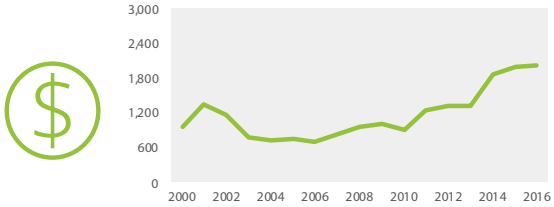
ASTI Country Brief | July 2019

NEPAL

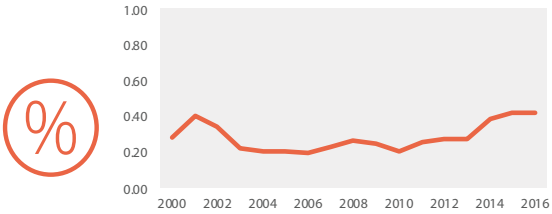
Gert-Jan Stads, Hari Shrestha, Alejandro Nin-Pratt, Samaya Gairhe, and Nguyen Thi Pham

AGRICULTURAL RESEARCH SPENDING



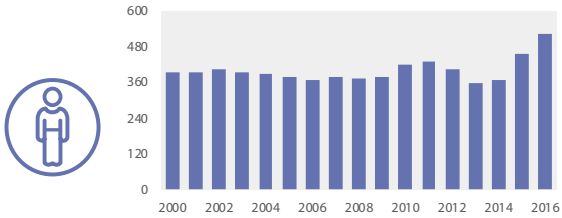
	NEPAL	BANGLADESH	INDIA (2014)	SRI LANKA
Million Nepalese rupees (2011 constant prices)	2,016.9			
Million PPP dollars (2011 constant prices)	81.9	287.9	3,298.4	112.4

SPENDING INTENSITY



	NEPAL	BANGLADESH	INDIA (2014)	SRI LANKA
Agricultural research spending as a share of AgGDP	0.42%	0.38%	0.30%	0.62%

AGRICULTURAL RESEARCHERS

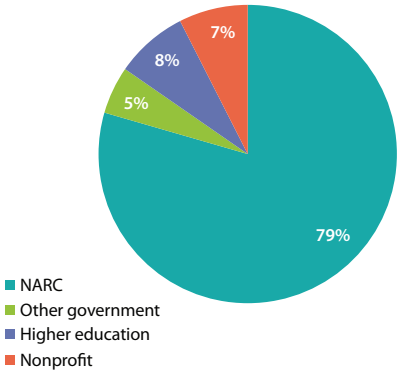


	NEPAL	BANGLADESH	INDIA (2014)	SRI LANKA
Full-time equivalents	519.7	2,268.6	12,746.6	648.0
Share of researchers with MSc and PhD degrees	71%	91%	99%	78%

Notes: Data in the table above are for 2016. Information on access to further resources, data procedures and methodologies, and acronyms and definitions are provided on Page 8. See **www.asti.cgiar.org/nepal/directory** for an overview of Nepal's agricultural R&D agencies.

- Agricultural research investment and human resource capacity in Nepal have grown rapidly in recent years in response to increased government funding; in 2016, the country invested 0.42 percent of its AgGDP in agricultural research.
- NARC is by far the largest agency conducting agricultural research, accounting for nearly 80 percent of Nepal's agricultural research investments and human resource capacity.
- Nepal's research agencies lack the infrastructure and critical mass of researchers needed to address the multidisciplinary challenges the agricultural sector is facing. It is important that recent government support be sustained in the long run.

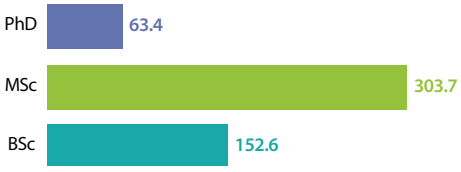
INSTITUTIONAL PROFILE, 2016



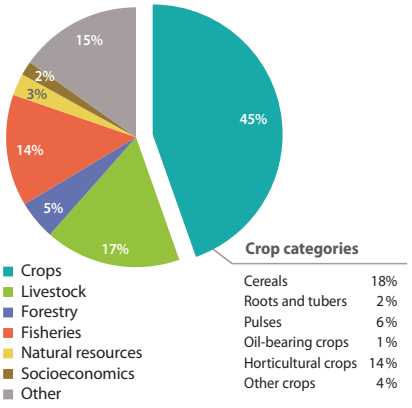
RESEARCHER PROFILE, 2016

By gender (%)

By qualification level (FTEs)



RESEARCH FOCUS, 2016



KEY CHALLENGE

- Protracted political instability in Nepal prompted long-term civil service recruitment restrictions, which were finally lifted in 2010. This impasse significantly distorted the age distribution of NARC's pool of scientists, such that the vast majority of the council's PhD-qualified researchers are due to retire in the next five years. Low salaries, limited training opportunities, an inequitable system of staff promotion, and a lack of performance-based incentives have caused many younger researchers to seek more attractive opportunities both in-country and abroad.

POLICY IMPLICATIONS

- A system of regular, vacancy-based recruitment is finally being established at NARC through the Public Service Commission, but large-scale training for young researchers remains an urgent priority. Raising the retirement age of NARC scientists from 60 to 63 years or higher (in line with the country's universities), would allow more time for senior researchers to train and mentor their younger colleagues. The government also needs to address the current inequitable system of staff promotions and pensions, and introduce performance-based incentives to attract, motivate, and retain scientists long term.

Agricultural researchers by degree level, 2016

AGENCY	PhD	MSc	BSc	TOTAL
		(FTEs)		
NARC	41.0	238.0	134.0	413.0
NAST	6.0	3.0	0.3	29.6
DFRS	0.8	11.2	5.6	17.6
AFU-FAAS	11.4	21.0	0.0	32.4
AFU-FF	1.5	7.0	0.0	8.5
LI-BIRD	2.1	19.6	9.1	30.8
FORWARD	0.6	3.9	3.6	8.1
Total	**63.4**	**303.7**	**152.6**	**519.7**

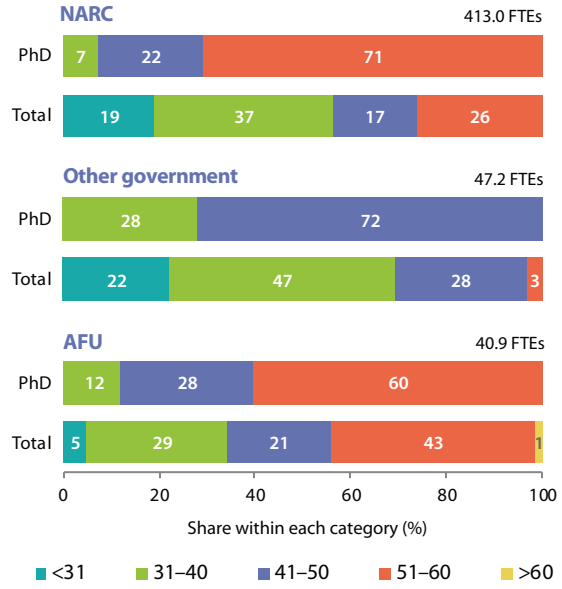
- Of the 520 FTEs involved in agricultural research in Nepal in 2016, only 12 percent were PhD-qualified. That year, researchers with MSc degrees accounted for 58 percent of the total, and researchers with BSc degrees for 29 percent. Although most of the country's PhD-qualified agricultural researchers were employed at NARC, the total number (41 FTEs) is small compared with many similarly sized national agricultural research institutes across the Asia-Pacific region.

DIFFICULTIES ATTRACTING AND RETAINING YOUNG, TALENTED SCIENTISTS

Agricultural scientists do not consider NARC to be an attractive employer, mainly because salary levels are considerably lower than those offered by nongovernmental organizations, and pensions are not assured by law. Although NARC has attempted to introduce a series of monetary incentives, none of these have been approved by the Ministry of Finance, and NARC employees are not eligible for a number of incentives available to other civil servants (such as medical discounts and scholarship opportunities for their children). Given these factors, many young and talented agricultural scientists have left—and continue to leave—Nepal to pursue opportunities in industrialized countries. Moreover, they are unlikely to return.

Another major disincentive to a career in agricultural R&D in Nepal is the fact that a PhD qualification has no impact on salary levels. The majority of NARC researchers undertaking PhD training under AFU's Plan B scheme (which is research- rather than course-based) are in their 50s, and some will have retired before completing their degrees. Consequently, while Plan B increases the number of PhD-qualified researchers short-term, it does not address long-term capacity constraints and constitutes an inefficient use of resources.

Agricultural researchers by age bracket, 2016



- Nepal has one of the oldest pools of agricultural researchers in the Asia–Pacific region. As of 2016, more than 70 percent of NARC's PhD-qualified researchers and 60 percent of AFU's agricultural researchers were in their 50s. The current retirement age for scientists at NARC is 60 years, compared with 63 years at AFU. It is important that young MSc-qualified researchers are given the opportunity to upgrade their qualifications so that NARC can maintain an appropriately trained pool of agricultural scientists into the future.

NARC'S INEQUITABLE STAFFING AND PROMOTION SYSTEM

- NARC researchers are promoted on a haphazard basis. Procedures do not follow a regular schedule, and upper level positions are not equitably granted. Consequently, a significant number of researchers face a career bottleneck. The 1,823 official research and support staff positions have been fixed since the early 1990s. Changes can only be made by the Council with the approval of the government, but to date this has never occurred. The current structure of positions and their distribution by discipline and location no longer meet NARC's needs. The system, therefore, urgently needs reform.

  On a positive note, with the introduction of the new constitution in 2015, all recruitment of public organizations is carried out through a rigorous process by the Public Service Commission. This new system has received broad support and has made recruitment more equitable and transparent. Nevertheless, given the relatively limited capacity of the Commission and the substantial backlog in recruitment, NARC's acute capacity challenges will take time to resolve.

CAPACITY STRENGTHENING INITIATIVES

- The majority of Nepalese agricultural researchers undertook their degrees in-country, and many continue to benefit from ongoing training. A number of NARC's researchers obtain degree-level training at AFU each year, and many benefit from training programs funded by CGIAR centers and international donor agencies, including the International Maize and Wheat Improvement Center, International Rice Research Institute, Bill and Melinda Gates Foundation, ACIAR (Australia), RDA (South Korea), SDC (Switzerland), USAID, and World Bank. In recent years, the Chinese government has increased opportunities for Nepalese scientists to receive training focused on hybrid rice breeding in China. Most of the externally funded training opportunities available to Nepalese scientists are focused on agronomy. Training opportunities in such areas as horticulture, livestock, and fisheries are rare.

  Four research institutes under the Indian Council of Agricultural Research have so-called deemed university status, which is an accreditation that allows them to award degrees. In Nepal, a proposal is currently under preparation to grant NARC deemed university status based on the Indian model. Such status, if adopted, would provide certain senior researchers with a (part-time) teaching mandate to enable the Council to more quickly and effectively strengthen its capacity. This would enhance junior researchers' access to higher degrees and contribute to staff retention, but it would require an official amendment to the NARC Act (1991).

NARC's MSc- and PhD-qualified agricultural researchers by discipline, 2016

	FTEs	
	MSc	**PhD**
Plant breeding/genetics (incl. biotechnology)	18.0	4.0
Plant pathology	23.0	2.0
Plant entomology	19.0	3.0
Agronomy	50.0	9.0
Horticulture	25.0	13.0
Animal breeding/genetics	4.0	1.0
Animal husbandry	20.0	—
Animal nutrition	5.0	1.0
Veterinary medicine	10.0	2.0
Pastures and agroforestry	8.0	—
Fisheries and aquatic resources	9.0	2.0
Soil sciences	20.0	—
Natural resources management	—	—
Water and irrigation management	—	—
Agrometeorology	1.0	—
Food sciences and nutrition	3.0	—
Socioeconomics (incl. agricultural economics)	11.0	4.0
Agricultural engineering	12.0	—
Other sciences	—	—
Total	**238.0**	**41.0**

- NARC lacks a critical mass of PhD-qualified researchers in a number of key areas. Given its aging pool of researchers, capacity gaps are only expected to increase in the coming years. Recruitment and training should therefore be based on a thorough skills gap analysis. In addition, incentives need to be put in place to motivate these new recruits over time. NARC currently has a significant number of vacancies for plant breeders, plant pathologists, agronomists, soil scientists, and veterinarians.

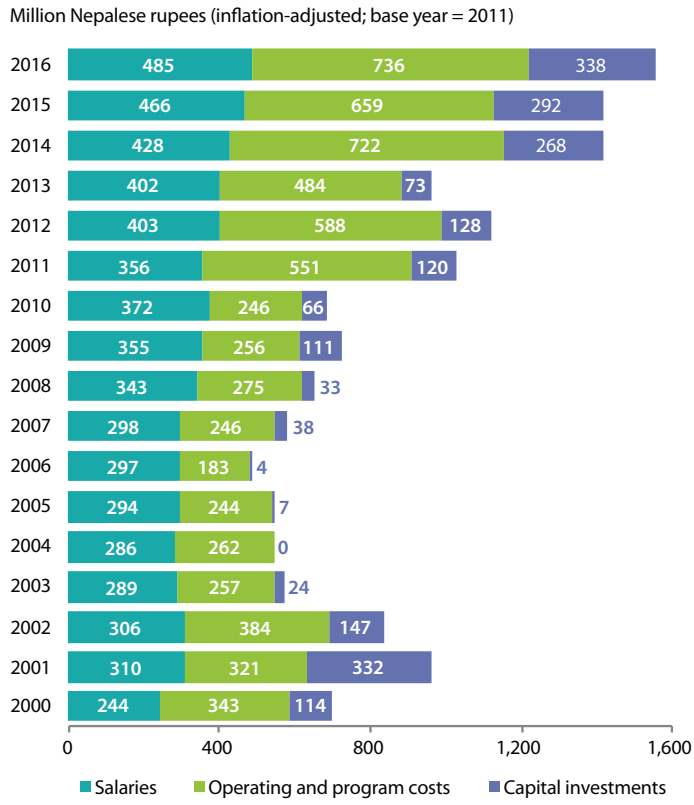
KEY CHALLENGE

- Despite its recent increase in agricultural research spending, Nepal is still underinvesting. In 2016, the country's spending on agricultural R&D represented only 0.42 percent of its AgGDP, which is low based on the country's rapid population growth, high levels of poverty and malnutrition, low agricultural productivity, and rising agricultural imports—all in the context of adverse climate change impacts.

POLICY IMPLICATIONS

- The recent launch of ADS and PMAMP are clear signs of government prioritization of agriculture and agricultural research, but it is important that this momentum be sustained. Research is a long-term endeavor requiring sustainable funding. Moreover, policy reform is needed to stimulate the diversification of funding sources, including funding by regional or local governments, as well as the private sector.

NARC's total expenditures by cost category, 2000–2016



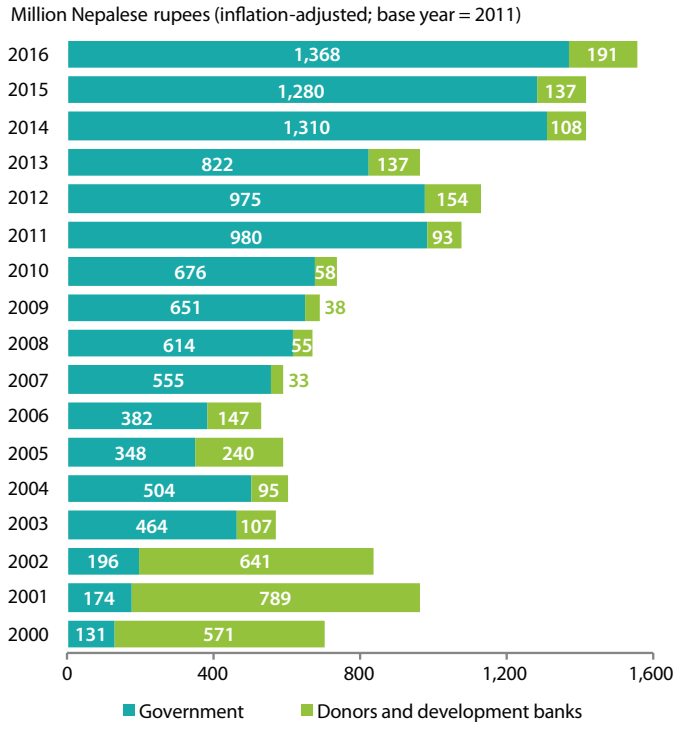
- The 2015 endorsement of ADS and the 2016 launch of PMAMP prompted an important influx of government funding for research programs and infrastructure upgrades.
- With the return of peace in 2006, NARC's spending levels rebounded. Both government and donor funding rose considerably between 2011 and 2013.
- The 2002 completion of the World Bank–funded Agricultural Research and Extension Project prompted sizable contractions in agricultural R&D spending.

MODERNIZING NEPAL'S AGRICULTURAL SECTOR

- In 2015, the Government of Nepal endorsed the 20-year, multibillion-dollar ADS, which recognizes the need for new, science-led innovations; strong seed and fertilizer input systems; and agricultural mechanization. ADS emphasizes productivity increases through a more decentralized agricultural research and extension system and a strengthened higher education system. In efforts to serve local demand, NARC will operate research stations across all of Nepal's regions, which will require major infrastructure investment. In addition, a number of new national research institutes—the National Horticultural Research Institute, National Animal Health Research Institute, and National Aquaculture and Fisheries Research Institute—will be established under NARC. Finally, a national agricultural research fund is set to make the research agenda more competitive and demand-driven.

PMAMP, which focuses on productivity enhancement and commercialization of major cereals, fisheries, fruits, and vegetables through farm mechanization, is closely aligned with the new strategy. Launched in 2016, PMAMP prioritizes wheat self-sufficiency by 2020, which will require an unprecedented increase in average yields of 10 percent per year. PMAMP has set similar targets for rice and maize. As the country's main agricultural research agency, NARC plays an important role in PMAMP through onfarm verification trials and community seed-production programs. After substantial PMAMP funding to NARC during 2016–2017, contributions fell by more than 80 percent in 2018. As a result of these budget cuts, NARC was forced to cut its role in the participatory research programs it conducted with the agricultural extension office, AFU, and farmers' groups. Volatility in funding has major implications for the long-term sustainability of the program.

NARC's funding sources, 2000–2016

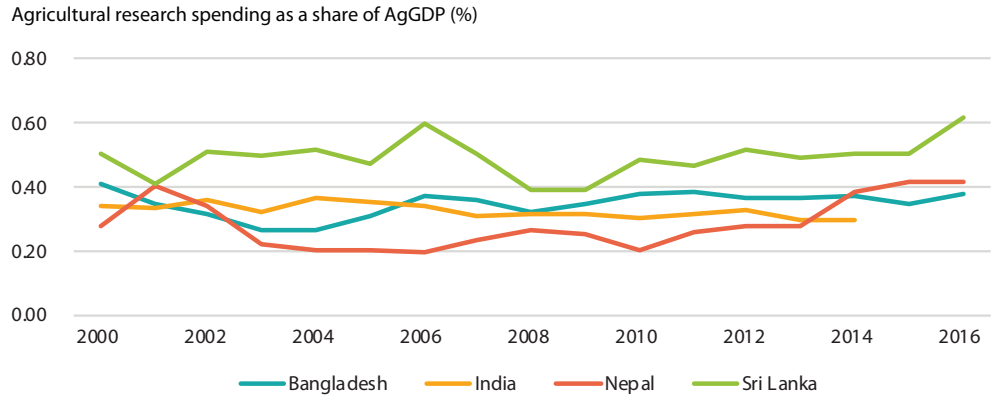


NARC has evolved from being heavily reliant on donor and development bank funding in the early 2000s, to being predominantly government-funded in recent years. Between 2010 and 2016, government contributions to NARC doubled (in inflation-adjusted terms), highlighting the government's increased focus on modernizing the agricultural sector. Donor funding has also increased in recent years. Unlike most other government agencies in Asian countries, NARC does not generate additional funding through the sale of goods and services because it is restricted from doing so by law.

DONOR FUNDING

- NARC was the main beneficiary of the technology development and adaptation component of the World Bank–funded Agriculture and Food Security Project (2013–2018). Over the course of the project, NARC released 22 improved crop and 8 improved livestock packages to project area producers. The project also included an important capacity strengthening component for NARC's staff.
- USAID's Feed the Future is funding the Nepal Seed and Fertilizer project (2016–2021), which aims to increase the availability of technologies to improve maize, rice, lentil, onion, cauliflower, and tomato productivity. The project works on improving the capacity within the public and private sectors (including NARC) in terms of their technology development and local dissemination roles.
- The Pilot Program for Climate Resilience (2012–2017), funded by the World Bank and the Asian Development Bank, included a small component implemented by NARC. In particular, NARC was responsible for developing weather and climate advisory bulletins, digitizing and archiving agricultural and spatial data, and studying the role of the public and private sector in agricultural insurance.
- Other donors include ACIAR, RDA, and SDC. ACIAR is funding the development and promotion of conservation technologies for rice, wheat, maize, and vegetables. RDA supports pest control in rice and the development of various vegetable and postharvest technologies. SDC is investing in improving land and labor productivity in rural areas by improving farmers' skills and enhancing their access to income-generating technologies.component for NARC's staff.

Agricultural research intensity, 2000–2016



Enhanced government prioritization of the agricultural sector is clearly visible in Nepal's agricultural research intensity ratio, which rose from 0.20 percent in 2010 to 0.42 percent in 2016. Nepal's 2016 ratio is higher than those of Bangladesh (2016) and India (2014), but lower than Sri Lanka's (2016). It should be noted, however, that when comparing intensity ratios across countries, broader agricultural and economic contexts also need to be taken into account.

KEY CHALLENGE

- Despite the release of a steady flow of improved varieties over time, ASTI analyses indicate that the long-term impact of agricultural research on agricultural productivity in Nepal has been relatively limited compared with many countries around the world. Political unrest, ineffective institutions, and an underachieving agricultural extension system are important underlying factors.

POLICY IMPLICATIONS

- Political and economic stability are just as important as increased research investment for ensuring future agricultural productivity growth. The government needs to ensure that R&D agencies have long-term human, financial, and physical resources to develop, adapt, and disseminate scientific and technological innovations effectively. An enabling policy environment is critical to maximizing the impact of innovations on agriculture, on rural and economic development, and ultimately on poverty and hunger.

Number of new varieties released or registered by NARC, 2013–2016

COMMODITY	RELEASED	REGISTERED
Rice	7	16
Maize	11	11
Wheat	4	0
Finger millet	2	0
Buckwheat	1	0
Rapeseed	1	2
Potatoes	2	2
Herbs and spices	2	5
Fruit and vegetables	3	34
Fodder	4	0
Total	**37**	**70**

- NARC's breeders released 37 new crop, horticultural, and fodder varieties during 2013–2016. This represents an improvement over the 2007–2012 period, when it released 33 new varieties. In addition, NARC is charged with testing externally developed varieties for a period of two years before they can be registered and released on the Nepalese market. During 2013–2016, NARC registered 70 externally developed varieties, mostly of rice, maize, cauliflower, gourds, and tomatoes.

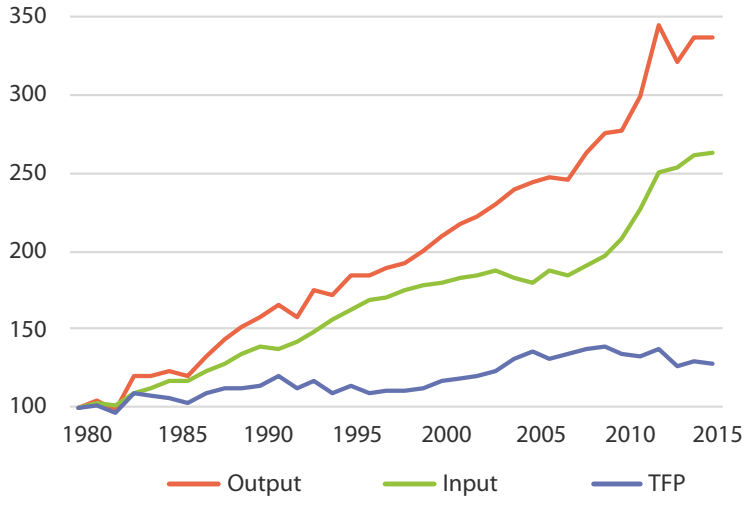
NARC's cereal-breeding program is relatively strong, but it has produced very few hybrid varieties. NARC's in-house capacity to conduct horticultural breeding remains very weak, however. Notwithstanding the steady release and registration of new varieties, Nepal lacks large seed companies that can commercialize these new varieties.

LIMITED AGRICULTURAL PRODUCTIVITY GROWTH

- Increasing the efficiency of agricultural production—that is, getting more output from the same amount of resources—is critical for improving food security. TFP is an indicator of how efficiently agricultural land, labor, capital, and other inputs (seed, fertilizer, and so on) are used to produce a country's agricultural outputs (crops and livestock). TFP is calculated as the ratio of total agricultural outputs to total production inputs. When more output is produced from a constant amount of resources—indicating that resources are being used more efficiently—TFP increases.

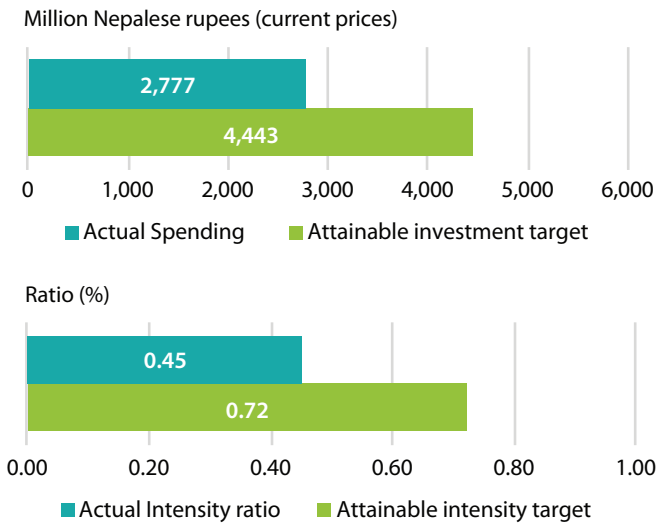
Agricultural output in Nepal more than tripled during 1980–2015, predominantly driven by growth in the use of inputs. TFP growth was low during this period, at just 0.7 percent per year compared with output growth of 3.5 percent per year on average. The highest increase in productivity occurred with the implementation of the Agricultural Perspective Plan in 1996, and lasted until 2004. The plan was technology-driven and emphasized livestock, high-value crops, agribusiness, and forestry. TFP has slowed since 2005, and average growth in recent years has been negative (the combined result of political unrest, civil conflict, and the devastating earthquake).

Long-term growth in agricultural input, output, and productivity, 1980–2015



Source: Calculated by authors based on USDA-ERS (2018).

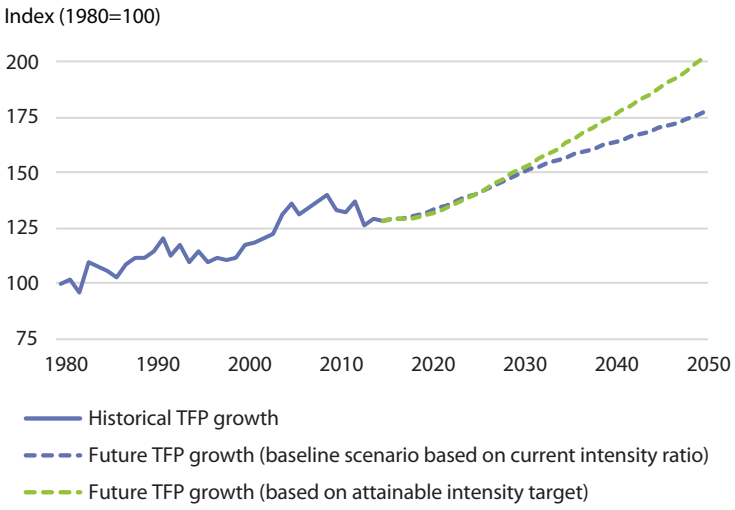
Actual agricultural research spending and attainable investment targets, 2016



Sources: Calculated by authors based on ASTI (2019) and Nin Pratt (2016).

Notes: Traditionally, agricultural research intensity ratios compare investment and AgGDP levels to determine whether countries may be underinvesting. ASTI's Intensity Index incorporates additional factors that account for the size and nature of a nation's economy and hence facilitate more accurate cross-country comparisons. For more information, see https://astinews.ifpri.info/2017/07/01/a-new-look-at-research-investment-goals-for-ssa/.

Agricultural productivity projections based on actual and attainable investment rates, 1980–2050



Sources: Calculated by authors based on ASTI (2019), USDA-ERS (2018), Nin Pratt (2016), FAO (2018), and World Bank (2018).

HOW MUCH IS NEPAL UNDERINVESTING IN AGRICULTURAL RESEARCH?

Conventional recommendations of agricultural research intensity levels, such as the 1 percent target set by the United Nations, assume that national investments should be proportional to the size of the agricultural sector. In reality, a country's capacity to invest in agricultural research depends on a range of variables, including the size of the economy, a country's income level, its agricultural production diversification, and the availability of relevant technology spillovers from other countries. In efforts to address these complexities, ASTI developed a multifaceted indicator of research intensity that comprises a range of weighted criteria (Nin Pratt 2016). This approach assumes that countries with the same mix of inputs will require similar minimum levels of research investment, and further that levels below this minimum indicate potential underinvestment.

ASTI's weighted indicator of research intensity demonstrates that Nepal is indeed underinvesting in agricultural research. Based on the structural characteristics of Nepal's economy and agricultural sector, the 1 percent investment target is out of reach, but an investment target of 0.72 percent of AgGDP is estimated to be realistic and attainable. To have met this lower target in 2016, Nepal would need to have invested an additional 1,666 million rupees over and above its actual investment of 2,777 million rupees (both in current prices). This gap—even though lower than in the 1990–2010 period—remains very high, raising questions as to the level of agricultural productivity that could have been achieved had these investments been made in the past.

In an effort to answer this question, ASTI undertook long-term projections of the impact of historical agricultural research investment on the country's agricultural output and productivity, and of the investment rates needed to close the investment gap. Results indicate that increasing agricultural research investment at a rate that will close the investment gap by 2030 will accelerate productivity growth between 0.9 and 1.3 annually between 2015 and 2050, which is significant, but not as striking as one would expect.

The fact that a productivity response to R&D investment in Nepal is relatively poor can be ascribed to two things. First, as a small country right next to India, Nepal receives important spillovers from its large neighbor, reducing the overall impact of domestic investment. Second, the fact that Nepal has struggled with political unrest almost continuously over the past few decades has had a severe impact on the continuity and effectiveness of agricultural policy, and limited the effectiveness of agricultural research investment on productivity growth. A sustained period of economic and political stability is likely to reverse this trend.

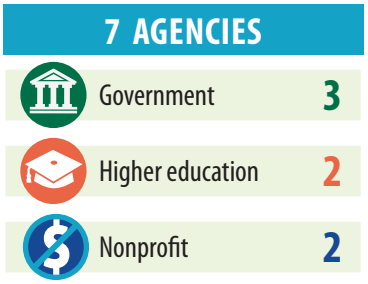
AN INEFFECTIVE AGRICULTURAL EXTENSION SYSTEM

Another important factor limiting the impact of agricultural research investment in Nepal is the relative ineffectiveness of the country's agricultural extension system. Problems often cited in association with Nepal's public agricultural extension system include insufficient funding, an inadequate number of extension workers, lack of extension worker qualifications and skills, lack of focus on farmers' needs, poor information and communications technology infrastructure and capacity, and dilution of impact due to thin coverage (Dhital 2017). The drivers of agricultural transformation are multidimensional and interrelated. A more holistic approach to agricultural innovation is vital, comprising research, extension, education, and policy, accompanied by an enabling institutional framework, political environment, and governance mechanisms.

OVERVIEW OF NEPAL'S AGRICULTURAL RESEARCH AGENCIES

Seven agencies undertake agricultural R&D in Nepal. NARC (413 agricultural FTEs in 2016) is the largest by far. It conducts research related to crops, livestock, aquaculture, natural resources, postharvest issues, and agricultural economics, together with assisting the national government in formulating agricultural policies. NARC is headquartered in Kathmandu and operates 5 regional agricultural research stations, 15 agricultural research stations, and 16 commodity research programs located across the country's various agroecological zones. DFRS (18 FTEs) and NAST (9 FTEs) are the only other government agencies involved in agricultural R&D. DFRS is engaged in limited forestry research, whereas most of NAST's research is focused on such areas as biofertilizer, biopesticide, and molecular studies.

Compared with most other countries in South Asia, nongovernmental organizations play an important role in agricultural R&D in Nepal: LI-BIRD (31 FTEs) mainly conducts research related to natural resources, biodiversity, and ecosystem services, whereas FORWARD (8 FTEs) conducts research in a variety of areas, including crops, dairy, and socioeconomics. In 2014, research units previously under Tribhuvan University were restructured under the newly established AFU. Research at AFU-FAAS (32 FTEs) focuses on crops, livestock, and fisheries, whereas research at AFU-FF (9 FTEs) focuses on forestry. The only private company identified as performing agricultural R&D in Nepal is a livestock feed company, Probiotech Industries, but its R&D activities are reported to be minimal.



For a complete list of the agencies included in ASTI's dataset for Nepal, visit **www.asti.cgiar.org/nepal**.

For more information on ASTI's **data procedures and methodology**, *visit* **www.asti.cgiar.org/methodology**; *for more information on agricultural R&D in Nepal, visit* **www.asti.cgiar.org/nepal**.

ACRONYMS USED IN THIS COUNTRY BRIEF

ACIAR	Australian Centre for International Agricultural Research
ADS	Agriculture Development Strategy
AFU-FAAS	Agriculture and Forestry University – Faculty of Agriculture and Animal Science
AFU-FF	Agriculture and Forestry University – Faculty of Forestry
AgGDP	agricultural gross domestic product
DFRS	Department of Forest Research and Survey
FORWARD	Forum for Rural Welfare and Agricultural Reform for Development
FTE(s)	full-time equivalent(s)
LI-BIRD	Local Initiatives for Biodiversity, Research, and Development
NARC	National Agricultural Research Council
NAST	National Academy of Science and Technology
PMAMP	Prime Minister Agriculture Modernisation Project
PPP	purchasing power parity (exchange rates)
R&D	research and experimental development
RDA	Rural Development Administration (South Korea)
SDC	Swiss Agency for Development and Cooperation
TFP	total factor productivity
USAID	United States Agency for International Development

ABOUT ASTI, IFPRI, APAARI, AND NARC

Working through collaborative alliances with numerous national and regional R&D agencies and international institutions, **Agricultural Science and Technology Indicators (ASTI)** is a comprehensive and trusted source of information on agricultural R&D systems across the developing world. In the Indo–Pacific region, ASTI is facilitated by the **International Food Policy Research Institute (IFPRI)** and the **Asia-Pacific Association of Agricultural Research Institutions (APAARI)**. The **Nepal Agricultural Research Council (NARC)** is Nepal's principal agricultural research agency. It operates under the Ministry of Agricultural Development and carries out research related to crops, livestock, horticulture, aquaculture, natural resources, and socioeconomics.

IFPRI, APAARI, and NARC gratefully acknowledge participating agricultural R&D agencies for their contributions to the data collection and preparation of this country brief. They also thanks the Bill and Melinda Gates Foundation and CGIAR Research Program on Policies, Institutions, and Markets for their generous support of ASTI's work in Nepal. This country brief has been prepared as an ASTI output and has not been peer reviewed; any opinions are those of the authors and do not necessarily reflect the policies or opinions of IFPRI, APAARI, or NARC.