INDIA

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KEY INDICATORS, 2000–2014

Total Agricultural Research Spending	2000		2009		2014
Indian rupees (million constant 2011 prices)	28,768.3		40,040.9		49,836.6
PPP dollars (million constant 2011 prices)	1,904.0		2,650.1		3,298.4
Overall Growth	|	**39%**	|	**24%**	|
Total Number of Agricultural Researchers					
Full-time equivalents (FTEs)	13,106.6		11,786.6		12,746.6
Overall Growth	|	**–10%**	|	**8%**	|
Agricultural Research Intensity					
Spending as a share of agricultural GDP	0.34%		0.32%		0.30%
FTE researchers per 100,000 farmers	5.52		4.48		4.62

Notes: Research conducted by the private for-profit sector is excluded from this factsheet due to lack of available data. Acronyms, definitions, and an overview of agricultural R&D agencies are provided on the back page.

- India has one of the largest and most well-coordinated agricultural research systems in the world. Research is primarily structured around agencies under the ICAR umbrella at the federal level and within agricultural universities at the state level.
- Notwithstanding the fact that India's agricultural research expenditures nearly doubled between 2000 and 2014 (in inflation-adjusted terms), agricultural research spending as a share of AgGDP fell slightly during this timeframe, from 0.34 to 0.30 percent.
- India's total number of agricultural researchers declined gradually between 2000 and 2009, which can largely be attributed to stagnating recruitment at the country's universities. Research capacity has rebounded since, primarily due to the establishment of a number of new universities and colleges.

FINANCIAL RESOURCES, 2014

Spending Allocation

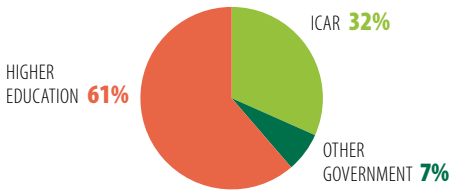
Salaries	73%
Operating and program costs	18%
Capital investments	10%

Funding Sources

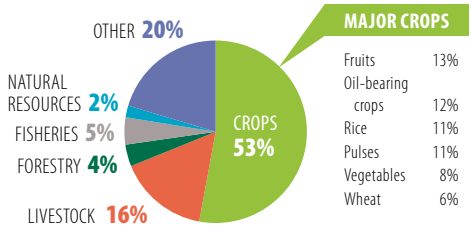
Government	90%
Other	10%

Note: Shares are based on ICAR agencies and State Agricultural Universities only.

INSTITUTIONAL PROFILE, 2014



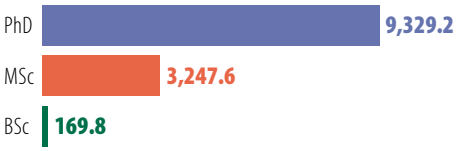
RESEARCH FOCUS, 2014



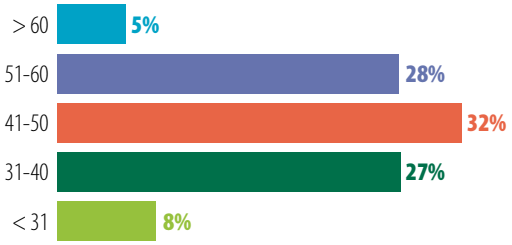
Notes: Major crops include those that are the focus of at least 5 percent of all crop researchers; 39 percent of total crop researchers focused on a wide variety of other crops.

RESEARCHER PROFILE, 2014

Number by qualification (FTEs)



Share by age group (years)



CHALLENGE

- Agricultural universities have gradually become less effective in stimulating necessary transformative change in India's agricultural sector. Over time, greater fragmentation of the higher education sector, coupled with recruitment restrictions, has eroded research capacity at agricultural universities. In addition, budgetary levels have not kept pace with increasing student admissions in recent years, so many universities lack sufficient staff and funding to conduct effective research programs.

POLICY OPTION

- An ambitious reform agenda for agricultural universities—detailed in the 2013 Bhubaneshwar Declaration—emphasizes transparent governance, financial and academic autonomy, more rigid quality and accreditation standards for new universities, public–private partnerships, reformed teaching curricula, and enhanced international cooperation. The upcoming World Bank–funded National Higher Agricultural Education Project is set to address all of these issues, key among them, sustainable funding and adequate staffing levels.

Number of agricultural researchers by institutional sector, 2000–2014 (FTEs)

- On average, agricultural researcher numbers have hovered around 12,000–13,000 FTEs. During 2000–2009, levels markedly decreased at ICAR and the universities in response to years of stagnating recruitment. The number of agricultural researchers has begun to rise again in more recent years, largely due to the establishment of a number of specialized universities focusing on animal science, together with an intensification of recruitment efforts by ICAR agencies.

Number of sanctioned and filled positions at ICAR and in the higher education sector, 2014 (headcounts)

	SANCTIONED	FILLED	DEFICIENCY (%)
ICAR	6,472	4,997	22.7
Agricultural universities	27,585	17,004	38.4

Sources: Data on sanctioned posts from IAUA and DARE.
Notes: Agricultural universities only include state agricultural, veterinary, horticultural, and fisheries universities as well as central agricultural universities. Data for ICAR deemed universities are reported under ICAR.

CHALLENGES CONFRONTING AGRICULTURAL UNIVERSITIES

Although funding support from state governments has prompted the number of agricultural universities to expand significantly, staff recruitment has not kept pace with growing student numbers, and numerous faculty and other positions remain vacant. Long-term recruitment restrictions have ultimately increased staff workloads and reduced the time available for research. Moreover, the phenomenon known as "academic inbreeding" is widespread: Roughly half of all agricultural faculty members earned their undergraduate and postgraduate degrees from a single university, and about 80 percent of faculty recruits graduated from their employing university. Weak linkages with the private sector have promoted academic stagnation at a time when competitiveness demands increased networking, not less. About half of India's agricultural employment opportunities are in the private sector, yet curricula predominantly target the needs of the public sector. Finally, few incentives are in place to incentivize innovation or productivity in either teaching or research.

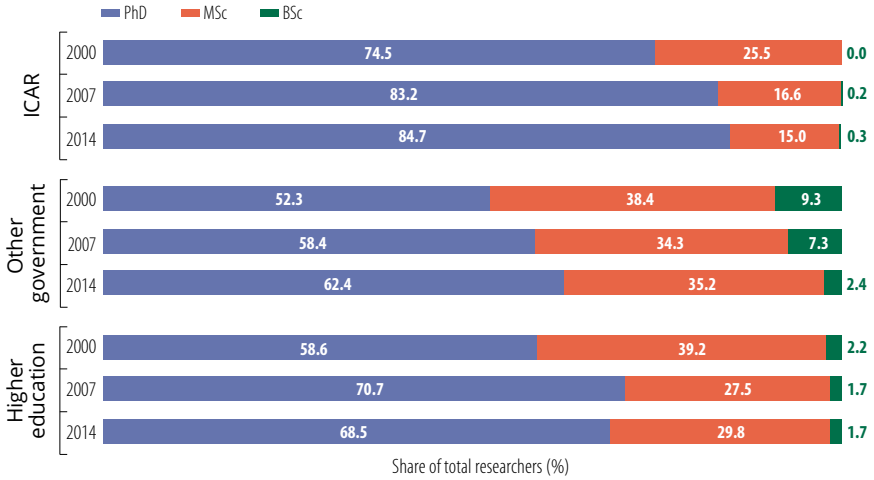
CHALLENGE

- Privately performed agricultural research has expanded rapidly since the 1990s, and by 2009—the latest year for which data are available—private companies accounted for an estimated 20 percent of India's total agricultural research spending. The coverage, quality, and depth of data on private agricultural research is poor, so government, donors, private companies, and other stakeholders are challenged in their ability to set future policy and research priorities.

POLICY OPTION

- Despite challenges related to collecting data from private firms, accurate and frequent monitoring of trends in private agricultural research capacity, spending, and outputs is critical to facilitate an accurate assessment of the impact of government policy on private innovation and, in turn, on private innovation's impact on food security, poverty, and other development goals. Access to up-to-date high-quality data will positively impact the quality of policy- and decisionmaking on the long run.

Distribution of agricultural researchers by qualification level, 2000, 2007, and 2014 (FTEs)



The average qualification levels of Indian agricultural researchers steadily improved during 2000–2014. In 2014, 85 percent of ICAR researchers held PhD degrees, as did 62 percent of researchers employed at the other government agencies and 68 percent of researchers employed at agricultural universities.

Note: Data exclude what is known as "regular research staff," who assist scientists and conduct maintenance in laboratories and on experiment farms. ICAR agencies employ nearly 6,000 regular research staff, and the agricultural universities employ approximately 3,000. While qualification levels vary considerably, most regular research staff are qualified to the MSc-degree level.

Certain states employ significantly lower numbers of researchers than their population or number of farmers warrants. This situation is particularly serious in Jharkand and Bihar, two of country's poorest and most agriculture-dependent states in terms income and employment levels. Delhi is home to a large number of researchers and very few farmers, which explains the city's extremely high FTEs-per-100,000-farmers ratio.

Distribution of agricultural researchers by state, 2014 (FTEs)

	FTEs	FTEs per 100,000 farmers		FTEs	FTEs per 100,000 farmers		FTEs	FTEs per 100,000 farmers
Uttar Pradesh	1,320.4	3.5	Rajasthan	427.3	2.4	Jharkand	130.8	1.6
Karnataka	1,319.1	10.1	Gujarat	417.6	3.6	Meghalaya	128.4	18.9
Maharashtra	1,217.6	4.9	Bihar	414.5	1.7	Manipur	87.5	17.7
Andhra Pradesh	998.8	4.5	Madhya Pradesh	388.4	1.8	Andaman and Nicobar	27.0	na
Tamil Nadu	943.7	7.7	Assam	348.1	6.0	Goa	23.0	49.2
Haryana	701.7	18.4	Odisha	344.5	3.2	Nagaland	20.3	3.5
Kerala	687.8	41.2	Jammu and Kashmir	330.8	19.7	Puducherry	18.2	na
Delhi	595.3	2,688.6	West Bengal	329.8	2.2	Sikkim	11.4	8.1
Punjab	514.1	15.5	Chhattisgarh	262.7	3.0	Arunachal Pradesh	9.0	4.5
Uttarakhand	477.5	24.7	Himachal Pradesh	251.6	11.3			

Source: Farmer data are from Indiastat (www.indiastat.com).
Notes: Researchers are allocated to the states in which their employing agency's headquarters are located (hence, states without headquarters are not included). Researchers based in Telangana (which split from Andhra Pradesh in June 2014) have been allocated to Andhra Pradesh; na = data were not available.

INTER-INSTITUTIONAL COLLABORATION

Lack of a critical mass of agricultural researchers in certain states is being mitigated to some extent by 62 AICRPs. These projects are intended to build national interdisciplinary research networks linking ICAR institutes with SAUs to focus attention on commodities, resources, and species of national importance. The AICRP network has been successful in mobilizing India's scarce resources through inter-institutional and interdisciplinary collaboration and joint evaluation of new technologies.

A major focus of India's Twelfth Five-Year Plan (2012–2017) is inter-institutional collaboration. This is promoted by allocating more funding through ICAR to large commissioned projects in priority fields like genomics, water conservation, diagnostics and vaccines, farm mechanization, and postharvest management. The collaborations involve institutions both within and outside ICAR and the SAU system and include private-sector participation.

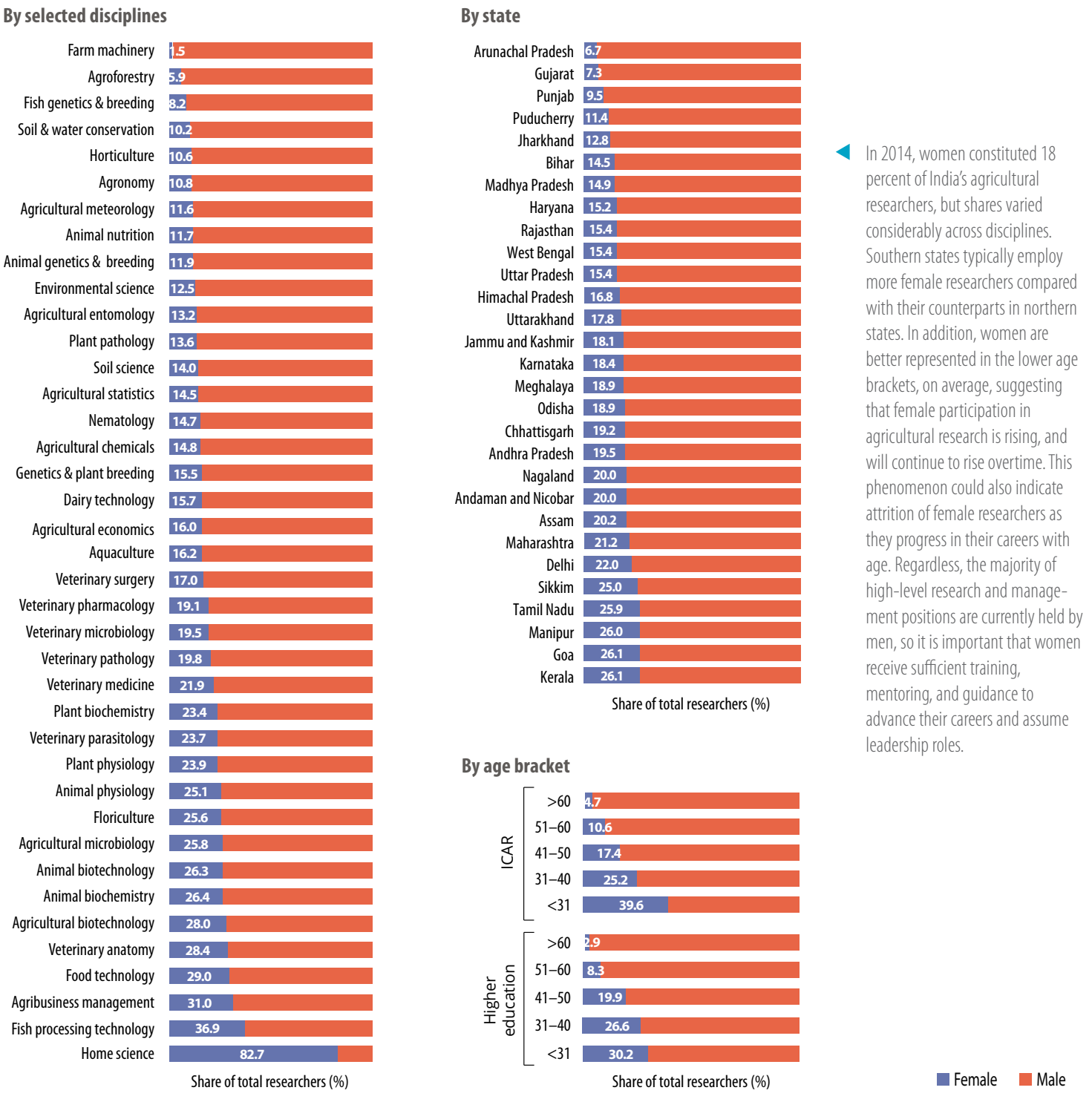
CHALLENGE

- About a third of India's crop farmers and close to half of its agricultural laborers are female, yet women constitute fewer than one in five agricultural researchers. Given that about half the postgraduate students enrolled at Indian agricultural universities are female, it would appear that institutes are recruiting a disproportionately low share of female graduates.

POLICY OPTION

- Female faculty members, researchers, and research managers offer different insights and perspectives of benefit to research institutes and universities in addressing the unique and pressing challenges of Indian farmers. Improving the gender balance, not only among agricultural researchers, but also among research managers will enable the country to more effectively address the priorities and challenges of all farmers, and female farmers in particular.

Distribution of researchers at ICAR and in the higher education sector by gender, 2014



In 2014, women constituted 18 percent of India's agricultural researchers, but shares varied considerably across disciplines. Southern states typically employ more female researchers compared with their counterparts in northern states. In addition, women are better represented in the lower age brackets, on average, suggesting that female participation in agricultural research is rising, and will continue to rise overtime. This phenomenon could also indicate attrition of female researchers as they progress in their careers with age. Regardless, the majority of high-level research and management positions are currently held by men, so it is important that women receive sufficient training, mentoring, and guidance to advance their careers and assume leadership roles.

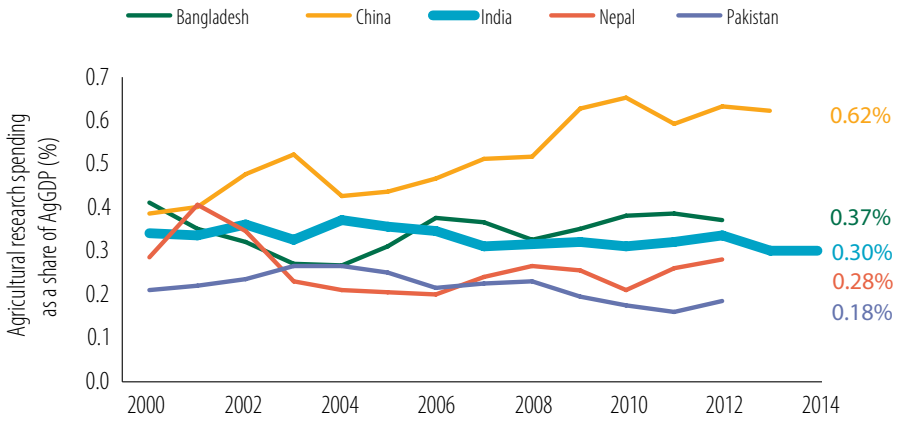
CHALLENGE

As stipulated in its Twelfth Five-Year Plan (2012–2017), India has set the goal of investing at least 1 percent of its AgGDP in agricultural research and education by 2017. Long-term R&D spending data reveal that agricultural research spending has not kept pace with AgGDP growth over time, resulting in a slight decline in the agricultural research intensity ratio in recent years.

POLICY OPTION

In order to reach the established targets, sustainable levels of (state) government funding are needed, not only to secure researchers' salaries, but also to support the multitude of other costs associated with operating viable research programs. Increased funding diversification needs to be further encouraged by stimulating private funding for agricultural R&D and enhancing institutes' capacity to generate resources internally through the sale of goods and services.

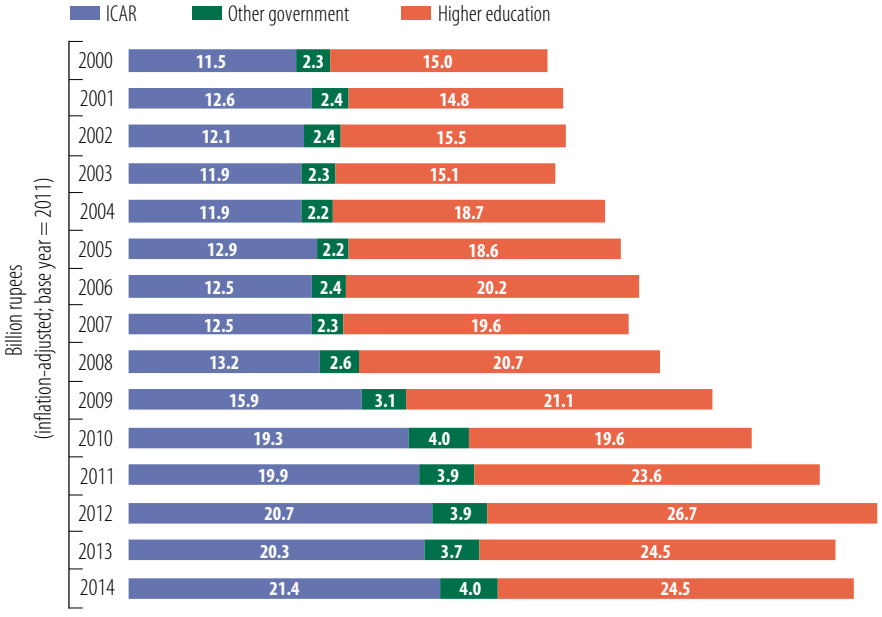
Agricultural research intensity, 2000–2014



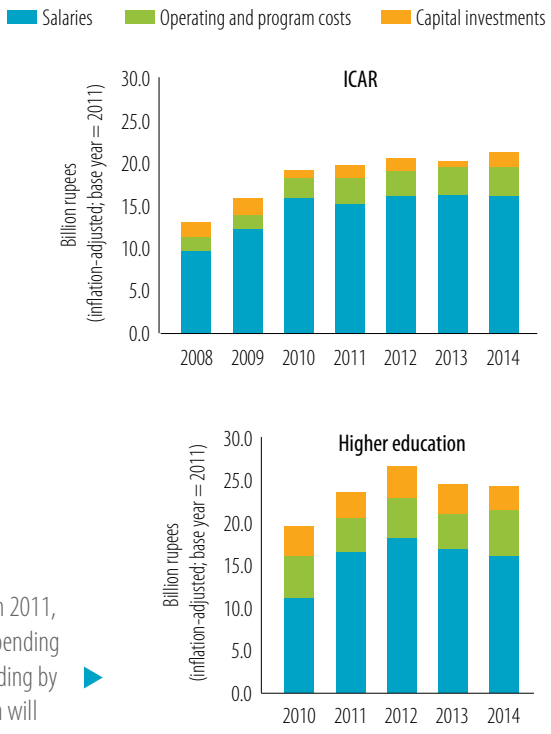
In 2014, India invested 0.30 percent of its AgGDP in agricultural research, representing a much higher share than neighboring Pakistan, but only half the share invested by China. Although data on agricultural education expenditures are not available, data on agricultural research expenditures suggest that India's 1-percent investment target is unlikely to be met within the stipulated timeframe.

It should be noted that intensity ratios must be interpreted within a broad national context. Doubling or tripling investments should not be misconstrued as the goal, but rather ensuring that R&D agencies have the necessary human, financial, and physical resources to develop, adapt, and disseminate S&T innovations efficiently and effectively. An enabling public policy environment is also essential in order to maximize the impact of innovations on agriculture, on rural and economic development, and ultimately on poverty and hunger.

Agricultural research spending, 2000–2014



Spending by cost category, 2008–2014



Beginning in 2009, ICAR's expenditures rose considerably due to a nationwide pay rise for civil servants. In 2011, India's universities adopted the same pay structure as ICAR, explaining the increase in higher education spending that year. Overall, salaries account for roughly three-quarters of spending by ICAR and 70 percent of spending by the higher education sector. Another nationwide civil servant salary increase is scheduled for 2017, which will certainly drive up the cost of national agricultural R&D once again. Although operating expenses and capital investments have increased in recent years, their overall share remains low by international standards.

OBSERVATION

- In 2006, ICAR adopted a management and commercialization regime to improve its intellectual property protection, increase the commercial viability of its research, and enhance and diversify its funding base. Researchers were offered training and capacity building, as well as financial incentives to promote the generation and commercialization of research outputs.

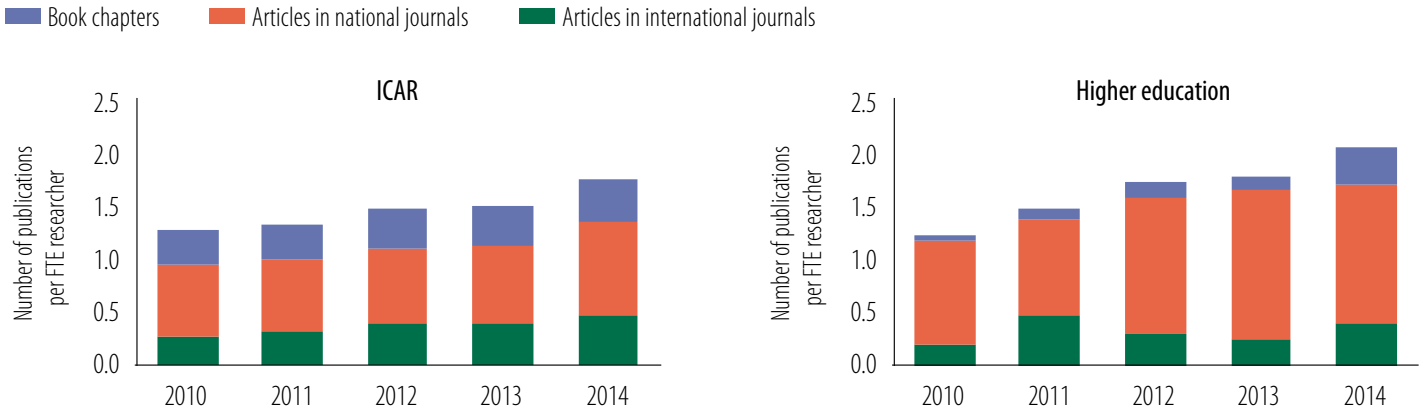
POLICY OPTION

- ICAR's measures to secure, manage, and commercialize its intellectual property have been widely regarded as a success. Although some universities have implemented similar measures, the vast majority have not. Policies and guidelines need to be put in place for India's agricultural university system as well to enhance revenue generation through commercialization of research products and through training and consultancy services. This could be a positive first step in addressing the research funding constraints universities are facing.

AGRICULTURAL RESEARCH FUNDING

- Agricultural research is funded by the federal government through ICAR and ICFRE, and by the state governments through their respective SAUs. Government contributions are determined in agency-specific five-year plans and fall into two broad categories: (1) plan expenditures, which support new research programs decided on through a stepwise consultative process, and (2) nonplan expenditures, which support the cost of salaries and overhead.
- In addition to state funding, SAUs receive a significant portion of their funding from ICAR in the form of development grants and as funding for coordinated and onfarm research. ICAR allocations to SAUs are based on past trends and new research proposals.
- NAIP (2006–2014) was jointly funded by the World Bank (through a loan of US$200 million) and the Indian government (US$50 million). The project mainly addressed challenges of strengthening institutional capacity; improving coordination among research agencies; and promoting partnerships among the national and state agricultural research institutions, the private sector, and farmer and nongovernmental organizations.
- A portion of NAIP funds have been allocated to competitive grant schemes. Competitive research grants are also provided by the Department of Biotechnology and the Department of Science and Technology, along with other ministerial funds. All these schemes are similar in that they support the operating costs of short-term projects but do not cover salary- or infrastructure-related expenses.
- An increasing share of Indian agricultural research is funded with revenues generated through the sale of goods and services. The management of intellectual property and commercialization of technologies and other innovations have gained momentum at ICAR, and were integral to NAIP. Overall, universities have been much slower in pursuing this revenue stream through the provision of fee-based research and consultancies and the sale of seed and plant material.
- A new World Bank–funded project, the National Higher Agricultural Education Project, is currently in the appraisal stage. This five-year, US$165 million project aims to address the many challenges facing India's agricultural universities.

Number of publications per agricultural researcher at ICAR and in the higher education sector, 2010–2014



In 2014, ICAR researchers published an average of 1.8 book chapters and national and international journal articles each. The scientific output per FTE researcher within the higher education sector was slightly higher, at 2.1, that same year. ICAR researchers, however, publish more extensively in international journals compared with their university-based colleagues. By international standards, average numbers of publications per agricultural researcher are relatively low in India. On a positive note, however, the number of peer-reviewed publications per researcher has risen substantially over time, both at ICAR and within the universities.

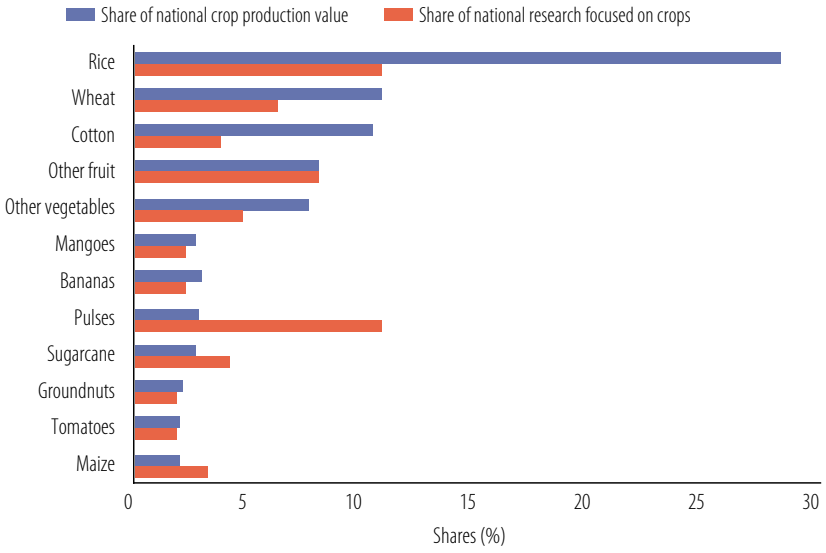
CHALLENGE

- ICAR and the SAUs currently have limited linkages with agencies under ICFRE and the commodity boards focusing on plantation crops because research relating to forestry and plantation crops is administered by central agencies outside the Ministry of Agriculture. Potential gains could be made, however, through interlinkages with ICAR and the SAUs.

POLICY OPTION

- Greater interaction across research entities could be facilitated with the establishment of a coordination mechanism interlinking entities conducting forestry, plantation crop, and other basic research with the ICAR institutes and the SAUs. The establishment of a dedicated competitive research fund for joint project proposals could be a useful first step to facilitate such research collaboration.

Congruence between agricultural research and production value for selected commodities, 2013/2014



- Major incongruencies exist between the focus of crop researchers and the crops that generate the highest shares of gross value of national crop production. Rice, for instance, accounted for 28 percent of India's total value of crop production in 2013, but only 11 percent of India's crop researchers conduct rice research. Wheat, cotton, and vegetables also appear to be underresearched based on their crop values. Notably, the congruency of this ratio is extremely high for pulses due to numerous recent nationwide initiatives promoting research on pulses.

Source: Crop production value data are from FAOSTAT (http://faostat.fao.org).
Notes: Crop production values data are for 2013; data on research focus are for 2014.

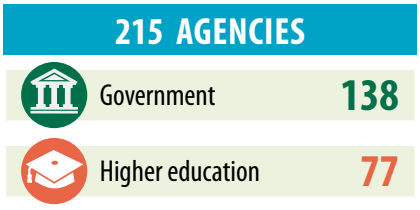
Focus of agricultural researchers at ICAR and in the higher education sector by thematic area, 2014

	ICAR	HIGHER EDUCATION
THEMATIC RESEARCH FOCUS	**Share of FTE researchers (%)**	
Crop genetic improvement	14.9	11.7
Crop production (agronomy, fertilizer)	10.6	11.0
Crop protection	9.7	8.8
Other crop-related themes	1.5	1.3
Genetic improvement of livestock	2.7	5.2
Livestock health	3.8	13.1
Livestock management	1.5	7.6
Pastures, forages, and animal nutrition	2.4	5.5
Other livestock-related themes	2.2	2.9
Fisheries-related themes	4.7	9.5
Soil	1.6	2.5
Water	1.3	2.9
Agricultural engineering	2.2	1.2
Biodiversity, germplasm conservation	7.0	1.7
Farming systems	2.2	2.1
Food safety	1.5	1.2
Emerging areas (biotechnology, nanotechnology)	5.5	2.4
Onfarm postharvest research	6.0	2.5
Socioeconomic and policy research	13.0	4.3
Other themes	5.8	2.6
TOTAL	**100**	**100**

- ICAR's research focuses on issues of national importance, whereas university research mandates target state-level priorities. Compared with the universities, research undertaken at ICAR generally has better funding, as well as better research infrastructure and equipment. ICAR researchers spend relatively more of their time on basic science, germplasm conservation, socioeconomic research, and emerging areas (such as biotechnology and nanotechnology). University research, on the other hand, tends to be more applied. The emergence of state veterinary universities is reflected in the substantial focus on livestock health by universities. Forestry research falls under ICFRE and hence does not feature prominently on either ICAR's or the universities' research agendas.

INSTITUTIONAL STRUCTURE OF INDIAN AGRICULTURAL RESEARCH

India's agricultural research system is structured under two tiers. The first tier, at the federal level, comprises a network of more than 100 institutes, centers, directorates, and bureaus coordinated by ICAR and located across the country. As of 2014, these agencies accounted for close to one-third of the country's agricultural researchers (in FTEs) focusing on a broad range of areas, including crops, horticulture, natural resources, agricultural engineering, livestock, and fisheries. Four of these ICAR agencies have university status: IARI, NDRI, IVRI, and CIFE. The second tier comprises of a system of SAUs mandated to deliver state-specific research and education. In 2014, these SAUs, which vary widely in size, jointly accounted for 61 percent of India's agricultural researchers (in FTEs). Universities established in the 1960s typically employ higher numbers of researchers, although some have been restructured into smaller universities in recent years. A number of auxiliary campuses have been upgraded since 2009 to create independent state veterinary, horticultural, and fisheries universities. Outside this two-tiered system, a number of additional government and higher education agencies are also involved in agricultural R&D. Most important among these are eight ICFRE institutes, and the country's coffee, rubber, silk, and tea boards. Private-sector participation in Indian agricultural R&D is dominated by local and multinational companies involved in breeding, biotechnology, animal health, plant protection, and farm machinery. Recent data on privately performed agricultural research in India were not available; hence, the sector is excluded from the analysis in this factsheet.



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

ASTI DATA PROCEDURES AND METHODOLOGIES

- The **data underlying this factsheet** were predominantly derived through primary surveys, although some data were drawn from secondary sources or were estimated.
- **Agricultural research** includes research conducted by the government, higher education, and nonprofit sectors; research conducted by the private for-profit sector is excluded due to lack of available data.
- ASTI bases its calculations of human resource and financial data on **full-time equivalent (FTE) researchers**, which take into account the proportion of time staff actually spend on research compared with other activities.
- ASTI presents its financial data in 2011 local currencies and **2011 purchasing power parity (PPP) dollars**. PPPs reflect the relative purchasing power of currencies more effectively than do standard exchange rates because they compare prices of a broader range of local—as opposed to internationally traded—goods and services.
- ASTI estimates the **higher education sector's research expenditures** because it is not possible to isolate them from the sector's other expenditures.
- Note that, due to **decimal rounding**, the percentages presented can sum to more than 100.

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

ACRONYMS USED IN THIS FACTSHEET

AgGDP	Agricultural gross domestic product
AICRP	All India Coordinated Research Project
CIFE	Central Institute of Fisheries and Education
DARE	Department of Agricultural Research and Education
FTE(s)	Full-time equivalent (researchers)
ICAR	Indian Council for Agricultural Research
IARI	Indian Agricultural Research Institute
IAUA	Indian Agricultural Universities Association
ICFRE	Indian Council of Forestry Research and Education
IVRI	Indian Veterinary Research Institute
NAARM	National Academy of Agricultural Research Management
NAIP	National Agricultural Innovation Project
NDRI	National Dairy Research Institute
PPP	Purchasing power parity (exchange rates)
R&D	Research and development
SAU	State Agricultural University

ABOUT ASTI, IFPRI, AND NAARM

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. ASTI is led by the **International Food Policy Research Institute (IFPRI)**, which—as a CGIAR member—provides evidence-based policy solutions to sustainably end hunger and malnutrition and reduce poverty. The **National Academy of Agricultural Research Management (NAARM)**, which is based in Hyderabad and administered by the Indian Council of Agricultural Research (ICAR), addresses issues associated with the management of agricultural research and education.

ASTI/IFPRI and NAARM gratefully acknowledge participating agricultural R&D agencies for their contributions to the data collection and preparation of this country factsheet. ASTI 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 India. This factsheet 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 or NAARM.