AGRICULTURAL SCIENCE AND TECHNOLOGY INDICATORS

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NEPAL

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This brief reviews the major investment and institutional trends in public agricultural research in Nepal since the mid-1990s, using recent data collected under the Agricultural Science and Technology Indicators (ASTI) initiative (IFPRI–NARC 2004-05).[1]

INTRODUCTION

With a 2003 per capita income of US$241 in 2000 prices, Nepal is the poorest country in South Asia. Two-thirds of the population is employed in the agricultural sector. In turn, agriculture contributes a significant share of GDP—more than 40 percent in 2004—and accounts for the bulk of the country's export earnings (FAO 2005; World Bank 2005). Landlocked between China and India, Nepal forms three agroecological zones of varying soil fertility and productivity potential, running northwest to southeast from the Indian border (the fertile plains of the Terai) to the mountains (the lower valleys and higher ranges of the Himalayas, at 1,000–3,000 and 3,000 or more meters above sea level, respectively). Rice is the principal crop in the lower parts of the country, maize dominates in the hills, wheat is grown in the Terai and Himalayan valleys, and livestock is strong in all three zones.

Nepal's agricultural sector grew at roughly 3 percent per year from 1993 to 2003, slightly higher than the comparable population growth of 2 percent per year (World Bank 2005). The country's dependence on agriculture therefore makes it critical to the country's overall economic growth and poverty alleviation goals. Recognizing this reality, the government of Nepal embarked on a 20-year agricultural development plan, which took effect in 1995. The Agriculture Perspective Plan (APP) was designed to promote annual agricultural growth of about 5 percent. The plan's agricultural research and development (R&D) component focuses primarily on expanding high-value commodities, such as tea, coffee, dairy products, and livestock. Nine agencies are involved in agricultural R&D in Nepal, eight of which are included

Table 1—Composition of agricultural research expenditures and total researchers, 2003

Type of agency	Total spending: 2000 Nepalese rupees	Total spending: 2000 international dollars	Total research staff	Share: Spending	Share: Researchers	Agencies in sample[a]
	(*millions*)		(*fte's*)	(*percent*)		(*number*)
NARC	257.9	20.7	331.0	74.4	76.5	1
Other government[b]	7.4	0.6	17.7	2.1	4.1	2
Nonprofit[c]	36.6	2.9	25.0	10.6	5.8	3
Tribhuvan University[d]	44.7	3.6	58.8	12.9	13.6	2
Total	**346.7**	**27.8**	**432.5**	**100**	**100**	**8**

Source: Compiled by authors from ASTI survey data (IFPRI–NARC 2004–05).

[a] See note 2 for a list of the eight agencies included in this sample.

[b] Staff at the other government agencies spent between 40 and 50 percent of their time on research, resulting in 17.7 fte researchers.

[c] Staff at the nonprofit agencies spent between 30 and 100 percent of their time on research, resulting in 25.0 fte researchers.

[d] Expenditures for the higher-education agencies in our sample are estimates based on average expenditures per researcher at the three government agencies. The 169 faculty staff employed at IAAS-DOR spent 20 percent of their time on research, resulting in 33.8 fte researchers. It was estimated that IOF employed 25 fte researchers.

KEY TRENDS

- During 1996–2003, total agricultural researcher numbers in Nepal rose steadily, while agricultural R&D expenditures followed an irregular trend.
- The principal agricultural research agency, the Nepal Agricultural Research Council (NARC), accounted for about three-quarters of Nepal's agricultural R&D spending in 2003.
- More than 40 percent of the scientist positions at NARC were vacant as of late 2005. Various financial, institutional, and security factors have hindered the retention of well-qualified staff.
- During 1998–2002, NARC was highly dependent on World Bank support through the Agricultural Research and Extension Project (AREP). The project's closure prompted a sharp drop in NARC's spending.
- Private-sector agricultural R&D is nonexistent in Nepal.

ABOUT ASTI

The Agricultural Science and Technology Indicators (ASTI) initiative comprises a network of national, regional, and international agricultural R&D agencies and is managed by the International Service for National Agricultural Research (ISNAR) division of the International Food Policy Research Institute (IFPRI). The ASTI 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's survey round in Asia was provided by the CGIAR Finance Committee/World Bank.

in our survey sample.[2] In 2003, these eight agencies employed a total of 433 full-time equivalent (fte) researchers and spent a combined 347 million Nepalese rupees or 28 million international dollars, both in 2000 constant prices.[3]

The Nepal Agricultural Research Council (NARC) under the Ministry of Agriculture and Cooperatives (MoAC) is the principal public agency involved in agricultural R&D in Nepal. In 2003, the council accounted for about 75 percent of both the country's agricultural research staff and its agricultural R&D expenditures. NARC was established as an autonomous body in 1991, with the goal of undertaking agricultural research in areas that generate overall economic growth (see *A Short History of Government-Based Agricultural Research* below). Governed by a council of 16 members, chaired by the Minister of Agriculture (and including an 8-member executive board responsible for the implementation of NARC's research programs), the council operates 14 commodity programs dealing with crops, horticulture, livestock, and fisheries.

NARC is headquartered in Kathmandu and comprises two national research institutes: the National Agricultural Research Institute (NARI) and the National Animal Science Research Institute (NASRI), both located in Lalitpur just outside the capital. Regional research in response to farmer needs is undertaken by four regional agricultural research stations (RARS) in Lumle, Nepalgunj, Parwanipur, and Tarahara, which address the needs of the western, mid-and far-western, central, and eastern regions, respectively. A further 18 agricultural research stations (ARS) function as regional testing sites. NARC also has several sites in specific agroecological zones focusing on outreach activities for specific commodities, such as fish, pastures and forages, citrus crops, and sericulture (NARC 2005).

Two other government agencies conduct agricultural R&D in Nepal. The Royal Nepal Academy of Science and Technology (RONAST) under the Ministry of Environment, Science, and Technology (MEST) was established in 1982 as an independent body to promote science and technology. RONAST's broad mandate includes advancing science and technology for national development, preserving and modernizing indigenous technologies, promoting science and technology research, and identifying and facilitating appropriate technology transfer (RONAST 2005). The academy is based in Lalitpur and comprises separate faculties of science and technology. In 2003, RONAST employed 13 fte researchers in agriculture, largely focusing on biotechnology, natural resources, and the environment. Under the Ministry of Forest and Soil Conservation (MFSC), the Kathmandu-based Department of Forest Research and Survey (DFRS) generates and updates forestry resources information for sustainable forest management and develops and demonstrates appropriate technologies for the conservation, management, and sustainable use of forestry resources. DFRS's Forest Research Division (FRD) conducts research related to natural forest management, agroforestry, plantation management, soil analysis, and socioeconomics, and employed 7 fte research staff in 2003. RONAST and DFRS only accounted for a combined 4 percent of Nepal's agricultural R&D staff and 2 percent of its agricultural R&D expenditures in 2003.

With the return of democracy in Nepal in 1990 (when the country was transformed from an absolute to a constitutional monarchy), a number of nongovernmental organizations (NGOs) involved in agricultural R&D emerged.[4] In 2003, four major NGOs conducted agricultural R&D in Nepal. The three NGOs for which data were available accounted for 6 percent of the country's agricultural research staff and 11 percent of agricultural R&D spending in 2003.[5] The Pokhara-based Local Initiatives for Biodiversity Research and Development (LIBIRD) is the largest of the three entities. This NGO aims to create and increase opportunities for the sustainable

A Short History of Government-Based Agricultural Research

Agricultural R&D in Nepal can be traced back to 1924, when the Department of Agriculture (DOA) was established, along with a trial/demonstration farm in Kathmandu and a nursery farm for fruit in Lalitpur. Until the 1950s, various agricultural stations and farms were established across the country, primarily for the purpose of adaptive research. The basic policy at the time was that Nepal should adopt and adapt technology from abroad. Scientists were largely engaged in providing support services to development activities rather than concentrating on research. In 1966, the existing DOA was dismantled, and five new departments were created, following a multidisciplinary approach: the Department of Agricultural Education and Research, the Department of Agricultural Extension, the Department of Horticulture, the Department of Livestock and Animal Health, and the Department of Fisheries.

National commodity development programs were established beginning in 1972. In 1972–73 a 10-year agricultural development plan was formulated and approved by the government. The five departments mentioned above were merged under the Ministry of Food, Agriculture, and Irrigation. Commodity-specific programs were expanded to include rice, maize, wheat, citrus crops, and potatoes. The agricultural projects services center (APROSC), a semiautonomous body within MOA, was established in 1975 with the mandate of conducting socioeconomic research.

In 1985, the National Agricultural Research and Services Centre (NARSC) was established under the Department of Agriculture. Two years later, the services branch of NARSC was discontinued, and NARSC became the central secretariat of the Research Coordination Committee (RCC), and then, in 1991, NARSC became the Nepal Agricultural Research Council (NARC). In 2000, APROSC's activities were halted, and its physical assets were absorbed by NARC.

The Department of Forest Research and Survey (DFRS) was initially established in 1963 as Forest Resources Survey Project to develop forest statistics and conduct research to maximize forest productivity. In 1976, DFRS became the Forest Survey and Research Office (FSRO), before being divided into survey and research branches in 1988. Forest Survey was relocated under the Ministry of Forestry, and Forest Research under the Department of Medicinal Plants, later to become the Department of Forestry and Plant Research. In 1993, these two entities were reunited to form the semiautonomous Forest Research and Survey Center (FORESC), which was given departmental status in 1999.

Sources: Mishra (1999) and DFRS (2005).

management of natural resources and biodiversity, and to improve the livelihoods of the poor through participatory R&D. In 2003, LIBIRD's 22 fte scientists were involved in research related to natural resources and biodiversity management at local, national, regional, and international levels (LIBIRD 2005). New ERA specializes in policy research, technical assistance, technology transfer, and training for development. Scientists employed at New ERA spent about one-third of their time on agricultural research (mainly socioeconomic and forestry research), resulting in 6 fte researchers in 2003. The Center for Environmental and Agricultural Policy Research and Development (CEAPRED) conducts limited micro- and macro-level policy studies and instigates action programs related to agriculture, health, and the environment. This NGO works in 17 of Nepal's districts and employed only 1 fte agricultural researcher in 2003.

Two higher-education agencies were involved in agricultural R&D in Nepal in 2003, together accounting for 13 percent of agricultural research staff and expenditures. Tribhuvan University's Directorate of Research within the Institute of Agriculture and Animal Science (IAAS-DOR) in Rampur promotes interdisciplinary research studies focusing on APP priorities. IAAS-DOR helps to develop proposals and carries out both basic and applied biological research and social science research related to agriculture. In 2003, IAAS-DOR employed 34 fte researchers working in a range of areas including crops, livestock, and fisheries. Forestry research is conducted by the Institute of Forestry (IOF), also under Tribhuvan University. In 2003, IOF employed an estimated 25 fte researchers working on 10 research projects, most of which were carried out in collaboration with foreign universities.

No private-sector agencies were identified as conducting agricultural R&D in Nepal. Where necessary, companies outsource their limited research requirements. Unlike many other Asian countries, no private seed companies have established breeding programs in Nepal. Nepalese companies largely rely on research conducted elsewhere (mainly India) for the distribution of hybrid seeds and plant and animal protection chemicals. Generally speaking, private-sector technological innovations in India quickly spillover into the markets of Nepal. Formal collaboration between NARC and the private sector has been rare to date. Linkages between private-sector companies (such as Dabur Nepal) and the NGOs are somewhat more common.

Nepal's agricultural R&D agencies engage in substantial collaboration at national, regional, and international levels. The National Agricultural Research and Development Fund (NARDF) was established in 2001 to enhance collaboration among the country's national R&D agencies (see the discussion of NARDF in the financing section). NARC promotes active collaboration with all national research entities, and also engages in substantial regional cooperation, particularly with national agricultural research centers of India, Sri Lanka, and South Korea. Internationally, the council maintains close ties with the International Rice Research Institute (IRRI), the International Maize and Wheat Improvement Center (CIMMYT), the International Plant Genetic Resources Institute (IPGRI), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and the International Center for Agricultural Research in the Dry Areas (ICARDA). Other major foreign and international partners include the Department for International Development (DFID, United Kingdom), the International Development Research Centre (IDRC, Canada), the United States Department of Agriculture (USDA), and the International Center for Underutilised Crops (ICUC). RONAST has official cooperation agreements with various Nepalese universities, including Tribhuvan University. In addition, RONAST has established formal and informal linkages with a number of universities and with international agencies, such as the Third World Academy of Science (TWAS), the Asian Institute of Technology (AIT), and various national science councils (RONAST 2005). At the national level, LIBIRD cooperates with NARC and IAAS. Internationally, the agency has established linkages with numerous foreign universities, NGOs, CGIAR centers, and private entrepreneurs specializing in seed multiplication and marketing activities (LIBIRD 2005). IAAS-DOR reported widespread cooperation with AIT, CIMMYT, and the Cummings School of Veterinary Medicine at Tuft University (United States), as well as with the German and Swiss development cooperation agencies. IOF scientists work closely with counterparts in Denmark and Norway.

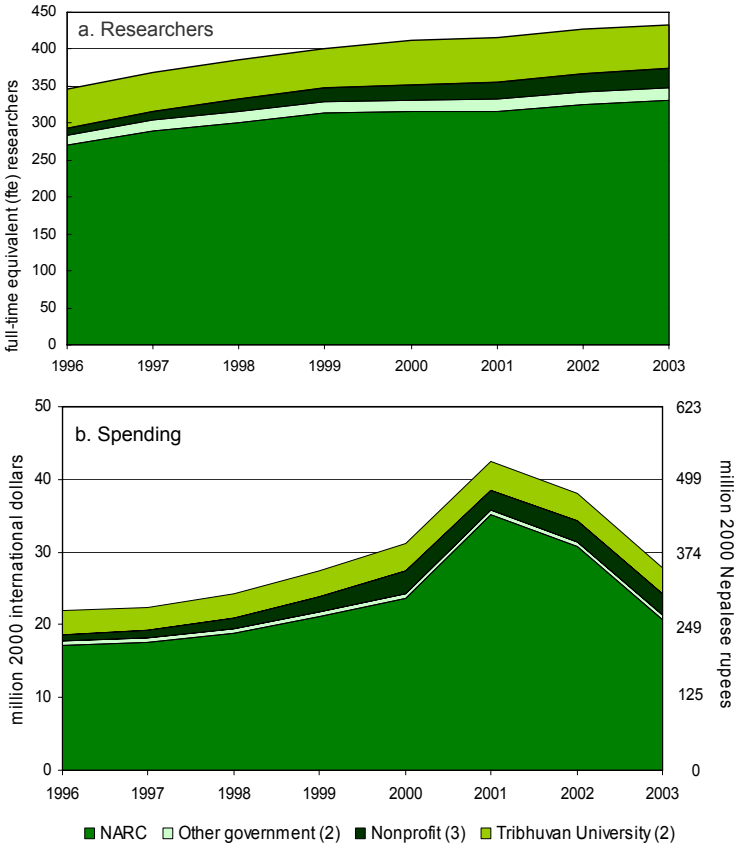
HUMAN AND FINANCIAL RESOURCES IN PUBLIC AGRICULTURAL R&D

Overall Trends

Total agricultural research staff numbers increased steadily in Nepal from 347 ftes in 1996 to 433 in 2003, representing average growth of 3.1 percent per year (Figure 1a). The nonprofit agencies displayed stronger growth during this period, at 14.3 percent per year. This was largely the result of rapid growth in researcher numbers at LIBIRD in association with collaborative research on in-situ plant genetic resources conservation funded by IPGRI. Total scientist numbers at NARC grew gradually during 1996–2003, from 270 to 331 fte's. Despite this increase, NARC faced serious difficulties in attracting and retaining qualified staff, given frequent management changes, difficulties attracting sufficient research funding, and factors creating political instability nationally. In 2003, NARC reviewed and adjusted its optimal requirement for research staffing in line with a government policy of reducing administrative costs.[6] At that time, the council approved 406 scientist positions and 306 technical officer positions, but as of December 2005 only 56 percent and 69 percent, respectively, had been filled.

Agricultural R&D expenditures in Nepal rose by 7.6 percent per year on average during 1996–2003 (Figure 1b). Total spending doubled during 1996–2001, from $22 to $42 million. For the most part, the World Bank-financed Agricultural Research and Extension Project (AREP) was responsible for this rapid growth. NARC received a substantial influx of funds through the project. Consequently, AREP's 2002 closure caused a sharp drop in NARC's—and hence the country's—agricultural R&D expenditures, such that by 2003 national agricultural R&D spending had contracted to $28 million. On the other hand, spending by LIBIRD increased steadily—fourfold during 1996–2003—on the basis of the aforementioned funding from IPGRI. In contrast, RONAST and CEAPRED both reported reduced 2003 spending levels on R&D (in real terms) compared with 1996.

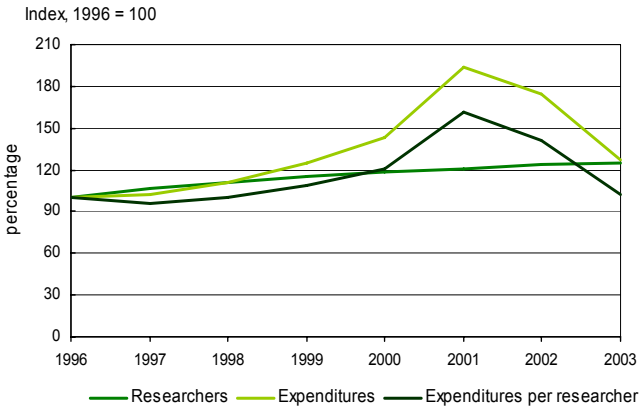
Figure 1—Public agricultural R&D trends, 1996-2003



Source: Compiled by authors from ASTI survey data (IFPRI–NARC 2004–05).
Notes: See Table 1. Figures in parentheses indicate the number of agencies in each category. Expenditures for the higher-education agencies in our sample are estimates based on average expenditures per researcher at the three government agencies. Expenditures at FRD-DFRS, LIBIRD, and New ERA for 1996–97/98 are estimates based on average expenditures per researcher at NARC and RONAST. Underlying data are available at the ASTI website (www.asti.cgiar.org).

Overall, average spending per researcher rose steadily from $63,000 in 1996 to $102,000 in 2001 (Figure 2). The completion of AREP, however, caused a significant drop in these levels. By 2003, Nepal's average expenditures per researcher, at $64,000, had effectively returned to their 1996 level, but these averages mask considerable variation across agencies. Unsurprisingly, LIBIRD's spending was high, resulting in average expenditures per researcher of $155,000 in 2003, while spending at RONAST, New ERA, and CEAPRED averaged only about $20,000. In comparison, spending per researcher at NARC averaged $63,000 in 2003.

Figure 2—Trends in public expenditures, researchers, and expenditures per researcher, 1996-2003

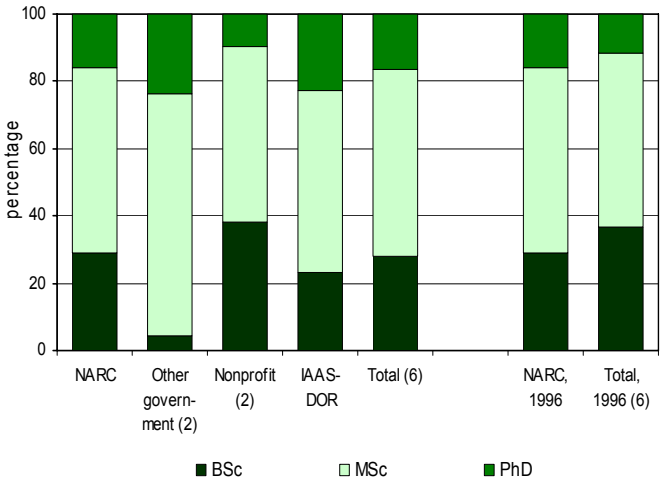


Source: See Figure 1.
Notes: See Figure 1.

Human Resources

In 2003, nearly three-quarters of fte agricultural researchers in Nepal were trained to the postgraduate level, and 17 percent held PhD degrees (Figure 3). The share of PhD-qualified staff is considerably lower than comparable shares in other South Asian countries, such as Bangladesh and Sri Lanka, at 25 percent each (Beintema and Kabir 2006; Stads et al. 2005). Higher-education agencies generally have higher shares of PhD-qualified researchers, and this is also true for Nepal. In 2003, 23 percent of staff at IAAS-DOR was trained to the PhD level, compared with 16 percent at NARC. Exact degree-level information for IOF was not available, but its share of postgraduate scientists is projected to be well above the NARC level. Atypically, the combined share of PhD-qualified researchers at RONAST and FRD–DFRS was 96 percent in 2003, but this can be explained by RONAST's policy of only employing scientists qualified to the MSc level or higher.

Figure 3—Educational attainment of research staff, 1996 and 2003



Source: Compiled by authors from ASTI survey data (IFPRI–NARC 2004–05).
Notes: Figures in parentheses indicate the number of agencies in each category. Figure excludes CEAPRED and IOF due to data unavailability.

Overall, qualifications of agricultural research staff in Nepal improved during 1996–2003. The total 1996 share of agricultural researchers with postgraduate degrees was 63 percent (compared with the 75 percent level in 2003 already mentioned). The share at NARC was 59 percent in 1996 compared with 71 percent in 2003. That year, two-thirds of NARC's researchers held degrees in agronomy and crop sciences, 17 percent were qualified in livestock health and husbandry, and the remainder were trained in fisheries, agricultural economics, food technology, and agricultural engineering (NARC 2005). Most of NARC's senior scientists were trained at Indian universities, while most BSc-qualified researchers received their degrees from IAAS. In the early 1990s, the United States Agency for International Development (USAID) made substantial contributions to human resource development in Nepal's agricultural sector—both generally, and to NARC in particular. The USAID-financed Agricultural Technology and Support Project (ATSP) provided MSc-level training opportunities to nine NARC scientists through universities in Thailand and to one scientist trained in the Philippines. The World Bank-funded AREP also incorporated an important training component, which offered significant short-term local training within NARC. In addition, funding under AREP supported 67 researchers in attaining MSc degrees and 13 in attaining PhD degrees. Most of these researchers were trained at IAAS and universities in India, although certain scientists studied at Philippine and Thai universities. With the completion of AREP in 2002, the number of NARC researchers undertaking postgraduate training abroad dropped sharply. The primary mechanism in support of training has since been allocations within donor-funded research projects, such as the Hill Maize Research Project (HMRP) financed by the Swiss Agency for Development and Cooperation (SDC). In the future, official training for NARC staff will be conducted at NARI and NASRI in collaboration with IAAS. The training program will also be integrated with NARC's research priorities.

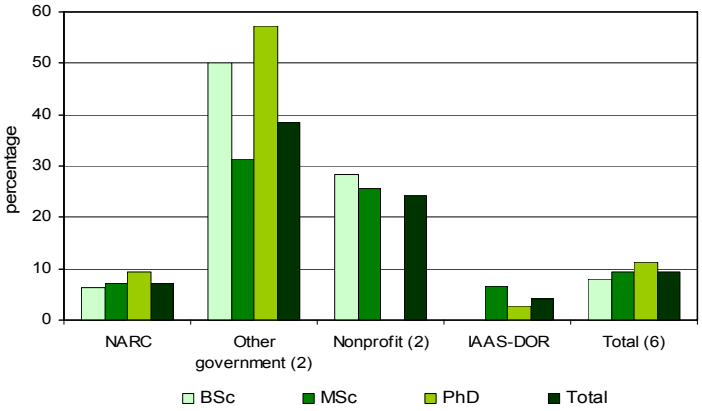
Given the extensive training discussed above, degree levels are now adequate at NARC, but the data presented above are for filled positions only. As previously mentioned, fewer than 60 percent of the positions available for scientists at NARC were actually filled as of 2005 because senior scientist turnover remains high. NARC has had difficulty competing for qualified staff with the higher-education and NGO agencies and institutions abroad. Salaries at the (international) NGOs are reported to be up to three times higher than those at NARC. A contributing factor is the NARC regulation encouraging scientists to continue working beyond the legal retirement age of 60; since the financial incentives are minimal, few scientists are willing to comply. The situation was further compounded by the practice of locating and transferring staff for nontechnical reasons that don't necessarily accommodate individual research interests or skill levels, which has negative consequences for job satisfaction and motivation (Hussein and Montagu 2000).

Retaining existing researchers and training new ones at NARC is a major challenge, and NARC recognizes that this trend needs to be halted (NARC 2005). NARC has made efforts to place senior staff in appropriate positions according to their field of research. Additional incentive plans for work satisfaction and training opportunities have also been put in place over time, including pensions and gratuity and medical allowances. Besides, research staff who manage to secure donor funding for their own projects are eligible for additional remuneration on top of their regular NARC salary. Nevertheless, these measures have not prevented the high senior-staff turnover. Moreover, many of NARC's senior scientists are approaching retirement age, which will only exacerbate the situation if a more effective solution is not found.

NARC's current recruitment policy aims to achieve a regional staffing balance according to program requirements, but only 28 researchers are employed in the mid-west and far-west regions of Nepal—some of the country's poorest and most remote areas.[7] The vast majority of NARC researchers are based in or around Kathmandu, and, as careers progress, scientists in the more remote areas tend to move from field locations to Kathmandu. Seniority often takes precedence over ability, skills, and merit when it comes to promotional opportunities. As a result, senior scientists are often cut off from their junior counterparts and the work carried at the remote stations. In this way, central decision-making processes are often divorced from the practical needs of the regional stations in addressing local farmer issues (Hussein and Montagu 2000).

Despite a rise in the number of women pursuing scientific careers worldwide, women still tend to be under-represented in senior scientific and leadership positions (Sheridan 1998). In 2003, only 9 percent of the fte researchers at Nepal's agricultural R&D agencies were female (Figure 4). Eleven percent of the PhD-qualified researchers, 10 percent of those with MSc degrees, and 8 percent of those with BSc degrees were female. Uncharacteristically, a relatively high share of researchers at RONAST was female. In 2003, half of this agency's scientists were women, as were half of its PhD-qualified researchers. Despite this, the overall share of female agricultural research staff in Nepal is very low compared with other South Asian countries; in Sri Lanka, for example, the share of female researchers was 33 percent in 2003, while in Bangladesh it was 13 percent (Beintema and Kabir 2006; Stads et al. 2005). The Asian Development Bank (ADB) (1999) reports that Nepal suffers from gender inequality in educational attainment, health status, and participation in the decision-making processes, and IAAS data indicate a severe gender gap in enrollment. In 1982 (when the institute only offered BSc-level training), women constituted only 2 percent of IAAS' total student population; 20 years later, this share had risen to 15 percent. In January 2006, 84 female and 482 male students were enrolled in the various degree programs offered (IFPRI-NARC 2005-06).

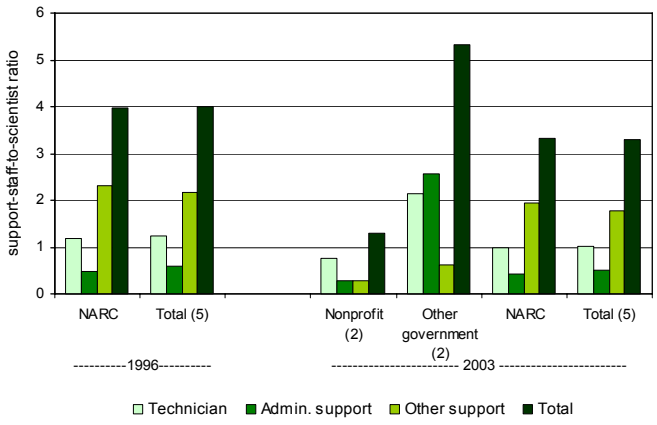
Figure 4—Share of female researchers, 2003



Source: Compiled by authors from ASTI survey data (IFPRI–NARC 2004–05).
Notes: Figures in parentheses indicate the number of agencies in each category. Figure excludes CEAPRED and IOF due to data unavailability.

In 2003, the average number of support staff per scientist in our five-agency sample was 3.3, comprising 1.0 technicians, 0.5 administrative personnel, and 1.8 other support staff such as laborers, guards, and drivers (Figure 5). The support-staff-ratio of the three nonprofit agencies (1.3) was much lower than the corresponding ratios at NARC (3.3) and the other government agencies (5.3). In 1996, the average number of support staff per scientist for a five-agency sample (excluding CEAPRED) was 4.0. The lower 2003 ratio was mainly the result of a decline in the average number of technicians and other support staff per researcher since 1996.

Figure 5— Support-staff-to-researcher ratios, 1996 and 2003

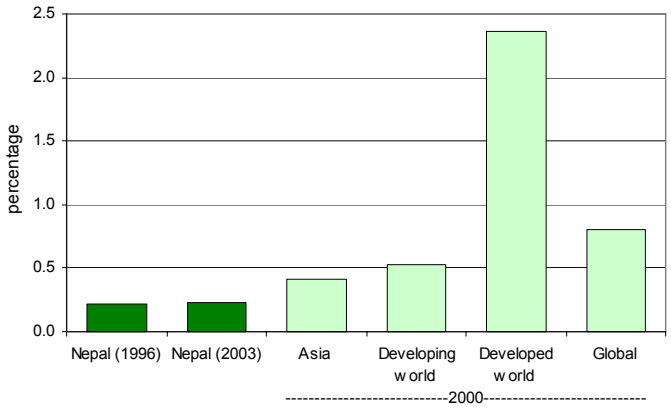


Source: Compiled by authors from ASTI survey data (IFPRI–NARC 2004–05).
Notes: Figures in parentheses indicate the number of agencies in each category. Figure excludes CEAPRED and the two higher education agencies due to data unavailability.

Spending

Total public spending as a percentage 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 2003, Nepal invested $0.22 for every $100 of agricultural output, which was identical to the corresponding ratio for 1996 (Figure 6). AREP caused a temporary rise in Nepal's intensity ratio, to 0.36 in 2001, but the project's completion prompted the abrupt return to earlier levels. By way of comparison, Nepal's intensity ratio was well below the reported average for Asia (0.41) and the developing world (0.53) for the year 2000.

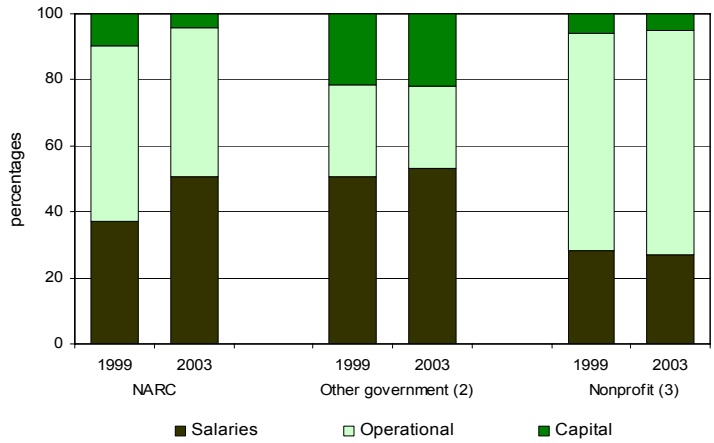
Figure 6—Nepal's public agricultural research intensity compared regionally and globally



Sources: Data for Nepal are compiled from Figure 2; AgGDP data are from World Bank (2005); all other intensity ratios are from Pardey et al. (2006).

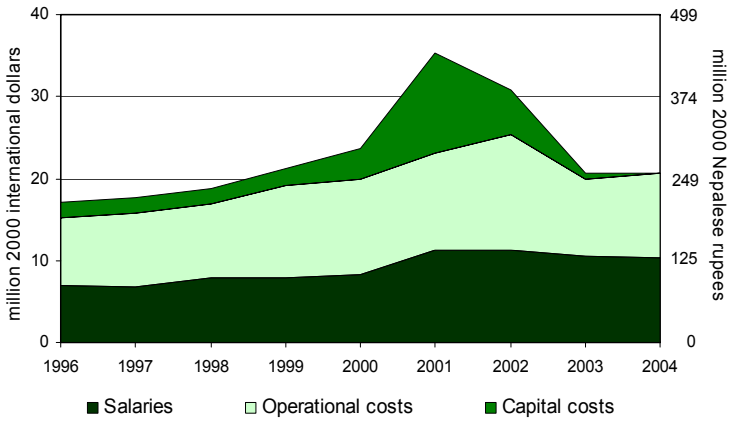
In 2003, salaries accounted for half of NARC's total expenditures; operating costs accounted for 45 percent, and capital costs for the remainder (Figure 7). These shares were quite different at the two other government agencies, which spent relatively more on capital expenses, and at the three nonprofit agencies, which spent relatively more on operating costs. Cost category shares remained fairly stable at both the other government agencies and the NGOs during 1999–2003. NARC's cost category shares were more irregular, however, given the council's dependence on AREP (Figure 8). This World Bank-financed project provided important funding for capital investments, such as construction works, laboratory equipment, farm machinery, and vehicles. Consequently, NARC's share of capital expenditures fluctuated broadly, rising from 11 percent in 1996, to 34 percent in 2001, and contracting to just 0.2 percent in 2004.

Figure 7— Cost-category shares, 1999 and 2003



Source: Compiled by authors from ASTI survey data (IFPRI–NARC 2004–05).

Figure 8— Cost-category shares in NARC's expenditures, 1996–2004



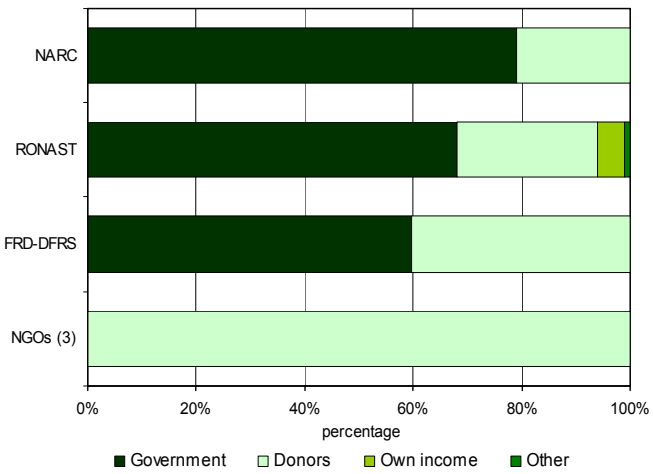
Source: Compiled by authors from ASTI survey data (IFPRI–NARC 2004–05).

FINANCING PUBLIC AGRICULTURAL R&D

Agricultural R&D in Nepal is supported by the national government, foreign donors, and loans from the World Bank and the ADB. RONAST receives its funding in the form of a national government grant. It supplements this allocation through donor grants, technical assistance, research contracts, and loans (RONAST 2005). In 2003, for example, the national government provided more than two-thirds of RONAST's funding; 25 percent was contributed by donors; and the remainder was generated internally or derived from other sources (Figure 9). FRD-DFRS is more donor-dependent. In 2003, this agency received 60 percent of its funding from the national government and the remainder from DFID. The three NGOs are entirely dependent on foreign donor support. LIBIRD's principal donors include IPGRI, DFID, the Sainsbury Family Trust (United Kingdom), German Technical Cooperation (GTZ), CIMMYT, the International Fund for Agricultural Development (IFAD), the International Centre for Integrated Mountain Development (ICIMOD), and the United Nations Development Programme (UNDP). New ERA's agricultural research is funded by USAID, UNDP, ADB, the World Bank, DFID, the Food and Agriculture Organization of the United Nations (FAO), and GTZ. CEAPRED reported financial support from ADB, CIMMYT, and various other donors.

Tribhuvan University reserves a small allocation of its annual budget for agricultural R&D, but most of its research funding is derived from external donors. IAAS-DOR currently has 16 externally funded research projects covering plant science, animal science, and plant protection measures. Many of these projects have been brought to the institute by individual faculty members who are actively encouraged to seek donor funding for their projects. Such donors include DFID, the Swiss Association for International Cooperation (HELVETAS), and CIMMYT. IOF reported funding from the European Union, the Danish International Development Agency (Danida), the Research Council of Norway, the Agricultural University of Norway, Winrock International, the Canadian International Development Agency (CIDA), and USAID. In recent years, an increasing number of research projects at Tribhuvan University are financed through NARDF.

Figure 9—Funding sources of government agencies and NGOs, 2003

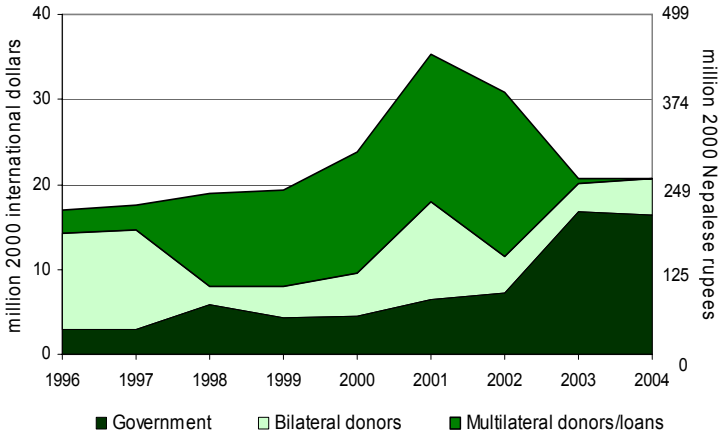


Source: Compiled by authors from ASTI survey data (IFPRI– NARC 2004–05).

Nepal Agricultural Research Council

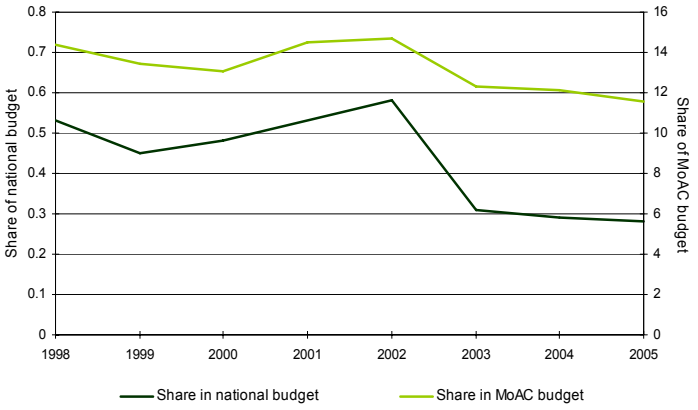
During 1996–2004, one-third of NARC's total funding was provided by the national government (through MoAC); the remainder was contributed as grants or loans from foreign donor agencies and financial institutions (Figure 10). Large shares of NARC's expenditures were financed through AREP during 1998–2002. Thereafter, the national government increased its allocation to NARC to an 80 percent share in 2003 and 2004. Despite this rise in recent years (in real terms), NARC's share of both the national budget and MoAC's budget has fallen (Figure 11), but this is mainly a reflection of increases in the national budget relative to those of MoAC and NARC.

Figure 10—NARC's funding sources, 1996–2004



Source: Compiled by authors from ASTI survey data (IFPRI–NARC 2004–05).

Figure 11— Proportion of NARC budget in MoAC budget and total national budget, 1998-2005



Source: NARC (2006).
Notes: The figures above are based on the annual budget allocated by the Nepalese government and do not include small research grants.

NARC has had a long history of donor support. USAID has been a principal supporter of agricultural research in Nepal for several decades. From 1990 to 1996, the agency provided intensive technical support to NARC under ATSP with the objective of strengthening the organization's ability to generate new technologies and transfer them to farmers by means of improved management systems. Database management and staff training were important components of the project.

Over the years, financial institutions such as the World Bank—and to a lesser extent ADB—have provided strong support to agricultural R&D and research–extension linkages in Nepal. The World Bank-supported AREP project consisted of agricultural research and extension components. Running from 1998 until 2002, the total cost of the project was US$30.5 million. The World Bank loan contributed 80 percent of this amount (US$24.3 million), and the Nepalese government contributed the remainder (US$6.2 million).[8] The project's research component totaled US$16.2 million. It was targeted to strengthening the country's agricultural research agencies by improving the management information systems, priority setting, monitoring, and evaluation; developing human resources through training and the introduction of a reward system based on results and performance; and expanding on-farm adaptive research in response to farmer needs. The research component also supplied capital upgrades to facilities, as well as equipment and working capital. The project was implemented by NARC and the Department of Agriculture (DOA), but the private sector, NGOs, and farmer groups were involved in the planning and implementation of activities such as contract research and technology transfer (World Bank 1997).

Despite important implementation difficulties during the early stages of AREP, a number of important results were achieved through the research component. NARC's 2021 Vision was finalized and approved,[9] and the project improved the regional management of research programs, including improving linkages with extension workers and farmers. In addition, many NARC scientists and technicians received postgraduate-level training. After the mid-term review of AREP, achievements were seen to falter. Of particular concern was senior staff turnover at NARC and the deterioration of political stability in Nepal from 2002, which greatly hindered fieldwork in the country's more remote areas (World Bank 2003).

In addition to AREP and the ADB-financed Secondary Crop Development Project, NARC received substantial funding from other donor agencies. During 1996–2004, the primary donors were the Japan International Cooperation Agency (JICA), through the KR-II Program; DFID, through the Hill Agriculture Research Project (HARP); SDC, through HMRP; and FAO, through the Hills Leasehold Forestry and Fodder Development Project (HLFFDP). Several international agricultural research centers also provide technical support to NARC to develop its human resource capacity and strengthen its research activities.

NARC did not receive any private-sector funding during our sample timeframe. However, the donor community is interested in involving the private sector in R&D in Nepal, and Vision 2021 envisages increased collaboration between NARC and the private sector.

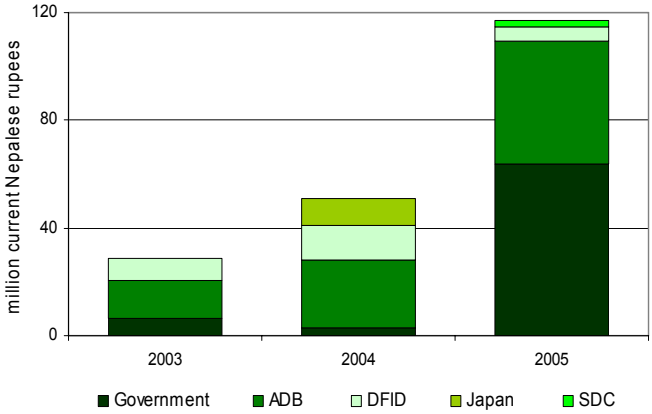
National Agricultural Research and Development Fund

The value of a competitive grant system for both research and extension has long been recognized in Nepal. In December 2001, HARP (financed by DFID) prompted the establishment of NARDF in 2001 as an autonomous organization to promote the participation of NGOs and private-sector agencies in agricultural R&D in Nepal and to provide full or partial grants to priority agricultural R&D programs (ITAD-New ERA 2005). NARDF also aims to promote a more demand-driven and pluralistic approach to increasing agricultural production by encouraging the development of institutional and organizational partnerships and by empowering end-users. NARDF is governed by a seven-member Fund Management Committee chaired by the Secretary of MoAC and administered and operated by the NARDF Secretariat. Research proposals are submitted to the secretariat under one of the following five themes: increased agricultural productivity of farming systems, crop research and extension, livestock and fisheries research and extension, sustainable natural resource use, and nontimber forest products and crops in the hill regions (NARDF 2005). NARDF has set clear criteria for demand-driven, participatory, action and adaptive research and development projects.

The initial funds for NARDF were largely provided by DFID and ADB, with limited counterpart funding from the Nepalese government. In subsequent years, the national government has funded an increasing share of NARDF through its annual budget. Total NARDF funds quadrupled during 2003–05 (Figure 12). Throughout this period, 43 percent of NARDF funds were provided by ADB, 37 percent by the Nepalese government, 13 percent by DFID, and the remainder by Japan and Switzerland. As of January 2006, NARDF has financed 38 individual research projects. NARC researchers managed to secure NARDF funding for 15 projects. Although cooperation between the various Nepalese agricultural R&D agencies was encouraged and envisaged at the introduction of the fund, NARDF has yet to substantially improve collaboration. Many NGOs do not involve NARC scientists in their NARDF proposals. NARC scientists, on the other hand, typically aim to involve extension agencies in most of their project proposals. NARC, for example, has submitted various joint proposals with the District Agriculture Development Office (DADO) for

research related to the cultivation and commercialization of rice, papaya, and vegetable crops in the west of Nepal. NARC has also secured NARDF funding for a project on infertility in dairy cattle in western and central Nepal in collaboration with the District Livestock Service Office (DLSO) and the National Livestock Breeding Centre (NLBC). Despite the rapid rise in total NARDF funding in recent years, the total fund is not expected to increase further in 2006.

Figure 12—NARDF's funding sources, 2003–2005



Source: Ministry of Finance (2004, 2005).

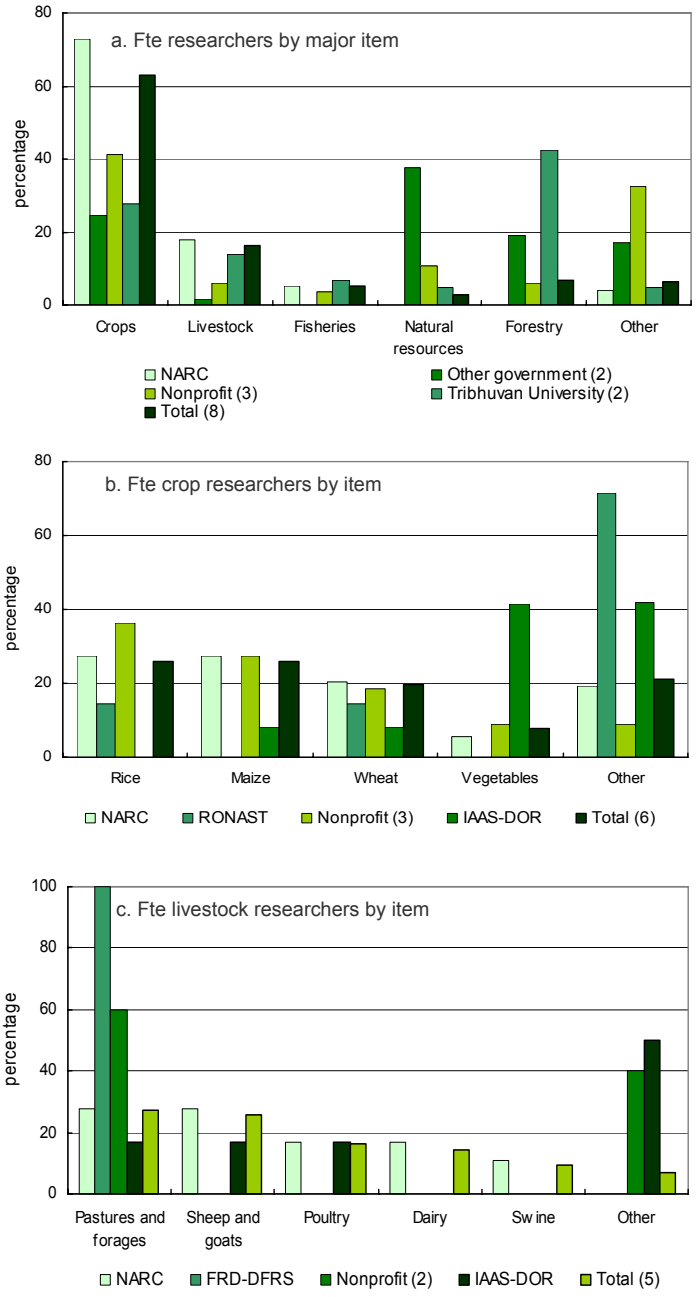
RESEARCH ORIENTATION

Commodity Focus

The allocation of resources among various lines of research is a significant policy decision, and so detailed information was collected on the number of fte researchers working in specific commodity and thematic areas. In 2003, nearly two-thirds of Nepal's 433 fte researchers conducted crop research. Livestock research accounted for 16 percent, forestry research for 7 percent, fisheries research for 5 percent, and natural resources research for 3 percent (Figure 13a). Research staff at NARC spent relatively more time on crop research than their counterparts at the other government agencies, the NGOs, and the higher-education agencies. Scientists at Tribhuvan University spent a relatively higher share of their time on forestry research and the two other government agencies were more involved in natural resources research than their counterparts in other sectors.

Rice and maize research each accounted for one-quarter of all crop research in 2003, while wheat research accounted for 20 percent and vegetable research for 8 percent (Figure 13b). Notable is the relatively high share of researcher time spent on vegetable research at IAAS-DOR (42 percent of crop research) and the strong focus on tea research at RONAST (71 percent). Most livestock researchers focused their efforts on pastures and forages (27 percent), sheep and goats (26 percent), poultry (16 percent), dairy (14 percent), and swine (10 percent) (Figure 13c).

Figure 13—Commodity Focus, 2003



Source: Compiled by authors from ASTI survey data (IFPRI–NARC 2004–05).
Notes: Figures in parentheses indicate the number of agencies in each category. Figure 13b only includes agencies involved in crop research; Figure 13c only includes agencies involved in livestock research.

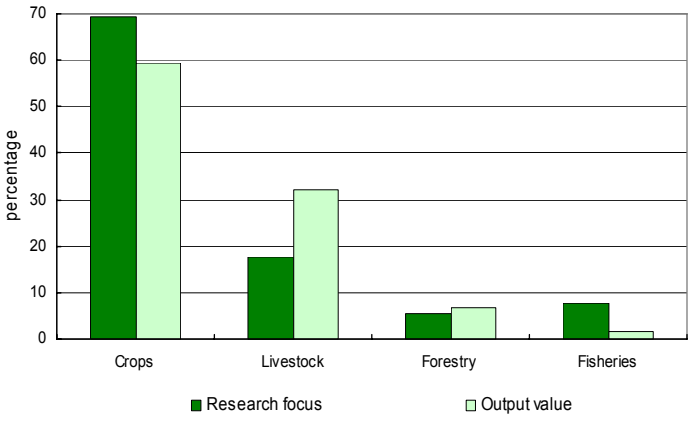
Due to budget cuts in recent years, the total number of individual NARC research programs has fallen from 514 in 2001 to 444 in 2005. Research activities on animal breeding, pastures and fodder, and soil science, in particular, were drastically cut. Fishery and socioeconomic research, on the other hand, have received more emphasis in recent years (ITAD-New ERA 2005).

The congruency or parity model is a commonly used method of assessing the allocation of research resources. This usually involves allocating funds (or, in this instance research personnel) among research areas in proportion to their

corresponding contribution to the value of agricultural production. For example, if the value of rice output were twice that of maize, then congruence would be achieved if research on rice were to receive twice as much funding (or, say, employ twice as many scientists). The model assumes that an additional dollar spent on research would yield a higher return if spent in areas with a relatively low ratio of research funding to output value, therefore funds should flow toward programs with relatively low research intensities and from those with higher ones. If research spending or scientist shares were congruent with the corresponding value of output for a particular commodity, then the congruency ratio for that commodity—measuring the commodity share of researchers to the corresponding share of output—would equal 1.0.[10]

Figure 14 shows the shares of crops, livestock, fisheries, and forestry in gross value of agricultural production with the corresponding share of research staff. In 2003, 70 percent of the researchers in our subsample conducted crop research—higher than the share of crops in the total value of agricultural production (59 percent). In contrast, the share of livestock researchers was almost half its share in total production value. The congruency ratios for fisheries was 4.6, meaning that the share of research staff involved in fisheries research was 4.6 times higher than the share of the fisheries sector in Nepal's total agricultural production (CBS 2005).

Figure 14—Congruence between agricultural R&D and production value, 2003–04



Sources: Compiled by authors from ASTI survey data (IFPRI–NARC 2004–05). Production values are from CBS (2005).
Notes: Natural resources and other research themes are not included. Production values are for 2004, research focus is for 2003.

Thematic Focus

In 2003, 15 percent of NARC's 331 fte researchers concentrated on crop genetic improvement, 15 percent on crop pest and disease control, and 10 percent on soil research (Table 2). The remaining researchers concentrated on other crop and livestock themes (25 and 15 percent, respectively). The thematic research focus of the 102 fte researchers at the seven other agencies was quite different. In 2003, 30 percent of these researchers focused on natural resources, 20 percent focused on crop pest and disease control, and 8 percent focused on crop genetic improvement.

Table 2—Thematic focus, 2003

Category	Numbers of researchers		Shares	
	NARC	Other (7)	NARC	Other (7)
	(*in fte's*)		(*percent*)	
Crop genetic improvement	49.7	8.1	15.0	8.0
Crop pest and disease control	49.7	20.0	15.0	19.7
Other crop	82.8	4.3	25.0	4.2
Livestock genetic improvement	16.6	0.0	5.0	0.0
Livestock pest and disease control	16.6	0.0	5.0	0.0
Other livestock	49.7	10.0	15.0	9.8
Soil	33.1	2.1	10.0	2.0
Water	0.0	0.8	0.0	0.8
Other natural resources	0.0	30.4	0.0	30.0
Postharvest	6.6	0.0	2.0	0.0
Other	26.5	25.9	8.0	25.5
Total	**331.0**	**101.5**	**100.0**	**100.0**

Source: Compiled by authors from ASTI survey data (IFPRI–NARC 2004–05).
Notes: Figures in parentheses indicate the number of agencies in each category.

CONCLUSION

Overall, agricultural researcher numbers in Nepal increased during 1996–2003, while the country's agricultural R&D expenditures followed a more irregular trend. Nepal's principal agricultural R&D agency, NARC, was highly dependent on the World Bank-financed project AREP, which ran from 1998 until 2002. The closure of this project led to a sharp fall in the council's and the country's agricultural R&D spending, prompting the Nepalese government to increase its funding to NARC. A distinctive feature of agricultural R&D in Nepal, compared with many other countries in the region, is the significant role of the nonprofit sector in agricultural research, which is funded entirely by foreign donors.

The agricultural sector has been identified by the Nepalese government as the primary engine for economic development. To this end, the government launched APP in 1995, a plan to accelerate annual agricultural production growth to about 5 percent during 1995–2015. Nevertheless, the country's average agricultural production growth was only 3 percent per year during 1995–2003, identical to the growth rate a decade prior to the launch of APP (World Bank 2005). NARC anticipated increased funding from the government at the onset of APP, but, in reality, NARC's share of the national budget has steadily fallen in recent years.

In addition to these financial challenges, certain institutional and security factors continue to hinder NARC in attracting and retaining qualified research staff. As of December 2005, just 56 percent of the council's available scientist positions were actually filled, mainly due to the fact that many scientists regard NGOs as much more attractive employers in terms of salaries. Most of NARC's scientists are based in or near Kathmandu, limiting the ability to respond appropriately to the needs of farmers in the country's more remote areas.

NOTES

1. The authors are grateful to numerous colleagues in Nepal for their time and assistance with the data collection, and thank Liliane Ndong for her assistance in collecting and inputting data. They also thank Nienke Beintema, B. R. Joshi, H. K. Manandhar, and S. B. Pandey for their useful comments on drafts of this brief. The authors would also like to express their gratitude to the Asia Pacific Association of Agricultural Research Institutions (APAARI) for facilitating the ASTI survey in the Asia-Pacific region.
2. The 8-agency sample consisted of:
   - three government agencies/units: the Nepal Agricultural Research Council (NARC), the Royal Nepal Academy of Science and Technology (RONAST), and the Forest Research Division of the Department of Forest Research and Survey (FRD-DFRS);
   - three nonprofit agencies: Local Initiatives for Biodiversity Research and Development (LIBIRD), New ERA, and the Center for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED); and
   - two higher-education agencies: the Directorate of Research of the Institute of Agricultural and Animal Science (IAAS-DOR) and the Institute of Forestry (IOF), both under Tribhuvan University.

   This sample excludes one nonprofit agency—the Forum for Rural Welfare and Agricultural Reform for Development (FORWARD)—for which data were unobtainable.
3. Unless otherwise stated, all data on research expenditures are reported in 2000 international dollars or 2000 Nepalese rupees.
4. This is said to be in response to the combination of the influx of donor funding and growing discontent among public-sector professionals, motivating them to seek alternative employment (ITAD-New ERA 2005). See the discussion in the section on human resources.
5. The omitted agency reportedly conducts minimal agricultural research; with its inclusion, these totals would be slightly, though not substantially, higher.
6. The total number of positions at NARC fell from 2,018 to 1,823; the number of approved scientist-level positions did not change, however.
7. Eight research stations are located in the mid-western region. There are no stations in the far-western region of Nepal.
8. US$5.3 million of the loan was cancelled during the mid-term review due to the project's slow start up (World Bank 2003).
9. Vision 2021 is a significant departure from past approaches that treated research as purely a public-sector responsibility. Following worldwide trends, the initiative recognizes the need for multiple partnerships among research providers in the public, academic, NGO, and private sectors (ITAD–New ERA 2005).
10. It is important to note, as described in Alston et al. (1998), that the model overlooks key factors affecting the payoff to R&D, such as the differences in probability of research success, likely adoption rates, and the likely extent of research-induced productivity gains. In addition, the model does not account for technology spill-ins from other countries, or differences in costs per scientists among different R&D areas. So, while the congruence rule is both useful for allocating resources and a distinct improvement over precedence and some other shortcut methods, ratios that differ from 1.0 are not necessarily a cause for concern.

METHODOLOGY

- Most of the data in this brief are taken from unpublished surveys (IFPRI and NARC 2004-05).
- The data were compiled using internationally accepted statistical procedures and definitions developed by the OECD and UNESCO for compiling R&D statistics (OECD 2002; UNESCO 1984). The authors 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. The researchers 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 2000 international dollars by deflating current local currency units with a Nepalese GDP deflator of base year 2000 and then converting to U.S. dollars with a 2000 purchasing power parity (PPP) index, both taken from World Bank (2005). 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.
- Annual growth rates were calculated using the least-squares regression method, which takes into account all observations in a period. This results in growth rates that reflect general trends that are not disproportionately influenced by exceptional values, especially at the end point of the period.

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

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