

ASTI IN RETROSPECT 04

Underinvestment in Agricultural Research



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This year marks the 20th anniversary of the inception of ASTI. During this time, governments, donors, and international organizations have used ASTI's evidence to guide agricultural research investment and policy decisions, to assess areas of underinvestment, to identify capacity gaps and training needs, and to demonstrate the returns to agricultural research investment. This series of notes marks this important milestone by focusing on—and updating—some of the key advancements and insights ASTI data have enabled in the past 20 years. This note focuses on the prevalence of underinvestment in agricultural research among developing countries, especially those with small- to medium-size research systems.

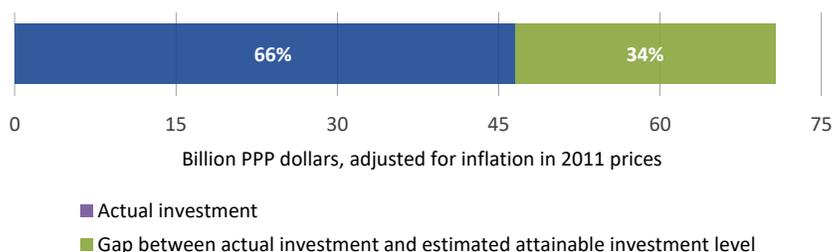
KEY ADVANCEMENT

Conventional measures of agricultural research investment—that is, intensity ratios—are based on the size of a country's agricultural output. They are useful for comparing investment levels across countries over time, but a country's capacity to invest in agricultural research actually depends on a range of factors, not just one. For this reason, ASTI developed a more nuanced measure of what is deemed to be an "attainable level" of national investment based on four variables: the size of a country's economy, its income level, the level of diversification of its agricultural production, and the availability of relevant technology spillovers from other countries. This weighted measurement, the intensity index, allows researchers and policymakers to identify potential investment gaps and quantify the additional investment needed to close those gaps based on comparisons with countries of similar status.^{1, 2}

RESULTING INSIGHTS

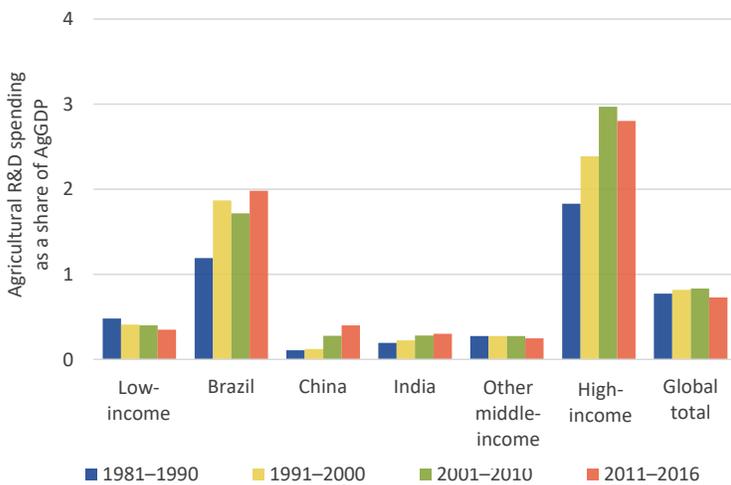
Despite rapid growth in global agricultural research investments since 2000, many countries are still not investing to the level of their potential. In 2016, the resulting gap between the world's actual and attainable investment levels was estimated to be 34 percent (Figure 1). Expressed in financial terms, global investment in agricultural research totaled \$47 billion in 2016 (in 2011 purchasing power parity [PPP] prices, excluding the private for-profit sector).³ Had countries invested at their estimated attainable rate, levels could have totaled \$71 billion, which means the estimated gap between actual and attainable agricultural research investment was \$24 billion globally. As expected, the differences across regions, countries, and income groupings are considerable (see overleaf for details).

1. Estimated global gap in agricultural research investment, 2016 (%)



ASTI's evidence is widely respected and has been extensively used by many international organizations and donors as a tool to advocate for increased agricultural research funding. ASTI's national investment trends were also presented, although less frequently, to national level policymakers. At events in Algeria, Ethiopia, Mauritania, Nigeria, and many other countries, ASTI data demonstrated that funding levels were insufficient, and this contributed to governments' decisions to increase their allocations to agricultural research. ASTI evidence has also been used to monitor progress on national commitments to targets under the Comprehensive Africa Agriculture Development Programme (CAADP).

2. Research spending intensity by income level, 1981–2016 (%)



CONTEXT

Investments in agricultural research are a key driver of agricultural productivity growth and technological innovation over time, and many developing countries—especially those with small- to medium-sized systems—are vastly underinvesting.

After a decade of slowing growth in the 1990s, global agricultural research spending grew from 31 to 47 billion inflation-adjusted PPP dollars during 2000–2016 (excluding the private for-profit sector). Notably, China accounted for about half of the overall global increase. In 2016, 70 percent of the 179 countries included in ASTI’s global total invested less than \$100 million that year, and 52 countries invested less than \$10 million.

CONVENTIONAL RESEARCH INTENSITY MEASURES

Conventional recommendations for agricultural research investment, such as the United Nations’ 1 percent investment

target, assume that a country’s investments should be proportional to the size of its agricultural sector. ASTI evidence has shown that many countries are still far from reaching this target. In fact, although agricultural research investments in many countries have risen in recent years, their actual intensity ratios have fallen because growth in agricultural output outpaced growth in agricultural research.

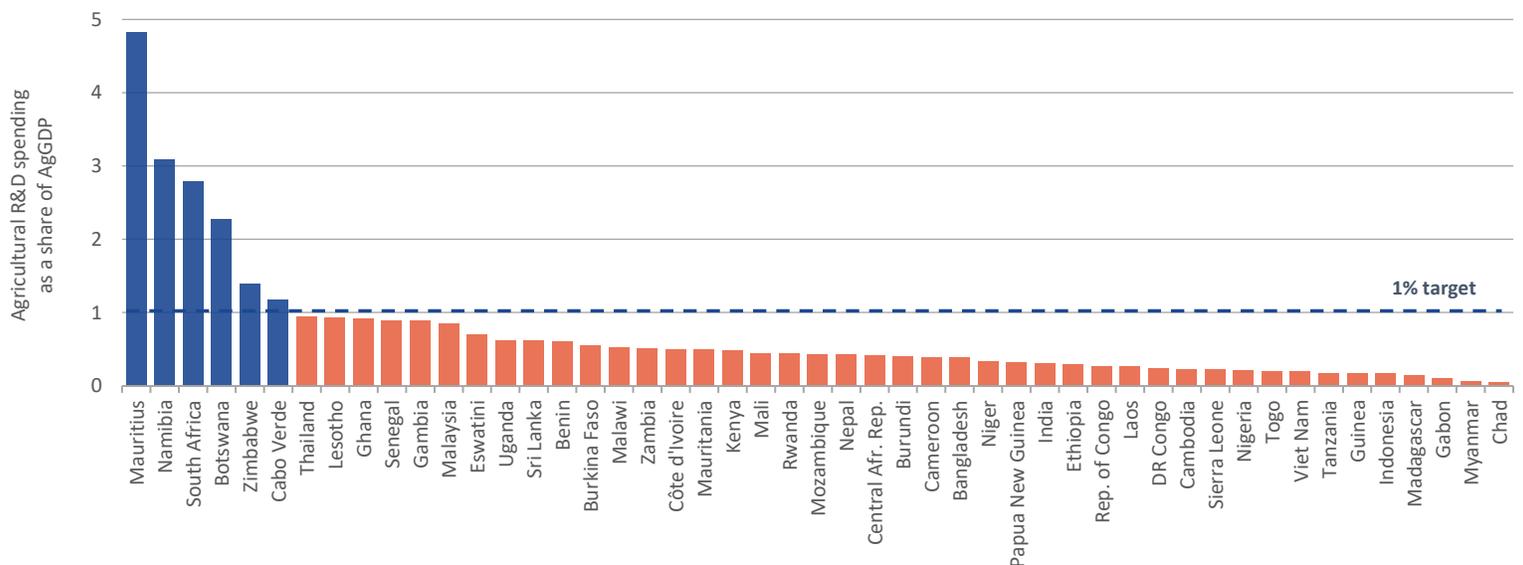
During 2011–2016, countries invested an average of 0.73 percent of their agricultural gross domestic product (AgGDP) in agricultural research globally (Figure 2). Spending averaged 0.35 percent in low-income countries; 0.25 percent in middle-income countries other than Brazil, China, and India; and 2.80 percent in high-income countries. The average ratio for low- and middle-income countries as a group—and for individual regions—remained fairly constant over time, indicating that growth in agricultural research spending largely followed the pattern of AgGDP growth. In contrast, agricultural research spending in high-income countries grew steadily from 1.83 percent in 1981 to 3.45 percent in 2009, after which it fell to 2.81 percent in 2016—primarily due to a contraction in spending in the United States.

The agricultural research intensity ratios for most low- and middle-income countries are well below the United Nations’ recommended 1 percent investment target (Figure 3). In 2016/17, only a handful countries from Africa south of the Sahara (SSA)—and none from Asia–Pacific (APC)—invested 1 percent or more of their agricultural output in agricultural research. In fact, about 60 percent of the 49 countries for which data were available recorded intensity ratios of less than 0.5 percent in 2016/17.

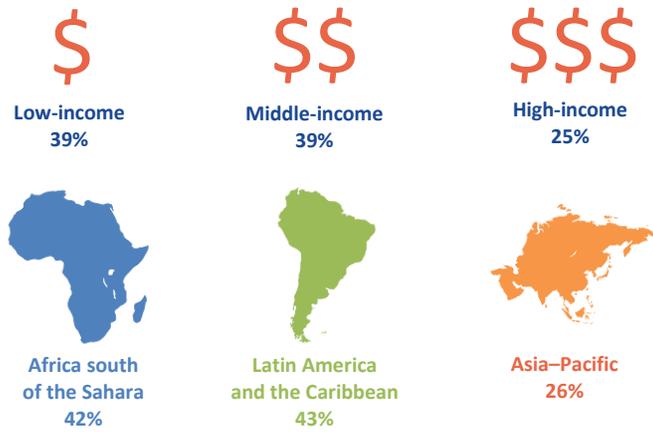
ASTI’S INTENSITY INDEX

ASTI’s intensity index provides an estimate of the gap between a country’s actual level of investment and the level deemed attainable

3. Intensity ratios for Africa south of the Sahara and Asia–Pacific, 2016/17 (%)



4. Gap between actual and attainable investment by national income-level and regional grouping, 2016 (%)

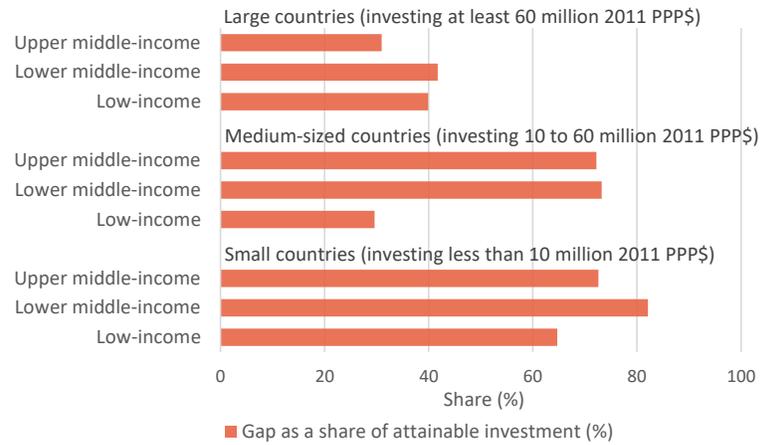


Note: Calculations by Alejandro Nin Pratt (see Beintema, Nin Pratt, and Stads 2020).

based on comparisons with countries of similar status. This, in turn, allows the investment needed to close the gap to be quantified.

Results indicate that, in 2016, the gap in agricultural research investment averaged 25 percent for high-income countries and 39 percent for both low- and middle-income countries (Figure 4). Underinvestment at the regional level was lower in APC (27 percent) than in SSA or Latin America and the Caribbean (42 and 43 percent, respectively), which reflects the positive impact of China’s and India’s extensive agricultural research systems. Importantly, underinvestment is prevalent among countries with small- to medium-sized agricultural research systems, a reality that conventional measures of underinvestment mask (Figure 5). Smaller systems face the challenge of creating a critical mass of research infrastructure with fewer resources. This requires a more strategic approach, such as prioritizing the adaptation of existing knowledge and technologies to local circumstances, or collaborating with other

5. Gap between actual and attainable investment by national investment-level and income-level grouping, 2016 (%)



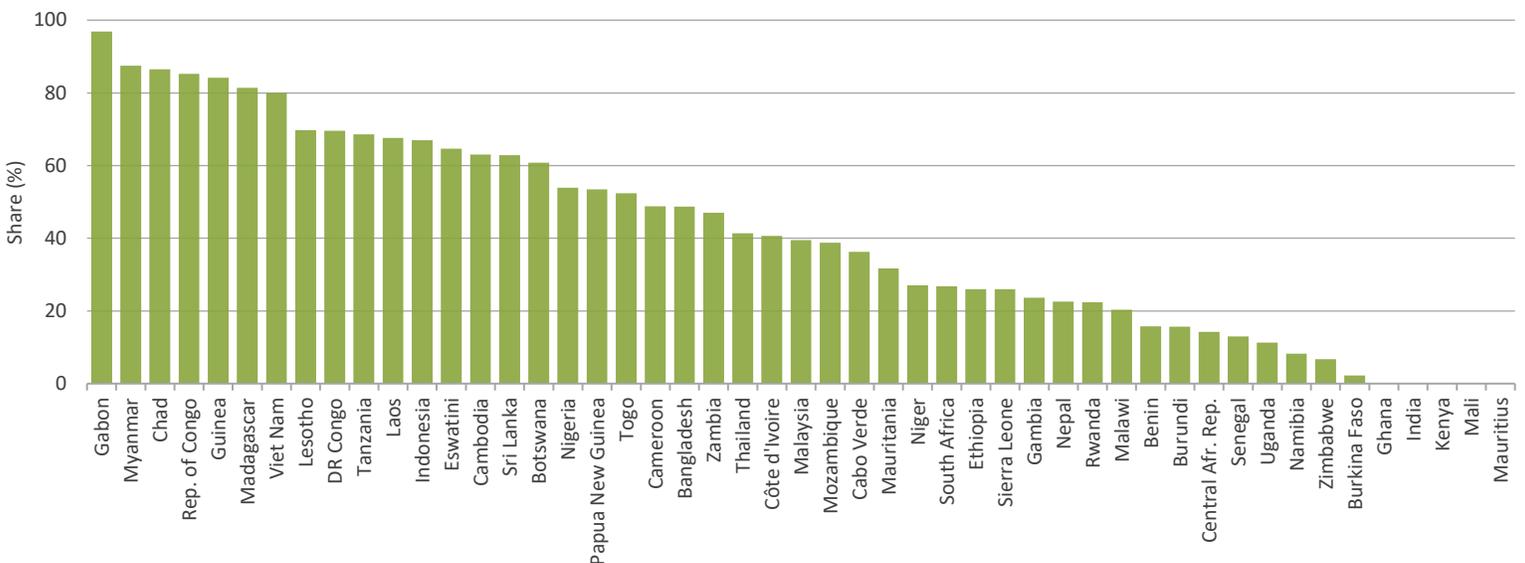
Note: Calculations by Alejandro Nin Pratt (see Beintema, Nin Pratt, and Stads 2020).

countries to target issues of common relevance. Most SSA and APC countries significantly underinvest in agricultural research (Figure 6). Actual investment in Chad, Gabon, Guinea, Madagascar, Myanmar, the Republic of Congo, and Viet Nam, for example, represented only 20 percent or less of their estimated attainable investment levels in 2016. In contrast, such countries as Burkina Faso, Ghana, India, Kenya, Mali, and Mauritius are estimated to be investing either at or near optimal levels.

CONCLUDING COMMENTS

ASTI’s index of research intensity demonstrates that, for a large number of low- and middle-income countries, the 1 percent investment target is simply not realistic. Targets that take the structural characteristics of each country’s economy and agricultural sector into consideration offer more detailed insights and hence are more useful in policy- and decisionmaking.

6. Gap in investment as a share of estimated attainable investment for countries of Africa south of the Sahara and Asia-Pacific, 2016 (%)



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2020

KEY MARKERS OF ASTI'S EVOLUTION

- ✓ ASTI was established as a CGIAR public good in early 2001, led by IFPRI and the former International Service for International Agricultural Research.
- ✓ In those earlier years, ASTI undertook the somewhat daunting task of developing key indicators and statistical methods in alignment with international standards; initiating data-collection activities on an ad hoc, project-driven basis; and forging fledgling relationships with potential national partners. And with the creation of its website, ASTI became one of the CGIAR's first sources of open-access data.
- ✓ With consistent funding from the Bill & Melinda Gates Foundation and numerous other supporters, ASTI matured to become a more holistic program, focusing not only on data collection, but also on building its partners' capacity, expanding its analysis and outreach activities, developing a suite of innovative online data tools, and contributing to influential global and regional initiatives and reports.
- ✓ Supplementary funding facilitated the expansion of geographic coverage, the initiation of more in-depth studies, and greater focus on increasing the capacity of ASTI's extensive network of national partners.

AUTHOR'S REFLECTIONS ON 20 YEARS

Twenty years ago—with email still relatively rare and Internet access very limited in developing countries—the only way to get information was to send (and resend) letters, faxes, and telexes, and to visit (and revisit) research institutes in person. Then came the fastidious work of manually entering the data into computer files. Thankfully, much has changed. Greater Internet access paved the way for ASTI to make its data freely available online, becoming one of the CGIAR's first open-access data sources. Technological advancements not only allowed collecting, processing, and sharing data to be done effectively, but also facilitated the development of creative solutions for accessing, presenting, and analyzing data. Fruitful partnerships became possible across national, regional, and international boundaries. Importantly, sustainable funding from the Bill & Melinda Gates Foundation and numerous other donors facilitated the expansion and capacity building of ASTI's network, collaboration with partners to undertake more in-depth analyses of the data's implications, and greater outreach to disseminate the resulting findings.

RELEVANT RESOURCES

- ASTI. 2019. ASTI database. International Food Policy Research Institute, Washington, DC.
- Beintema, N., A. Nin Pratt, and G. Stads. 2020. *Key Trends in Global Agricultural Research Investment*. ASTI Program Note. Washington, DC: International Food Policy Research Institute (forthcoming).
- Nin Pratt, A. 2016. *Comparing Apples to Apples: A New Indicator of Research and Development Investment Intensity in Agriculture*. IFPRI Discussion Paper. Washington, DC: International Food Policy Research Institute.
- Stads, G. 2016. "Investment in Agricultural Research and Development: An account of Two-speed Growth, Underinvestment, and Volatility." Chapter 4 in *Agricultural Research in Africa: Investing in Future Harvests*, J. Lynam, N. Beintema, J. Roseboom, and O. Badiane, ed. Washington, DC: International Food Policy Research Institute.

NOTES ON DATA

1. The underlying data presented in this note can be downloaded, by country and available year, via the [Data Tool](#) available at [ASTI's website](#).
2. In calculating the index, countries with similar characteristics are expected to require a similar minimum level of research investment. Levels below that are interpreted as an indicator of under-investment. The challenge in developing the index was to determine appropriate weights for each of the four variables that make up each country's index value. For more information, see Nin-Pratt (2016).
3. Note that all dollar values are based on 2011 PPP exchange rates, which reflect the purchasing power of currencies more effectively than do standard exchange rates because they compare the prices of a broader range of local, as opposed to internationally traded, goods and services. ASTI collects all its financial time-series data in local currency units and converts these into constant prices using official World Bank GDP deflators. Currently, ASTI expresses its financial data in 2011 prices.

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Nienke Beintema is the former head of ASTI. This series of notes has been prepared as an ASTI output and has not been peer reviewed; any opinions are those of the author and do not necessarily reflect the policies or opinions of IFPRI. The author acknowledges the Bill & Melinda Gates Foundation and the CGIAR Research Program on Policies, Institutions, and Markets for their generous support of ASTI and, in particular, this series of notes. She also thanks Alejandro Nin Pratt, who developed the intensity index and provided updated data for this note, and Mary Jane Banks, who provided editorial and graphic design support in the preparation of this series.

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