



ETHIOPIA

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This country brief reviews the major investment and institutional trends in Ethiopian agricultural research since the early 1970s, including a new set of survey data for the 1990s collected through the Agricultural Science and Technology Indicators (ASTI) initiative (IFPRI–ISNAR–ASARECA 2001–02).¹

INSTITUTIONAL DEVELOPMENTS

Ethiopia is characterized by great geographic and climatic diversity. The Ethiopian economy relies heavily on the agricultural sector, which contributes 85 percent of total employment, 46 percent of GDP, and 92 percent of total exports earnings. The country has vast, untapped agricultural potential, but the agricultural sector, dominated by small-scale farmers with low productivity, is confronted with increasing population and food insecurity, very low—and declining—levels of agricultural productivity, and worsening natural resource degradation (Demel 2002).² Currently, close to 20 million Ethiopians are under the threat of famine as a result of a poor rain season and will need food aid if they are to survive (Vidal 2003).

We identified 41 agencies engaged in agricultural research in Ethiopia in the late 1990s, 30 of which are included in our sample.³ These 30 agencies employed a total of 742 full-time equivalent (fte) researchers and spent a combined 93 million 1999 birr on agricultural research and development (R&D)—equivalent to \$81 million in

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

| Type of agency | Spending | | Researchers ^a (fte's) | Share | | Agencies in sample ^b (number) |
|----------------------------------|-------------------------|----------------------------|-------------------------------------|-----------------------|-------------|---|
| | 1999 birr (millions) | 1993 international dollars | | Spending (percent) | Researchers | |
| <i>Public agencies</i> | | | | | | |
| EARO | 61.3 | 53.5 | 428.0 | 65.9 | 57.7 | 15 |
| Regional government ^c | 21.4 | 18.7 | 232.0 | 23.0 | 31.3 | 7 |
| Higher education ^{c, d} | 10.0 | 8.8 | 80.2 | 10.8 | 10.8 | 6 |
| Subtotal | 92.7 | 80.9 | 740.2 | 99.8 | 99.7 | 28 |
| <i>Business enterprises</i> | | | | | | |
| Business enterprises | 0.2 | 0.2 | 2.0 | 0.2 | 0.3 | 2 |
| Total | 92.9 | 81.1 | 742.2 | 100 | 100 | 30 |

Sources: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).

^aInclude national and expatriate staff.

^b See note 2 for details of all agencies. The Abobo Agricultural Research Center in the Gambela Region, the Mekele Agricultural Research Center in the Tigray Region, the eight regional animal health laboratories, and the Ambo College of Agriculture were excluded from this table and further data analysis in this brief because data were unavailable.

^c Expenditures for NFLAR, NSRC, the higher-education sector, and the two business enterprises in our sample are estimates based on the average expenditures per researcher of the government agencies in our sample.

^d The 313 faculty staff employed in the five higher-education agencies spent between 10 and 30 percent of their time on research, resulting in 80.2 fte researchers.

KEY TRENDS

- Since the early 1990s, total investments in Ethiopian agricultural research have almost doubled. This is largely the result of increased government contributions and a World Bank loan.
- Nonetheless, the intensity of the country's agricultural research investment efforts—research investments as a share of total agricultural GDP—remain far below the Sub-Saharan African average.
- The main agricultural research agency in Ethiopia, the Ethiopian Agricultural Research Organization (EARO), accounted for close to two-thirds of Ethiopia's total research spending and staff in 2000.
- In addition to generating new agricultural technologies, EARO's mandate includes the coordination of all of Ethiopia's agricultural research activities.
- A few private companies conduct some agricultural research in Ethiopia, but their combined efforts are reportedly small.

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 Center for International Agricultural Research (ACIAR), the European Union, and the U.S. Agency for International Development (USAID).

1993 international prices (Table 1).⁴ With the inclusion of the 11 agencies for which data were unobtainable, these totals would be slightly—though not substantially—higher, given the omitted agencies are reported to conduct only a minor amount of agricultural research in Ethiopia.

The main agricultural research entity is the Ethiopian Agricultural Research Organization (EARO), which accounted for about two-thirds of total agricultural spending and a slightly smaller share of total number of researchers. EARO was established in 1997 to coordinate the agricultural research activities of the federal and regional research centers and the higher-education agencies (see *A Short History of Government-Based Agricultural Research* below). EARO's mandate encompasses a broad definition of agricultural research including crops, livestock, fisheries, forestry, and other natural resources. Its main objectives are to generate, develop, and adopt agricultural technologies that focus on overall agricultural development and the needs of its beneficiaries; to coordinate the research activities of agricultural research centers, higher-education agencies, and related entities conducting research under contract;⁵ to build research capacity and establish an efficient and effective system addressing development needs; and to disseminate and publicize research results. These objectives are built on the principle of establishing a coordinated but decentralized research system.

EARO falls under the administrative responsibility of the Ministry of Rural Development and, as of 2000, organized its research through 5 research directorates, 3 research coordination offices, 40 programs, and 106 projects. The organization is headquartered in Addis Ababa and directly manages a network of 15 federal research centers;⁶ EARO's federal research centers have some autonomy in setting financial and human resource policy, including managing their own budgets (within certain parameters), recruiting and promoting staff, and determining salaries.

Nine of the current EARO research centers were inherited from EARO's predecessor, the Institute of Agricultural

Research (IAR).⁷ The two largest of these former IAR centers are the Holetta Agricultural Research Center (HARC) and the Melkassa Research Center (MRC). HARC employed 79 researchers in 2000; its mandate focuses on all aspects of agricultural research in the medium-altitude and highland areas of the country. HARC has one subcenter and one trial site and manages 13 national programs on various crops, animal production, and crop technology transfer. MRC employed 88 researchers in 2000 and was generally responsible for agricultural research in Ethiopia's dry farming zones, as well as 5 other semi-arid to submoist agroecological zones. MRC has 2 subcenters and manages 10 of the 40 national programs.

In addition to the IAR centers, six other centers with broad research programs were transferred to EARO. The Debre Zeit Agricultural Research Center (DZARC) conducts research on crops, forestry, and livestock; the Forestry Research Center (FRC) focuses on forestry and forest products; the Forest Product Utilization Research Center also conducted forestry research and was transferred into FRC in 1998; the Sebeta Animal Health Research Center (SAHRC) addresses veterinary research, animal pest and disease control and diagnosis, and the testing and adoption of animal health technologies developed elsewhere; the National Soil Research Center (NSRC) conducts soil R&D as well as provides services for other soil research and education agencies; and the National Fisheries and Other Living Aquatic Resources Research Center (NFLARC) is responsible for Ethiopia's fisheries research (Getinet and Tadesse 1999). DZARC was formerly part of the Alemaya University (AU), while the remaining five centers fell under the administrative responsibility of the Ministry of Agriculture prior to their transfer to EARO.

As part of the reorganization of the national agricultural research system in 1997, agricultural research activities were decentralized, and a number of IAR research stations were transferred to the regional states. In 2000, 9 of these regional centers remained in operation in five of the six regions (Amhara, Gambela, Oromia, South Nations Nationalities Peoples, and Tigray). Seven of these centers are included in our sample and

A Short History of Government-Based Agricultural Research

Agricultural research began relatively late in Ethiopia. Limited research was initiated when the Ambo and Jima Junior Colleges of Agriculture were established in 1947. In 1953, the Debre Zeit Agricultural Research Center (DZARC) of the Imperial College of Agriculture and Mechanical Arts (now AU) was established and remained the primary Ethiopian agricultural research entity until 1966. At that time, the Institute of Agricultural Research (IAR) was established as a semi-autonomous institute with financial support from the United Nations Development Programme (UNDP) and the Food and Agriculture Organization of the United Nations (FAO). IAR subsumed the limited and scattered research activities of the Ministry of Agriculture and became responsible for formulating national agricultural research policy and conducting research on crops, livestock, and natural resources. In 1977, IAR's research programs were restructured as departments according to subject areas and, multidisciplinary commodity teams were assembled to make more effective use of IAR's small number of research specialists. In the mid 1980s, IAR was again restructured to emphasize regional research, whereby a center was identified in each regional zone to take responsibility for coordinating IAR's research activities. In June 1997, the Debre Zeit Agricultural Research Center and other remaining federal IAR research centers were merged and subsumed by the newly created EARO.

During the 1970s, a number of other federal research centers were established such as the Plant Protection Research Center (1972), the Plant Genetic Resources Center (1974), the Forestry Research Center (1975), and the Wood Utilization Research Center (1979). Two more centers were established some time later—the National Soils Laboratory (1989) and the Institute of Animal Health Research (1992).

Agricultural research underwent significant reform in the early 1990s when a new government began to campaign for a decentralized political system. As a result, a number of IAR centers were transferred to the respective regional governments and became independent research centers in 1993. In June 1997, the Debre Zeit Agricultural Research Center and other remaining federal IAR research centers were merged and subsumed by the newly created EARO.

Sources: Roseboom and Pardey (1994), Getinet and Tadesse (1999), and Demel (2002).

accounted for close to one-quarter of total agricultural R&D spending in 2000. Their research activities focus on the specific problems of the agroecological zones in which they are located, and on national research themes. In 2000, the regional research centers were the administrative responsibility of the regional Bureaus of Agriculture, but—as of 2003 each of the six regions has established its own Regional Agricultural Research Institute (RARIs), whose main focus will be solving agricultural problems in the region. Consequently, the regions will fund their center's operating costs and staff salaries. EARO funds the budget requirement of research projects that are approved by a national review forum and have national implications. Regional governments fund the remainder of research projects that focus on the specific agricultural problems of the agroecological zones in each region. In addition to the regional research centers, a total of 8 regional animal laboratories are located under the regional Bureaus of Agriculture. EARO funds most of the research activities in these laboratories, while limited funds are provided by external donors.

We identified 7 higher-education agencies, 6 of which are included in our sample. These 6 agencies accounted for 11 percent of the agricultural researchers in 2000. AU was responsible for about half of these activities, employing 275 faculty staff in 2000 or—adjusted to reflect time spent on research—69 fte research staff. AU's research activities are managed at the Alemaya University Agricultural Research Center (AUARC) and focus on crops, livestock, dryland agriculture, forestry, fisheries and aquatic resources, socioeconomics, and postharvest issues. Research is conducted at about 14 different sites across the country (AU 2003). Other institutions forming the higher-education sector in Ethiopia are the University of Addis Ababa's Faculty of Veterinary Science, Mekele University's Faculty of Dryland Agriculture and Natural Resources, and three colleges—Awassa College of Agriculture, Jimma College of Agriculture, and Wondo Genet College of Forestry.

We identified only two private companies undertaking limited agricultural research activities in Ethiopia, each employing only 1 fte researcher in 2000. The Birale Agricultural Development Corporation initiated its research activities in 1991, predominantly focusing on cotton research, although it also undertakes some field trials on vegetables, fruits, and sugarcane. The Quality Control and Research Service within the Ethiopian Spices Extraction Factory focuses on the quality of locally grown spices and herbs.

With EARO's establishment in 1997, collaboration among the various centers, AU, and the regional research centers increased. As a member country of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), EARO also collaborates with neighboring countries and is engaged in collaborative projects with various international agricultural research centers, like the International Maize and Wheat Improvement Center (CIMMYT), the International Livestock Research Institute (ILRI), and the International Center for Agricultural Research in the Dry Areas (ICARDA). EARO also collaborates with the International Center For Insect Physiology and Ecology (ICIPE), the United States' International Sorghum and Millet Collaborative Research Support Program (INTSORMILL-CRSP), a number of European universities such as Bonn University, and U.S.-based foundations such as the McKnight Foundation.

HUMAN AND FINANCIAL RESOURCES IN PUBLIC AGRICULTURAL R&D

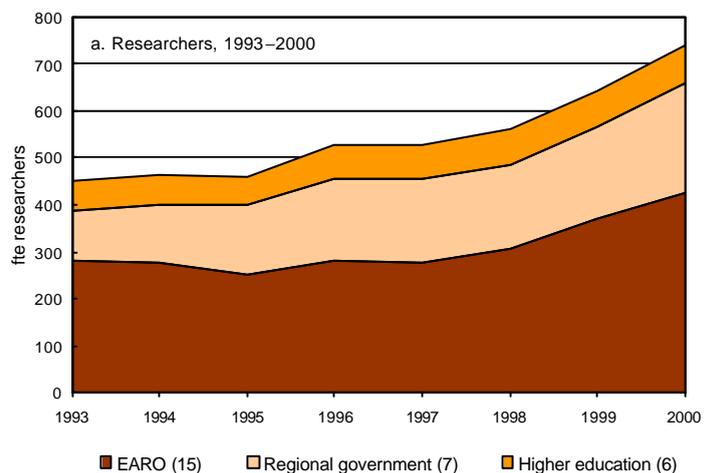
Overall Trends

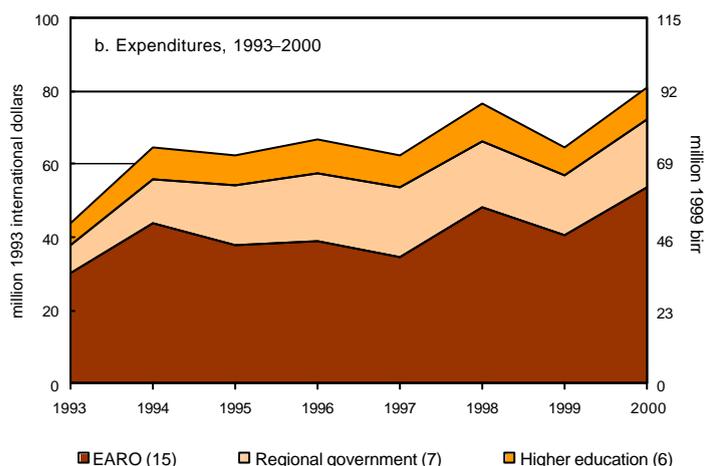
In contrast to most African countries, investments in Ethiopian public agricultural R&D grew considerably, and at an apparently steady pace during the past three decades. The total number of public agricultural researchers increased by more than 10 percent per year during 1971–2000 (Figure 1a).⁸ Total fte researchers employed at EARO increased from 276 at its creation in 1997 to 428 in 2000, and reached 586 in 2002. Fte researcher numbers also increased at the regional research centers, although to a relatively smaller degree, while combined numbers at the 6 higher-education agencies remained fairly constant in recent years.

Though nearly half of all fte researchers in Ethiopia in the early 1970s were expatriate staff, this share fell to only 6 percent by 1991 (Roseboom and Pardey 1994) and further declined to only 1 percent by 2000; and while most of the expatriate staff were employed at IAR in 1991, the 1 percent (7 fte researchers) remaining in 2000 all worked at AU, mostly replacing national staff on study leave.

During 1971–2000, total public agricultural R&D spending grew by 6 percent per year on average—lower than the corresponding rate for total researchers, but high compared with many other African countries (Figure 1b). EARO's total spending doubled during the 1997–2000 period, masking a one-year decline in 1999 resulting from a drop in donor contributions. Despite a strong increase in total research staff numbers, total spending for the seven regional research centers remained fairly stable during 1997–2000, once again with the exception of 1999.

Figure 1a Public agricultural R&D trends, 1993–2000





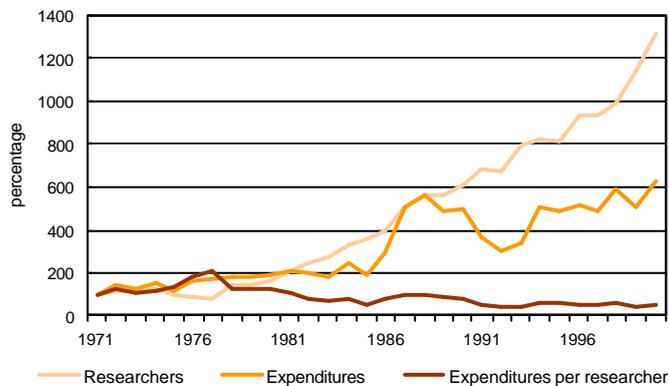
Sources: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).

Notes: See Table 1. Figures in parentheses indicate the number of agencies in each category. Underlying data are available at the ASTI website (www.asti.cgiar.org).

As a result of the relative slower growth in total spending compared with total research staff, expenditures per researcher weakened during 1971–2000. In 2000, a researcher spent \$109,000 on average—less than half the 1971 average, but in line with other countries in the East and Central African region (Beintema 2003).⁹

Figure 2^{3/4} Long-term public agricultural R&D trends, 1971–2000

Index, 1971 = 100



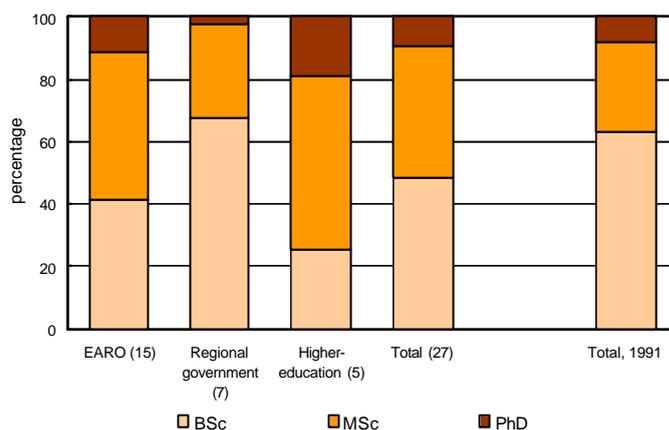
Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02, CIFOR–AFREA 2001–02), and Roseboom and Pardey (1994).

Note: See Table 1. Figures in parentheses indicate the number of agencies in each category. Underlying data are available at the ASTI website (www.asti.cgiar.org).

Human Resources

The quality of agricultural staff in Ethiopia—measured as the share of PhD- and MSc-qualified researchers—was relatively low compared with other African countries. In 2000, slightly more than half of the 728 fte researchers in an 27-agency sample had postgraduate-level training, while less than 10 percent held doctorate degrees (Figure 3). EARO employed relatively more researchers with postgraduate degrees (59 percent), but this average masks a wide variation among EARO's research centers. In 2000, only about 20 percent of researchers employed at the Pawe Research Center (PRC) were trained to the postgraduate level, while over 75 percent of the researchers at EARO's headquarters, Ambo Plant Protection Research Center (APPRC), and DZRC held PhD or MSc degrees. And while only 5 of the 232 fte researchers employed at the regional research centers were trained to the PhD level (2 percent), about three-quarters of university researchers held postgraduate degrees—a high proportion compared with the other institutional categories in Ethiopia, but in line with other African countries (Pardey et al. 1997; Beintema 2003).

Figure 3^{3/4} Educational attainment of researchers, 2000



Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02 and CIFOR–AFREA 2001–02) and Roseboom and Pardey (1994).

Note: Number of agencies in sample shown in brackets. Figure excludes expatriate staff.

These levels were comparatively low for the region but indicate an improvement over the previous decade; in 1991, only 37 percent of all researchers held postgraduate degrees. Of note, most of this growth stemmed from a three-fold increase in the numbers of staff trained to the MSc level. In addition, the aforementioned increase in total EARO staff during 2000–02 was mainly the result of an increase in the total number of researchers with BSc degrees (from 177 to 316).¹⁰

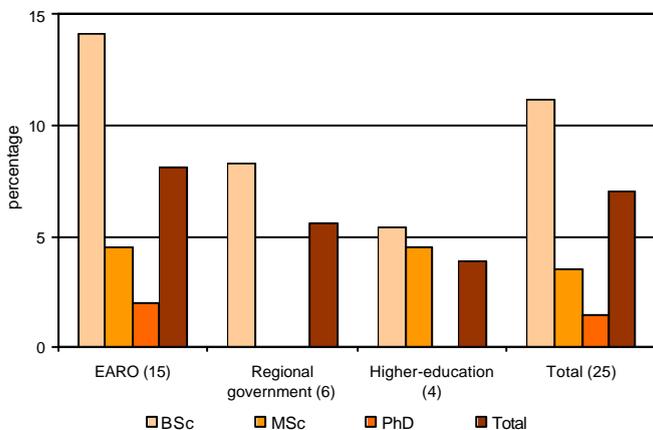
AU provides MSc training in a number of areas, including agronomy, horticulture, crop protection, plant and animal breeding, animal production, and agricultural economics for national agricultural researchers. The annual intake of the 2-year program is about 25 students, with 10–15 graduating each year (ASARECA 1995; AU 2003). UAU initiated 2 PhD programs in 2002 and plans to add 6 more in the short-term future.

The Agricultural Research and Training Project (ARTP), cofinanced by a World Bank loan and the Ethiopian Government, includes a human resources development component for staff at EARO, AU, and the regional research centers. The project also funds the cost of replacing AU staff by newly recruited expatriates while they are studying abroad (World Bank 1998). As of June 2003, the total numbers of researchers from EARO and the regional centers undertaking PhD, MSc, or BSc degrees under this program were 110, 265, and 1 researcher, respectively. Of these, 2 researchers were undertaking PhD training locally and 152 were undertaking MSc training locally, and of those studying outside Ethiopia, 77 were located at South African universities, 117 at Asian universities, and 21 at Jordanian Universities. Only 4 researchers were located at European universities (undertaking MSc training), while none were located in the United States. A further 46 AU researchers were undertaking PhD training abroad, and 1 was undertaking MSc training abroad.

A small number of researchers obtained funding from other sources, mainly the European and U.S. government-based aid bodies. Most of the researchers studying for PhDs abroad were following the so-called sandwich program, meaning they would return to their respective agencies to conduct research relevant to Ethiopia once they had completed their course work. Under ARTP's predecessor—the Ethiopian Agricultural Research Project (also funded through a World Bank loan) 10 researchers received PhD degrees and 30 received MSc degrees at universities outside Ethiopia.

The female researcher shares are also low compared with regional averages. For a 25-agency sample in 2000, on average, 7 percent of total research staff were female, ranging from 4 percent for the 4 higher-education agencies combined, to 8 percent at EARO (Figure 4). Of the EARO share, female researchers holding BSc and MSc degrees dominate (14 and 5 percent of total research staff, respectively). The average share of female researchers in Ethiopia ranked second-lowest for countries in East and Central African region (following Eritrea at 4 percent). The average regional share was 18 percent in 2000, while Kenya, Madagascar, Sudan, and Uganda reported shares above 20 percent (Beintema 2003).

Figure 4 Share of female researchers, 2000

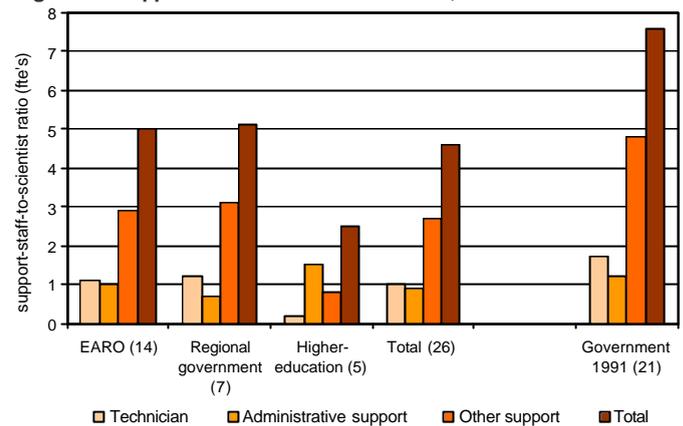


Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).

Note: Number of agencies in sample shown in brackets. Figure excludes expatriate staff.

In 2000, the average number of support staff per scientist for a 26-agency sample was 4.6, comprising 1.0 technical staff, 0.9 administrative personnel, and 2.7 other support staff such as laborers, guards, drivers, and so on (Figure 5). The support-staff-per-scientist ratio was lower in the higher-education agencies, at 2.5. This 2000 ratio was considerably lower than the corresponding ratio of 7.6 in 1991, which is the result of the disproportionate increase in research staff compared with support staff in recent years. EARO's average support-staff-per-scientist ratio, at 5.0, masks wide variation across its numerous research centers—from 1.0 at NFLARC to 13.0 at WRC.

Figure 5 Support-staff-to-researcher ratios, 1991 and 2000



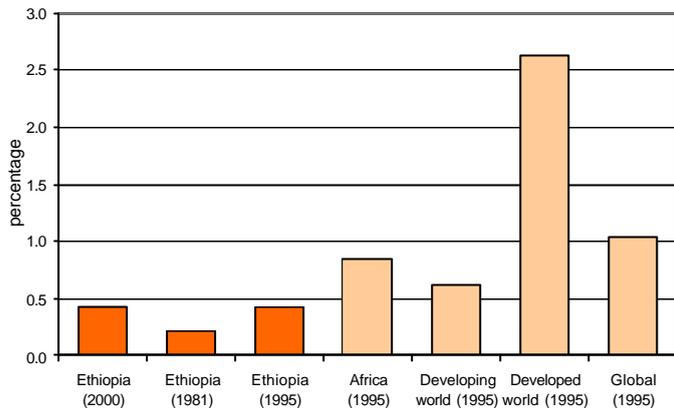
Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).

Note: Number of agencies in sample shown in brackets. Figure excludes expatriate staff.

Spending

Total public spending as a percent of agricultural output (AgGDP) is a common research investment indicator used to place a country's agricultural R&D spending in an internationally comparable context. In 2000, Ethiopia invested \$0.43 for every \$100 of agricultural output, which was higher than the (very low) level of \$0.22 in 1981 (Figure 6). The 1995 ratio was similar to the 2000 level and was appreciably lower than both the average ratio for Africa (0.85 percent) and the average for the developing world (0.62 percent). This lack of growth in the intensity of spending in recent years, despite the aforementioned increase in total agricultural R&D spending, can be explained by the parallel (inflation adjusted) increase in total AgGDP.

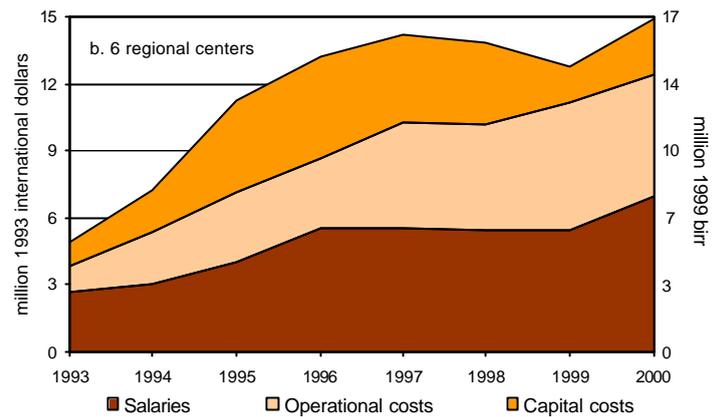
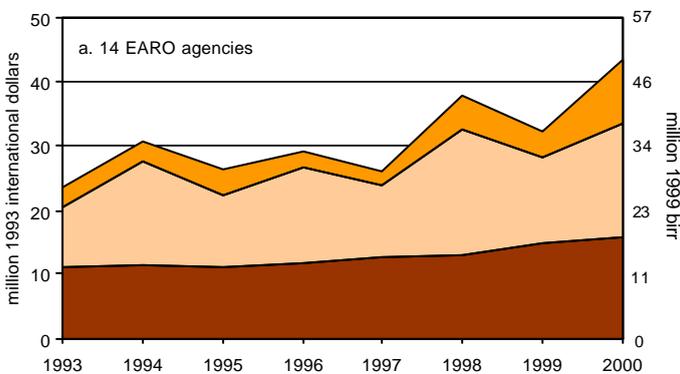
Figure 6¾ Ethiopia's public agricultural research intensity compared regionally and globally



Sources: Ethiopia compiled from Figure 2; AgGDP from World Bank (2003); other intensity ratios from Pardey and Beintema (2001).

With strong government support of agricultural research and the two consecutive World Bank loans, EARO and the regional research centers have been able to invest significantly in infrastructure, equipment, and staff training. This investment is reflected in EARO's high average operational and capital cost shares during 1993–2000. Over this period, total salaries averaged only 41 percent, while operational and capital costs accounted for 42 and 17 percent of the total spending, respectively (Figure 7). ARTP (discussed earlier) provides funding for the rehabilitation of the research infrastructure at 18 existing research centers. These include improvements to housing facilities, laboratories, libraries, and office space, along with the purchase and upgrade of additional farm and laboratory equipment, vehicles, and some furniture. In addition, 6 new centers will be established in agroecological areas, previously without research facilities, that are characterized as less-favorable lands given low rainfall and are inhabited by the poorest farmers in the country (World Bank 1998). ARTP also provides funding to AU for the construction of office buildings and for the purchase of vehicles, lab equipment, and so on.

Figure 7¾ EARO and regional government agency expenditure shares, 1993–2000



Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).

Note: Data for one EARO institute and one regional research center were missing. Data include estimated salaries for expatriate staff (see Methodology on page 10).

FINANCING PUBLIC AGRICULTURAL R&D

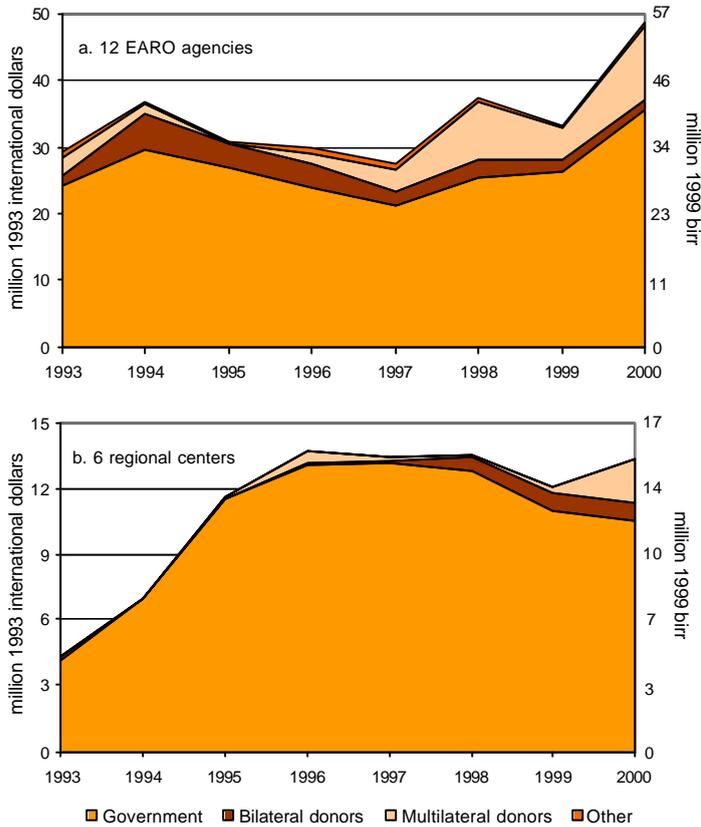
Agricultural research in Ethiopia is largely funded by the government, loans from the World Bank, and contributions from other donors. During 1993–2000, on average, government contributions accounted for about 80 percent of funding for research at the federal level (meaning EARO and the higher-education agencies), though this share has grown in more recent years (Figure 8). By comparison, the regional research centers relied even more heavily on government funds, with a 90 percent share of their funding coming from the government.

In its management role, EARO funds the budget requests (for both capital and recurrent costs) of EARO centers and capital budget requirements of the regional research centers, higher-education agencies, and the regional animal health laboratories for their research activities that have national importance. Requests are categorized (and budgets aggregated) on the basis of programs and projects, and are sent to the Ministry of Finance and Economic Development (MoFED), which generally approves about 85 to 95 percent of the total budget requested. This approved budget is allocated proportionately across all requests.

During 1993–2000, bilateral and multilateral donor contributions accounted, on average, for 6 and 11 percent of total funding, respectively. Contributions from bilateral donors remained fairly stable over this period while those from multilateral donors increased in recent years as a result of the initiation of ARTP in 1999. ARTP runs until 2005, with two-thirds of its US\$90 budget coming from World Bank and the International Fund for Agricultural Development (IFAD) loans, and the remaining one-third coming from the Government of Ethiopia. ARTP has three components, two of which—developing human resources and strengthening the agricultural research system—have already been discussed. The third component focuses on the design and implementation of a decentralized agricultural research system incorporating participatory approaches to planning and prioritizing agricultural research, improving research–extension–farmer linkages, and developing national and international linkages across the various research agencies as well as with international agricultural research centers and other research partners abroad

(World Bank 1998; Demel 2002). Over this same period, 1993–2000, funding from other donors was limited, partly because many countries halted their funding during the war between Ethiopia and Eritrea. After the war's end in 2000, EARO prepared a number of proposals that are currently under negotiation.

Figure 8¾ EARO and regional government agency funding sources, 1993–2000



Source: Compiled by authors from ASTI survey data (IFPRI–ISNAR–ASARECA 2001–02).

Note: Data for three EARO institutes and one regional research center were missing.

EARO and the regional research centers receive very limited funding through other sources. During 1993–2000, less than \$1 million per year (1 percent of total funding) was generated internally. Ethiopia's federal research centers can sell their outputs (specifically basic and pre-basic seeds), but the revenues raised are passed on to MoFED. EARO is an exception in that it forecasts the total amount of expected revenue at the beginning of each fiscal year and is allowed to utilize all the money generated as far as it doesn't exceed the initial forecasted amount. If it is otherwise, the balance that exceeds the forecast is submitted to MoFED.

The Agricultural Research Fund (ARF) is a competitive finance mechanism created under ARTP. As per June 2003, the ARF management committee and its secretariat had been established and 88 proposals had been received from researchers at EARO, the agricultural universities, nongovernmental and community-based organizations, and the private sector. About 11 research proposals had been selected by the ARF management committee for funding in the final round of ARF implementation.

PRIVATE AGRICULTURAL R&D

Agricultural R&D performed by the private sector in Ethiopia is extremely limited. We identified two private companies employing only one fte researcher each in 2000, and together accounting for less than half of one percent of total agricultural R&D investments. Many of the private companies do not employ their own research staff but instead contract EARO and other agencies to conduct research on specific issues.

RESEARCH ORIENTATION

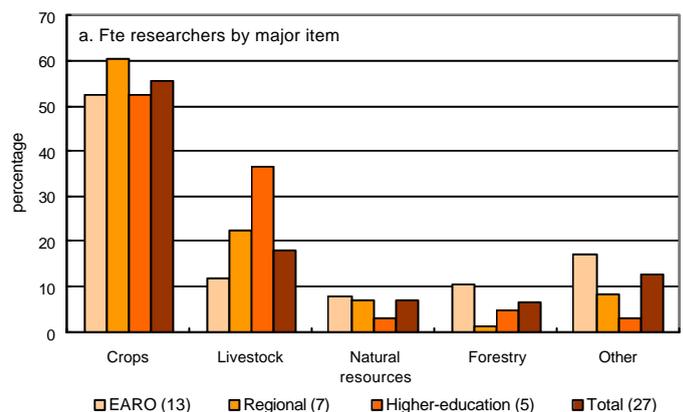
Commodity Focus

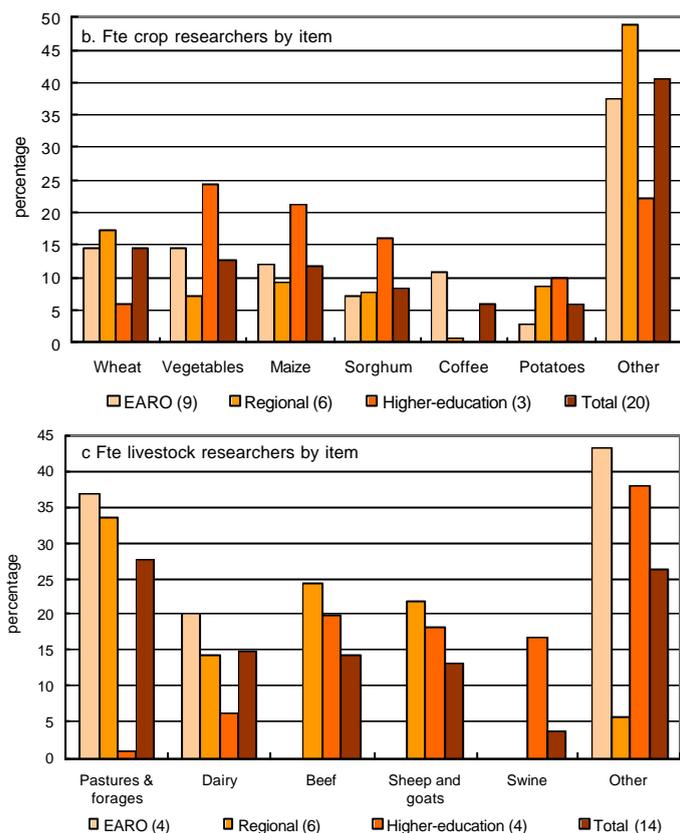
The allocation of resources across various lines of research is a significant policy decision; hence detailed survey information was collected on the number of fte-researchers working in specific commodity and thematic areas.

In 2000, more than half of the 691 fte researchers in a 27-agency sample conducted crop research (Figure 9a). Livestock accounted for 18 percent, while forestry and postharvest research each accounted for 7 percent. As compared to other regional research centers and higher-education agencies, EARO researchers spent more time on forestry and other issues like fisheries. Notable was the relatively intensive focus of the higher-education agencies on livestock research.

The major crops being researched were wheat, vegetables, and maize, each of which each accounted for 12–15 percent of total fte crop researchers in our sample; sorghum, coffee, and potatoes were each the focus of 6–8 percent of total fte crop researchers (Figure 9a). The remaining 41 percent of crop researchers focused their efforts on other crop items, including tef—a primary foodcrop in Ethiopia. Only 14 agencies in our sample conducted livestock research, and about one-quarter the fte researchers working on livestock focused their efforts on pastures and forages (Figure 8c). Other livestock items being researched were dairy and beef (15 percent each) and sheep and goats (13 percent).

Figure 9¾ Commodity focus, 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. Figure 9b only includes agencies involved in crop research; Figure 9c only includes agencies involved in livestock research.

Thematic Focus

Of the total researchers at the 13 EARO research centers in our sample, crop genetic improvement was the focus of 33 percent, and pest and disease control was the focus of 14 percent in 2000 (Table 2). The corresponding researcher shares at the other agencies were slightly lower, at 24 and 11 percent, respectively. The remainder of the researchers at EARO and the other agencies focused on livestock, postharvest, natural resources research with only a small portion working on other thematic areas.

Table 2^{3/4} Thematic focus, 2000

| | Numbers of researchers | | Shares | |
|------------------------------------|------------------------|--------------|------------------|------------|
| | EARO (13) | Other (14) | EARO (13) | Other (14) |
| | <i>(in fte's)</i> | | <i>(percent)</i> | |
| Crop genetic improvement | 109.9 | 71.8 | 32.5 | 23.5 |
| Crop pest and disease control | 47.9 | 33.4 | 14.2 | 10.9 |
| Other crop | 35.7 | 50.1 | 10.6 | 16.4 |
| Livestock genetic improvement | 3.0 | 11.1 | 0.9 | 3.6 |
| Livestock pest and disease control | 11.9 | 19.9 | 3.5 | 6.5 |
| Other livestock | 37.9 | 40.0 | 11.2 | 13.1 |
| Soil | 30.0 | 26.4 | 8.9 | 8.6 |
| Water | 2.9 | 6.1 | 0.9 | 2.0 |
| Other natural resources | — | 6.3 | — | 2.1 |
| Postharvest | 2.8 | 1.1 | 0.8 | 0.4 |
| Other | 55.8 | 39.2 | 16.5 | 12.8 |
| Total | 338.0 | 305.5 | 100 | 100 |

Source: Compiled by authors from ASTI survey data (IFPRI –ISNAR –ASARECA 2001–02).

CONCLUSION

Agricultural R&D in Ethiopia has received increasing financial support from the government and through two consecutive World Bank loans. Total researcher numbers and total spending almost doubled in the 1990s, but the country's intensity of investment is still low compared with other African countries. Through ARTP, a number of long-standing constraints to Ethiopian agricultural research are being addressed, including the shortage of MSc- and PhD-qualified research staff; insufficient physical and financial resources; weak organizational structures for agricultural research; inadequate coverage of agroecological zones; inadequate planning and prioritization of research; and lack of collaboration among research agencies, with extension and farmers organizations, and with possible partners abroad (Demel 2002).

These are vital steps given that a large number of Ethiopians are in food crisis and will depend on food aid for their survival. Agricultural research must continue to address the major problems of declining production and productivity, worsening land degradation, increasing food insecurity, and lack of rain.

NOTES

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2. See Fisseha (1999) for more comprehensive details of constraints on the Ethiopian agricultural sector.
3. The 30-agency sample consisted of:
 - The Ethiopian Agricultural Research Organization (EARO)'s headquarters and its 14 federal research centers: Awasa National Maize Research Center (ANMRC), Ambo Plant Protection Research Center (APPRC), Bako National Maize Research Center (BNMRC), Debre Zeit Research Center (DZRC), Forestry Research Center (FRC), Holetta Agricultural Research Center (HARC), Jimma Research Center (JARC), Kulumsa Research Center (KRC), Melkassa Research Center (MRC), National Fisheries and Other Living Aquatic Resources Research Center (NFLARC), National Soil Research Center (NSRC), Pawe Research Center (PRC), Sebeta Animal Health Research Center (SAHRC), Werer Research Center (WRC);
 - Seven regional research centers: Adet, Sheno and Sirinka Agricultural Research Centers in the Amhara Region; Adamitulu, Bako and Sinana Agricultural Research Centers part of the Oromia Region Agricultural Research Institute; and Awassa Agricultural Research Center of the South Nations Nationalities Peoples Region;
 - Six higher-education agencies: Alemaya University (AU), Faculty of Veterinary of Addis Ababa University in Debre Zeit; Mekele University's Faculty of Dryland Agriculture and Natural Resources, Awassa College of Agriculture, Jimma College of Agriculture, and Wondo Genet College of Forestry;
 - Two private enterprises: Birale Agricultural Development Corporation and Ethiopian Spices Extraction Factory.

This agency sample excludes 10 government and 1 higher-education agency involved in agricultural research: 2 regional research centers—Abobo Agricultural Research Center in the Gambela Region and the Mekele Agricultural Research Center in the Tigray Region, 8 regional animal health laboratories, and the Ambo College of Agriculture.
4. Unless otherwise stated, all data on research expenditures are reported in 1993 prices and in international dollars or in 1999 birr.
5. The overall science and technology policy for Ethiopia is coordinated by the Ethiopian Science and Technology Commission (ESTC), which is an apex body under the central government (Fisseha 1999).
6. EARO'S headquarters comprises of five directorates, three coordination offices, the Project Planning, Monitoring and Evaluation department, and the Biometrics, Agrometrology and GIS Services.
7. Some of the entities under IAR were not transferred to EARO but became regional research centers.
8. Data are calculated as least squares growth rates.
9. Averages for East and Central Africa in this brief include 8 of the 10 member countries of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA): Burundi, Ethiopia, Eritrea, Kenya, Madagascar, Sudan, Tanzania and Uganda.
10. The 2000–02 increase in the number of EARO researchers holding PhD and MSc degrees was 14 and 4 researchers, respectively.

REFERENCES

- AU (Alemaya University). 2003. Welcome to Alemaya University page. <<http://www.telecom.net.et/~alemayau/history.html>> (accessed April 22, 2003).
- ASARECA (Association for Strengthening Agricultural Research in Eastern and Central Africa). 1995. *Regional human resource development for agricultural research in Eastern and Central African countries*. Entebbe.
- Beintema, N. M and P. G. Pardey. 2001. Recent developments in the conduct of Latin American agricultural research. Paper prepared for the international conference on agricultural science and technology, Beijing, November 7-9.
- Beintema, N. M. 2003. Presentation given at the 25th Meeting of the ASARECA Committee of Directors, Inter-Continental Hotel, Nairobi, January 27–31.
- CIFOR–AFREA (Centre for International Forestry Research and Association of Forestry Research Institutes for Eastern Africa). 2001–02. Research capacity assessment. Unpublished surveys. CIFOR, Bogor, Indonesia.
- Demel, T. 2002. Evolution and strategic plan of agricultural research in Ethiopia. Paper presented at the second committee of directors retreat of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), Kigali, September 30–May 4.
- EARO (Ethiopian Agricultural Research Organization). n.d. *Brighter future for Ethiopians through agricultural research: National agricultural research strategy 2001–2020*. Addis Ababa.
- Fisseha, F. 1999 Ethiopian agricultural research information management system (EARIMS). <<http://falcon.ifs.uni-inz.ac.at/research/masters/fisseha/>> (accessed April 22, 2003).
- Getinet, G., and G. Tadesse 1999. The national agricultural research system of Ethiopia. In *The national agricultural research systems in the West Asia and North Africa region*, ed. J. Casas, M. Solh, and H.Hafez. Aleppo, Syria: ICARDA, FAO, AARINENA, and CIHEAM.
- IFPRI–ISNAR–ASARECA (International Food Policy Research Institute, International Service for National Agricultural Research, and Association for Strengthening Agricultural Research in Eastern and Central Africa). 2001–02. Agricultural Science and Technology Indicators (ASTI) survey for East Africa. Unpublished surveys. IFPRI and ISNAR, Washington, D.C.
- OECD (Organisation for Economic Co-operation and Development). 1994. *The measurement of scientific and technical activities 1993: Standard practice for surveys of research and experimental development—Frascati Manual*. Paris.
- Pardey, P. G., and N. M. Beintema. 2001. *Slow magic: Agricultural R&D a century after Mendel*. IFPRI Food Policy Report. Washington, D.C.
- Pardey, P. G., J. Roseboom, and N. M. Beintema. 1997. Investments in African agricultural research. *World Development* 25 (March): 409–423.
- Roseboom, J., and P. G. Pardey. 1994. *Statistical brief on the national agricultural research system of Ethiopia*. Statistical Brief No. 7. The Hague: ISNAR.
- UNESCO (United Nations Educational, Scientific and Cultural Organization), Division of Statistics on Science and Technology. 1984. Manual for statistics on scientific and technological activities. UNESCO, Paris. Mimeo.
- Vidal, J. 2003. Ethiopia's worst famine in 20 years. *The Guardian* (April 18).
- World Bank–African Region. 1998. *Project appraisal document on a proposed credit in the amount of US\$60 million to the Federal Democratic Republic of Ethiopia for an agricultural research and training project*. No. 17794-ET. Washington, D.C.
- World Bank. 2003. *World development indicators 2003*. Washington, D.C. CD-ROM.

METHODOLOGY

- Most of the data in this brief are taken from unpublished surveys (IFPRI, ISNAR, and ASARECA 2001-02 and CIFOR-AFREA 2001) and Roseboom and Pardey (1994).
- 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 international dollars by deflating current local currency units with a Ethiopian 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 (2003). 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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