates with many other agencies in the Eastern and Central African region as part of Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA). The center has a large collaborative project with Center of International Agricultural Research Cooperation for Development (CIRAD) and the University of Antananarivo and is engaged in smaller projects with Cornell University, the International Atomic Energy Agency, and the Ueshima Coffee Corporation in Japan.

HUMAN AND FINANCIAL RESOURCES IN PUBLIC AGRICULTURAL R&D

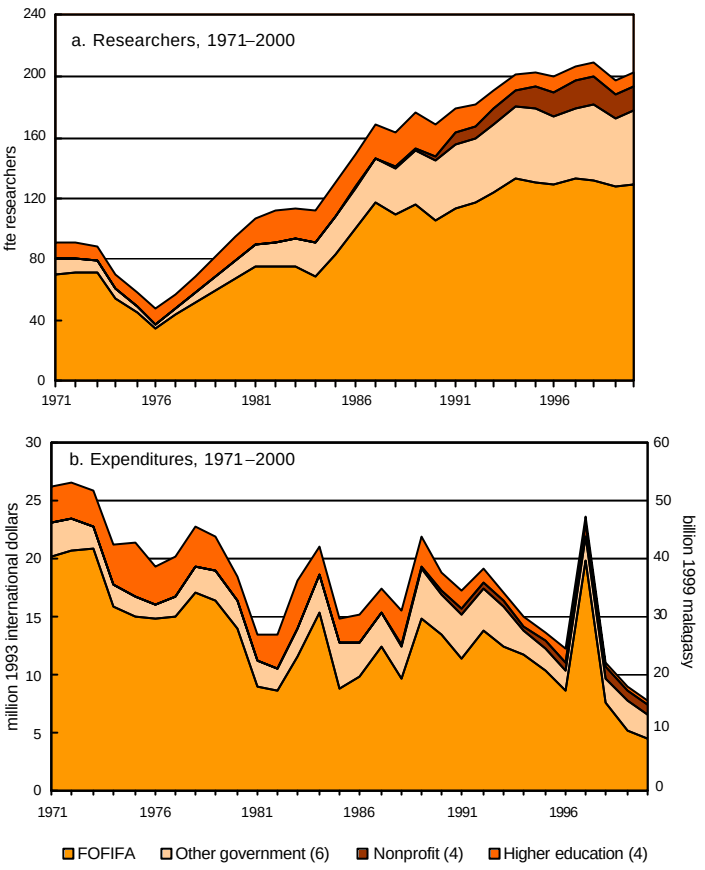
Overall Trends

Our data on public researchers and expenditures cover a 30-year period. A significant discrepancy can be observed in research staff and expenditure trends: overall public research staff grew at 4.7 percent per year, while expenditures decreased by 2.4 percent during 1971–2000.[7] These trends were inconsistent over time. During the mid-1970s, total researcher numbers dropped after the nationalization of research in 1974, when the previous French institutes were dismantled and FOFIFA was created (Figure 1a). At that time, Madagascar had a low number of national researchers, mostly with low-level training. The 1980s and early 1990s were a relatively prosperous period, specifically for the government sector where total researcher numbers grew considerably, but in more recent years the numbers have once again contracted slightly. Relative shares across the institutions have changed since the early 1990s when a number of nonprofit institutions were created. The number of fte researchers employed in the higher-education sector has decreased over the years, causing a decline in the sector's share in total agricultural research staff from 12 percent in 1971 to only 4 percent in 2000—partly the result of a Government restriction on the recruitment of new staff at government and universities.

Public agricultural R&D spending (when adjusted for inflation) decreased dramatically over the past 30 years (Figure 1b). In 2000, total spending was $8 million, less than one-third of the $26 million spent on agricultural R&D in 1971. The declining trend in total spending during the mid-to-late-1970s was the result of the aforementioned nationalization of research in 1974. FOFIFA experienced the largest spending cuts, but expenditures by all the other agencies also dropped. The sudden increase in FOFIFA's expenditures in 1997 was the result of the late disbursement of outstanding funds from the World Bank loan under NARP, which had to be spent in that year.

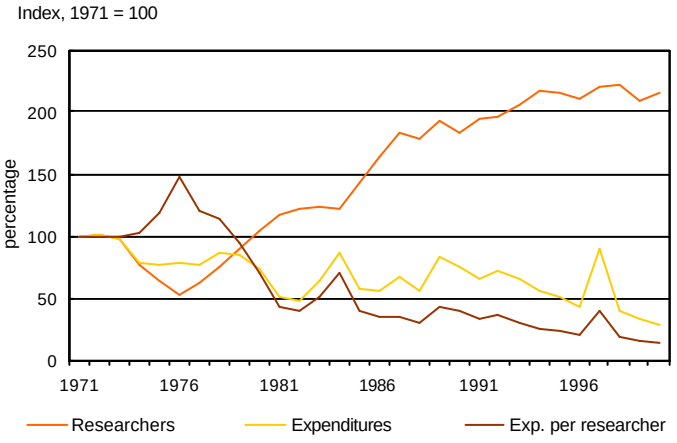
An overall increase in staff numbers and a decrease in expenditures amounted to declining expenditures per researcher, which in 2000 were only about $38,000, considerably lower than the $289,000 in 1971 or the $96,000 in 1991 (Figure 2).

Figure 1¾ Public agricultural R&D trends, 1971–2000



Sources: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02) and Roseboom and Pardey (1994).
Notes: Figures in parentheses indicate the number of agencies in each category. Underlying data are available at the ASTI website (www.asti.cgiar.org). Expenditures for CNARP (the years prior to 1991), NSRC, IREDEC, and the higher-education sector are estimates based on the average expenditures per researcher for the government agencies combined.

Figure 2¾ Long-term public agricultural R&D trends, 1971–2000

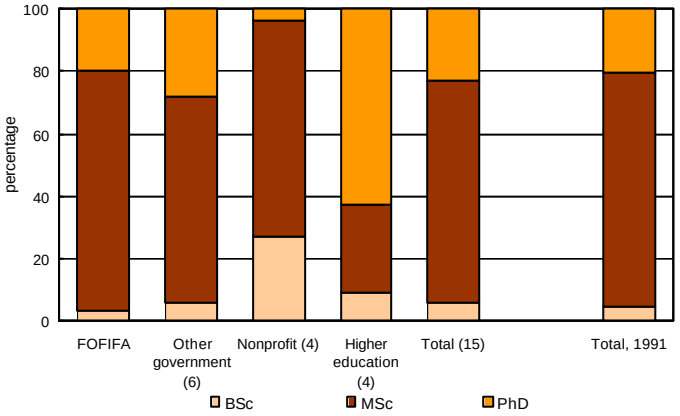


Source: Figure 1.

Human Resources

In 2000, 95 percent of the 194 fte researchers in our sample had postgraduate-level training, with close to a quarter holding doctorate degrees (Figure 3). The nonprofit institutions, combined, employed a lower proportion of researchers holding postgraduate degrees compared with other agencies. IREDEC employed half a fte researcher with PhD training, while the other three nonprofit institutions had no PhD-trained staff. In part, this lower education profile may reflect that the non-profit research agencies operate more at the applied end of the agricultural research spectrum. The overall quality of staff—measured as the share of researchers with PhD and MSc—remained fairly constant throughout 1991–2000: FOFIFA and the other government agencies experienced a combined increase of 5 percent in the share of researchers holding PhD degrees. The slight decline in numbers of postgraduate-trained staff stemmed from the low levels of PhD-qualified researchers at the nonprofit institutions (three of which were established after 1991).

Figure 3¾ Educational attainment of researchers, 2000

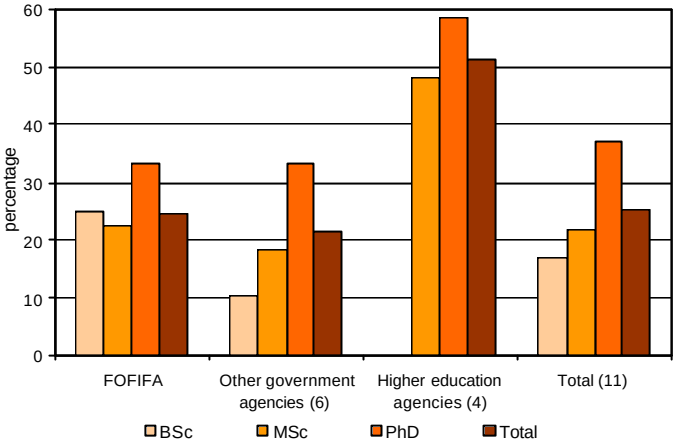


Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).
Notes: Figures in parentheses indicate the number of agencies in each category. Data exclude expatriate staff.

The relatively static education profile disguises the fact that there has been substantial staff turnover and that training of newly recruited research staff is needed permanently. The training that did occur in the 1990s was largely the result of NARP, which included a training component for FOFIFA staff. Forty-seven of a planned 50 researchers received postgraduate training, mostly funded through bilateral agreements and not through the World Bank loan. However, during the late-1990s the Government of Madagascar froze civil service recruitment, affecting FOFIFA, the other government agencies, and the higher-education agencies. Another constraint over the past years has been the relative youth and inexperience of FOFIFA researchers (World Bank 1998). The recruitment restriction was lifted in 2000, but since then new FOFIFA recruits on the whole have been young. Currently FOFIFA is upgrading the educational levels of its young researchers, and has sent them for training (often at the PhD level), mainly funded by the Rural Development Support Project (RDSP) supported by a second World Bank loan.[8]

About a quarter of the research staff at FOFIFA and other government agencies in 2000 was female (Figure 4). For the higher-education agencies, nearly half the research staff was female that year. In terms of degrees, a third of the researchers at the government agencies holding PhD degrees and approximately 20 percent of those holding MSc degrees were female. At the higher-education agencies, a much higher share of higher degree holders were female; approximately 60 percent of researchers holding PhD degrees and close 50 percent those holding MSc degrees were female.

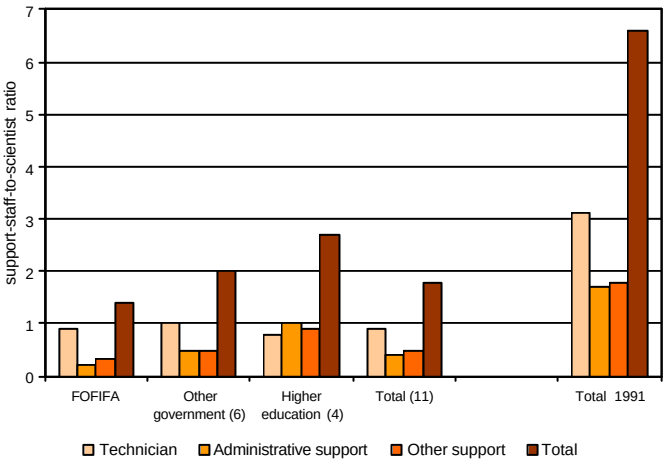
Figure 4¾ Share of female researchers, 2000



Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).
Notes: Figures in parentheses indicate the number of agencies in each category. Data exclude expatriate staff.

In 2000, the average number of support staff per scientist in an 11-agency sample was 1.8—comprising 0.9 technicians, 0.4 administrative personnel, and 0.5 other support staff such as laborers, guards, and drivers (Figure 5). The higher-education agencies had the highest combined ratio of support staff per scientist (2.7), while FOFIFA only employed 1.4 support staff per scientist.

Figure 5¾ Support-staff-to-researcher ratios, 2000



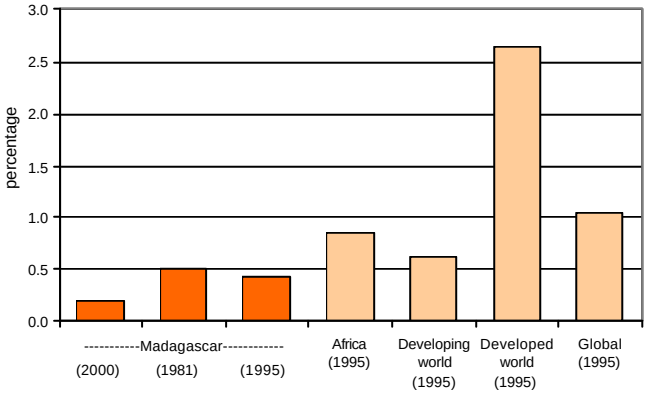
Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).
Notes: Figures in parentheses indicate the number of agencies in each category. Data exclude expatriate staff.

A significant decrease in the ratio of support staff occurred during the 1991–2000 period for almost all the agencies in our sample. The overall ratio fell by almost one-sixth, fairly uniformly across the support-staff categories. FOFIFA undertook the largest reduction, mainly reflecting nonscientific staff retrenchments during the 1990s under NARP. Total research staff numbers at FOFIFA fell from over 1,000 in the late-1980s to less than 900 in early 1997. Further, in 1997/98, FOFIFA implemented a voluntary departure and early retirement program that resulted in the reduction of 484 (mainly nontechnical) support staff. At the completion of NARP, the total number of staff was slightly more than a third of the total at the time the project was initiated. In addition to severence payments, the resulting savings of about US$220,000 per year have been used to employ 46 new researchers (World Bank 1998). About 30 additional support staff have left FOFIFA in recent years.

Spending

Total public spending as a percent of agricultural output (AgGDP) is a common research investment indicator that helps to place a country's agricultural R&D spending in an internationally comparable context. In 2000, Madagascar invested $0.20 for every $100 of agricultural output (Figure 5). Madagascar's ratio declined over time making its ranking considerably lower than other countries in the region. The 2000 intensity ratio was less than half the 1981 and 1995 levels, even though the 1995 level of 0.44 percent was already low compared with the average for Africa and the developing world at the time (0.84 and 0.62 percent, respectively).

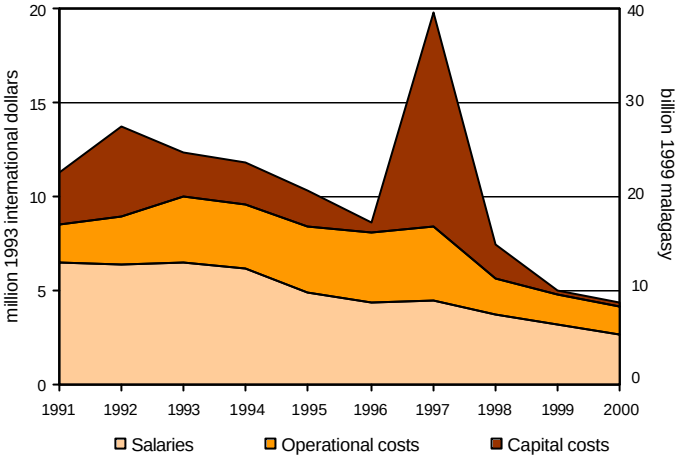
Figure 6¾ Madagascar's public agricultural research intensity compared regionally and globally



Sources: Madagascar compiled from Figure 1b; AgGDP from World Bank 2002; other intensity ratios from Pardey and Beintema 2001.

Consistent with many agencies in the region and elsewhere, a considerable share of FOFIFA's spending was on salaries. During the early to mid-1990s, capital and other expenditures were also significant, but by the end of NARP, funding was seriously constrained and capital investments diminished (Figure 7). Capital spending was extremely high during 1997 (58 percent) because of the aforementioned late disbursement and spending of resources under NARP, which were used to build infrastructure. Most of this spending was invested in the agency's regional centers and their satellite stations as opposed to FOFIFA's headquarters. A particular focus was on improving housing facilities (including the provision of running water and electricity) to provide incentive for research staff to relocate to the regional centers (World Bank 1998).[9]

Figure 7¾ Cost-category shares in FOFIFA's expenditures, 1991-2000



Source: Compiled by authors from ASTI survey data (IFPRI –ISNAR–ASARECA 2001–02).
Note: Data include estimated salaries for expatriate staff (see *Methodology* on page 8).

FINANCING PUBLIC AGRICULTURAL R&D

Funding for agricultural research in Madagascar has been fairly dependent on government contributions, World Bank loans, and contributions from external donors. Over the past ten years, overall donor funding diminished so the government had to absorb more responsibility in funding agricultural research. Other government agencies (such as CNRO and CNRE) are almost completely funded through government contributions. The nonprofit institutions are funded by government contributions as well as funding from bilateral donors such as the French government for TAFA, FAO, the Belgian government, and the Catholic University of Leuven for RAMILAMINA, and the Swiss government for FAFIALA.

NARP, which was funded through a World Bank loan and the Government of Madagascar, initially ran from 1990 to 1997 but was later extended until the end of 1999. The total budget of the project was US$71 million, of which US$24 million represented a World Bank loan, US$31 million came from the government, US$10 million was from donor contributions, and US$6 million was from FOFIFA. After the first 2.5 years of the project, only 8 percent of the total World Bank loan was disbursed because of lack of project activity during a period of political unrest in the country. In August 1993 the project was restructured and the overall budget was reduced by over US$12 million. The main objectives of the project were to stimulate a multi-disciplinary and decentralized approach to research, rationalize staffing levels, and disseminate research findings and their impact through regional offices. These decentralization efforts resulted in the successful transfer of 40 percent of total researchers at FOFIFA's headquarters to the regional offices by the time NARP concluded in 1999 (World Bank 1998).

In 1999, in follow-up to NARP, the government developed a Rural Development Action Plan (PADR) to promote sustainable

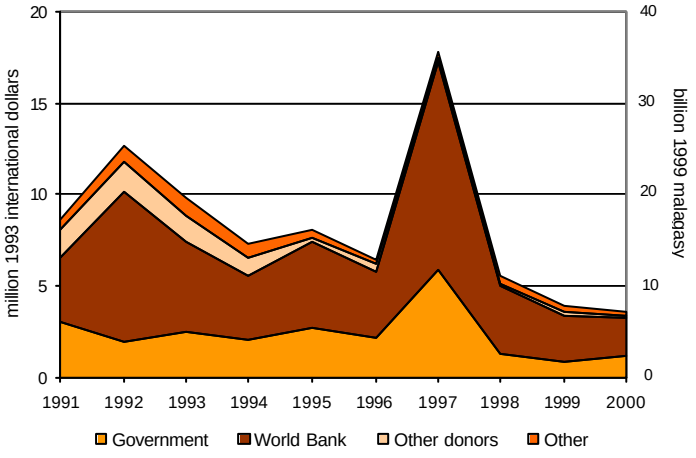
development and to improve food security and access to basic services in rural areas. Though the plan included all research agencies, its most significant impact will be on FOFIFA. Under the plan, FOFIFA developed a strategic plan to improve the quality of its scientific programs, encourage regional activities and partnerships, and provide institutional support to existing research systems. To implement PADR, RDSP was developed, with funding from a second World Bank loan (US$89 million), government contributions (8 million), an contributions from local communities (US$9 million). The project began in 2001 and is scheduled to be completed by 2006. Through RDSP, FOFIFA will receive financial support to implement its aforementioned new strategic plan.

National Center of Applied Research and Rural Development

Like other government research agencies, FOFIFA met with considerable financial hardships during the 1990s. Total funding went from about $10 million per year in the early 1990s to less than $5 million in 1999 and 2000 (Figure 8). During 1991–2000, more than half of FOFIFA's funding came from the World Bank loan under NARP, while the balance came from other donors like the French government, the African Development Bank, and the international agricultural research centers. The International Rice Research Institute (IRRI), for example, provided over $5 million during the early 1990s for training, attendance at international conferences, technical assistance on rice research, and housing. Collaborative projects through ASARECA's network also financed some of FOFIFA's research. Government funding has increased in nominal terms over the years but decreased considerably when adjusted for inflation: in 2000, government contributions to FOFIFA totaled $1.2 million—far less than the $3 million contribution of 1991.

During the 1990s, internally generated funds accounted for 5–10 percent of total funding. These funds were derived from the sale of produce, cattle, and seeds from, for example, beans, rice, maize, cassava, and vegetables, and from laboratory analysis and staff consultancies.

Figure 8¾ FOFIFA's funding sources, 1991- 2000



Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02)..
Note: "Other" includes internally generated income and contributions from private enterprises.

RESEARCH ORIENTATION

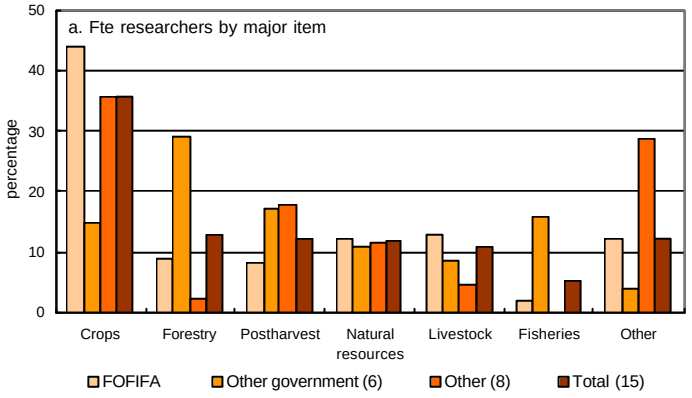
Commodity Focus

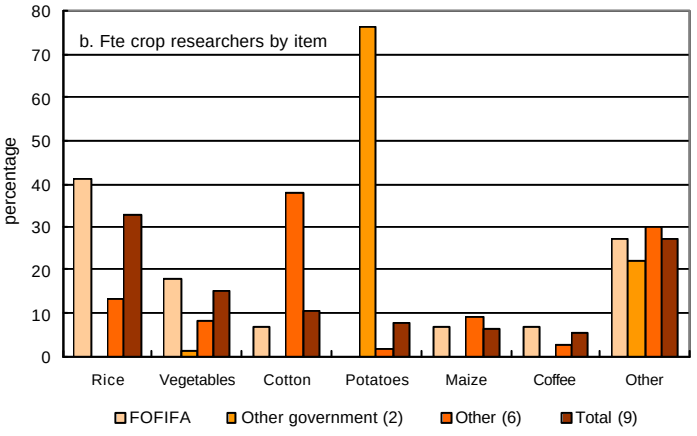
The allocation of resources across various lines of research is a significant policy decision; hence detailed survey information was collected on the number of fte-researchers working in specific commodity and thematic areas.

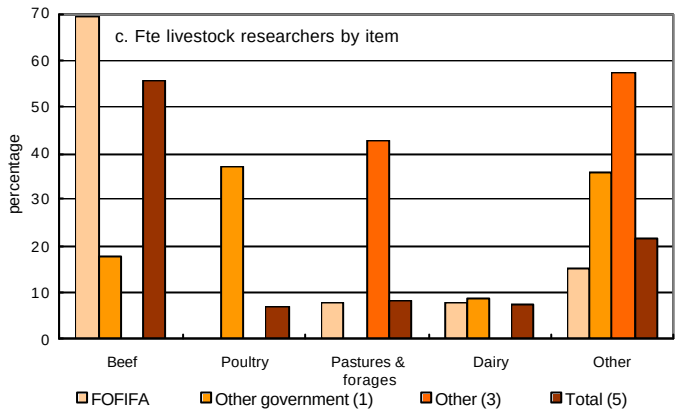
In 2000, about one-third of the 202 fte researchers in the 15-agency sample conducted crop research (Figure 9a). Forestry, postharvest, natural resources, and livestock accounted for 11–13 percent each, while fisheries accounted for only 5 percent. A considerable amount of research was done in other areas, such as oils, environmental issues, and land and pest management. FOFIFA researchers spent relatively more time on crops and livestock research than the other agencies in our sample (44 and 13 percent, respectively).

Notable is the intensive focus on rice by FOFIFA crop researchers, one-third of which worked on rice (Figure 9b). Other important crops being researched were vegetables, cotton, potatoes, corn, and coffee. The strong focus on potatoes in the government agencies (other than FOFIFA) stems from FIFAMANOR's intense focus on this crop. Only 5 agencies conducted livestock research, with more than half the total (combined) livestock researchers conducting research on beef (Figure 9c).

Figure 9¾ Major research areas and congruency with production value, 2000







Sources: Compiled by authors from ASTI survey data (IFPRI –ISNAR–ASARECA 2001–02.
Note: Figures in parentheses indicate the number of agencies in each category. "Other" includes four nonprofit institutions, four higher-education institutions, and one private enterprise. Figure 9b only includes agencies involved in crop research; Figure 9c only includes agencies involved in livestock research.

Table 2¾ Thematic focus, 2000

	Numbers of researchers		Shares	
	FOFIFA	Other (13)	FOFIFA	Other (13
	(*in fte's*)		(*percent*)	
Crop genetic improvement	41.1	4.1	32.0	5.3
Crop pest and disease control	15.4	3.1	12.0	4.0
Other crop	16.7	5.8	13.0	7.5
Livestock genetic improvement	6.4	—	5.0	—
Livestock pest and disease control	7.7	4.4	6.0	5.7
Other livestock	6.4	2.8	5.0	3.6
Soil	10.3	3.4	8.0	4.4
Water	—	1.7	—	2.2
Other natural resources	—	6.1	—	7.9
Postharvest	9.0	5.6	7.0	7.2
Other	15.4	40.7	12.0	52.3
Total	**128.5**	**79.0**	**100**	**100**

Source: Compiled by authors from survey data.

Thematic Focus

In 2000, 22 percent of the total researchers in the 14-agency sample were working on crop genetic improvement, 9 percent on crop pest and disease control, and 11 percent on other crop themes (Table 2). The remainder of the researchers focused on livestock, postharvest, and natural resources research, with only a small portion working in other areas. FOFIFA staff spent relatively more time on crop genetic improvement than the other agricultural research agencies in our sample (41 percent).

CONCLUSION

Although the total number of fte researchers in agricultural R&D has continued to grow (albeit at a very low rate in recent years), Madagascar experienced a dramatic decrease in public agricultural R&D spending over the past 30 years. This was the result of declining government contributions combined with the completion of NARP in 1999.

Under NARP, FOFIFA underwent major institutional changes. Total nontechnical staff numbers declined considerably—allowing a rise in researcher numbers—and research was decentralized through regional improvements and incentives that successfully attracted researchers from headquarters to regional centers, at least for the duration of the project (World Bank 1998). Since the completion of NARP, FOFIFA's funding situation has worsened considerably. A second World Bank project, RDSP, was initiated in 2002, which will provide added financial support to FOFIFA and FIFAMANOR. RDSP is scheduled to run until 2006.

NOTES

1. The authors are grateful to numerous colleagues in Madagascar for their time and assistance with data collection, Olympia Icochea and Tatiana Prada Owen for their assistance with data processing, and Harison Andrianasolo, Yvonne Rabenantoandro, Lucile Ramilison, François Rasolo, Holy Ratompoalimanana, and Han Roseboom for useful comments on drafts of this brief.
2. The 15-agency sample consisted of:
   - Seven government agencies/units: *Centre National de Recherche Appliquée au Développement Rural* (FOFIFA), *Centre National de Recherche sur l'Environnement* (CNRE), *Centre National de Recherches Océanographiques* (CNRO), *Centre National d'Application de Recherche Pharmaceutique* (CNARP), *Centre National de Recherche Industrielle et Technologique* (CNRIT), *Institut Malgache de Vaccins Vétérinaires* (IMVAVET), and *Centre de Développement Rural et de Recherche Appliquée* (FIFAMANOR);
   - Three nonprofit institutions: *Institut de Recherche et de Développement Communautaire* (IREDEC), *Tany sy Fampandrosoana* (TAFA), and Fafiala;
   - Four higher-education agencies—one school and three laboratories of *Université d'Antananarivo*: *Ecole Supérieure des Sciences Agronomiques* (ESSA), the *Faculté des Sciences*' *Laboratoire de Biologie Végétale* (LBV), *Laboratoire de Physiologie Végétales* (LPV), and *Laboratoire de Radio Isotope* (LRI)
   - One private enterprise was also engaged in agricultural research: *Hasy Malagasy* (HASYMA);

   One additional private enterprise initiated research in 2001—*Centre Technique Horticulture de Tamatave* (CTHT), which was involved in agricultural research. *Ramilamina*, a nonprofit institution, ceased its research activities in 1999.
3. Unless otherwise stated, all data on research expenditures are reported in 1993 international dollars or in 1999 magalasy.
4. English translations of institute names have been used throughout the brief except in note 2, where the original French is provided.
5. A summary of NARP is provided in the financing section of this brief.
6. Before 1995, IMVAVET used to be the Vaccine Department of FOFIFA, which was largely funded by GTZ through the Animal Production Support Project (PEPA). In 1994, FOFIFA determined make its vaccine department more autonomous, which led to the creation of IMVAVET through a government decree.
7. Data are calculated as least squares growth rates.
8. A summary of RDSP is provided in the financing section of this brief.
9. FOFIFA offers staff packages that include the provision of free housing at its regional research centers.

METHODOLOGY

- Most of the data in t his brief are taken from unpublished surveys (IFPRI, ISNAR, and ASARECA 2001-02).
- The data were compiled using internationally accepted statistical procedures and definitions developed by the OECD and UNESCO for compiling R&D statistics (OECD 1994; UNESCO 1984). We grouped estimates using three major institutional categories—government agencies, higher-education agencies, and business enterprises, the latter comprising the subcategories private enterprises and nonprofit institutions. We defined public agricultural research to include government agencies, higher-education agencies, and nonprofit institutions, thereby excluding private enterprises. Private research includes research performed by private-for-profit enterprises developing pre, on, and postfarm technologies related to agriculture.
- Agricultural research includes crops, livestock, forestry, and fisheries research plus agriculturally related natural resources research, all measured on a performer basis.
- Financial data were converted to 1993 intern ational dollars by deflating current local currency units with a Madagascar GDP deflator of base year 1993 and then converting to U.S. dollars with a 1993 purchasing power parity (ppp) index, both taken from World Bank (2002). Ppp's are synthetic exchange rates used to reflect the purchasing power of currencies, typically comparing prices among a broader range of goods and services than conventional exchange rates.
- The salaries and living expenses of many expatriate researchers working on donor-supported projects are paid directly by the donor agency and are often excluded in the financial reports of the agricultural R&D agencies. These *implicit* costs have been estimated using the average cost per researcher in 1985 to be $160,000 1993 international dollars and backcasting this figure using the rate of change in real personnel costs per fte researcher in the US state agricultural experiment station system. This extrapolation procedure has the assumption that the personnel-cost trend for US researchers is a reasonable proxy of the trend in real costs of internationally recruited staff in the agricultural R&D agencies.

See the ASTI website (http://www.ASTI.cgiar.org) for more details on methodology.

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