

PRACTITIONER'S GUIDE FOR NATIONAL AND REGIONAL FOCAL POINTS

ASTI METHODOLOGY AND DATA COLLECTION STANDARDS

INTRODUCTION

ASTI data collection activities have been rather ad hoc in the past and focused mainly on updating out-of-date datasets. The initiative is now being transformed into a sustainable, decentralized system of frequent data compilation and analysis. Part of this transition will be to institutionalize regular data collection via a network of national and regional focal points. Establishment of this decentralized system will facilitate more frequent data gathering, synthesis, and analysis. It will also enhance local ownership of the data and stimulate fuller use of the datasets for country-level advocacy and analysis purposes. Furthermore, more continuous data collection will enable closer monitoring of trends in agricultural R&D investment and capacity.

Like its predecessor projects at the International Food Policy Research Institute (IFPRI) and the International Service for National Agricultural Research (ISNAR), ASTI has amended and improved its list of indicators over the years. It has also refined the underlying definitions and data collection procedures, based on its own experience and consultation with partners during the various national survey rounds. This *PRACTITIONER'S GUIDE FOR NATIONAL AND REGIONAL FOCAL POINTS* sets out the definitions and procedures currently in use by ASTI and its network of national and regional focal points. The aim of the guide is to help practitioners implement the national survey rounds while enhancing their understanding of the ASTI datasets, stimulating better use of the datasets at the national and regional level.

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I. OVERVIEW

CURRENT INDICATORS AND DATA AVAILABILITY BY REGION

National survey rounds have been rather ad hoc in the past, focusing on one region at a time depending on the availability of funds. As a result, most regional data collection has been limited to updating datasets. ASTI uses a various indicators to measure agricultural research investment and capacity. Table 1 summarizes these, as well as the regions and time periods covered up to 2012.

Table 1. ASTI indicators and geographical and time coverage per December 2011

Indicator	Regions and years covered	Details
Professional research staff	<ul style="list-style-type: none"> - SSA: 1971–2008 - SA: 1981/91– 2009 - SEAP: 1981/91–2002/03 - LAC: 1971–1996, 2004–06 - WANA: 1991/96–2001/03 	<ul style="list-style-type: none"> - By degree level (PhD, MSc, and BSc) - Collected for multiple years - Government, nonprofit, higher education, and private sector
Professional female research staff	<ul style="list-style-type: none"> - SSA: 2000/01 and 2008 - SA: 2002/03 and 2009 - SEAP: 2002/03 - LAC: 2006 - WANA: 2001/03 	<ul style="list-style-type: none"> - By degree level (PhD, MSc, and BSc) - Numbers (not by degree level) for 14 countries in SSA (1991) and 16 countries in LAC (1996) - Government, nonprofit, and higher education
Professional research staff by age group	<ul style="list-style-type: none"> - SSA: 2007/08 - SA: 2009 	<ul style="list-style-type: none"> - For 15 SSA countries only; conducted as part of a special study for the African Women for Agricultural Research (AWARD) scholarship program
Research focus by subsector	<ul style="list-style-type: none"> - SSA: 2000/01 and 2008 - SA: 2002/03 and 2009 - SEAP: 2002/03 - LAC: 1996 and 2006 - WANA: 2001/03 	<ul style="list-style-type: none"> - Includes crops, livestock, forestry, fisheries, postharvest, natural resources, socioeconomics - Government, nonprofit, higher education, and private sector
Research focus by crop and livestock items	<ul style="list-style-type: none"> - SSA: 2000/01 and 2008 - SA: 2002/03 and 2009 - SEAP: 2002/03 - LAC: 1996 and 2006 - WANA: 2001/03 	<ul style="list-style-type: none"> - Includes ± 20 crops, ± 6 livestock items, and ± 6 other items - Listed crops differ by region - Government, nonprofit, higher education, and private sector
Thematic research focus	<ul style="list-style-type: none"> - SSA: 2000/1 and 2008 - SA: 2002/03 and 2009 - SEAP: 2002/03 - LAC: 1996 - WANA: 2001/03 	<ul style="list-style-type: none"> - Includes ± 4 themes related to crops, ± 5 to livestock, and ± 7 other - List is currently being adjusted to capture emerging thematic areas such as climate change, bioenergy, and biotechnology - Government, nonprofit, higher education, and private sector
Research expenditures	<ul style="list-style-type: none"> - SSA: 1971–2008 - SA: 1981/91– 2009 - SEAP: 1981/91–2002/03 - LAC: 1971–1996, 2004–06 - WANA: 1991/96–2001/03 	<ul style="list-style-type: none"> - By salaries, operational costs, and capital costs - Government and nonprofit

Indicator	Regions and years covered	Details
Funding sources	<ul style="list-style-type: none"> - SSA: 1991, 2000/1 and 2008 - SA: 1996–2009 - SEAP: 1996–2002/03 - LAC: 1996, 2004–06 - WANA: 2001/03 	<ul style="list-style-type: none"> - Government, (multilateral and bilateral) donors, producers and marketing boards, public and private enterprises, own income, other - Sources differ by region and by country - For some countries multiple years are available - Government and nonprofit
Technical support staff	<ul style="list-style-type: none"> - SSA: 2001–08 - SA: 1996–2009 	<ul style="list-style-type: none"> - By degree level (PhD, MSc, BSc, other/without diploma) - By gender
Support staff	<ul style="list-style-type: none"> - SSA: 1991–2008 - SEAP: 1991/96–2002/03 - LAC: 1991–96, 2004–06 - WANA: 1996–2001/03 	<ul style="list-style-type: none"> - By technical, administrative, and other support - Government, nonprofit, and higher education

Source: ASTI datasets.

Notes: LAC = Latin America and the Caribbean, SA = South Asia, SEAP = Southeast Asia and the Pacific, SSA = Sub-Saharan Africa, WANA = West Asia and North Africa. Country coverage from 2001 to 2010 includes 34 countries in Sub-Saharan Africa, 5 countries in South Asia, 6 countries in Southeast Asia and the Pacific, 15 countries in Latin America and the Caribbean, and 6 countries in West Asia and North Africa. Yearly coverage applies for most, but not all, countries. “/” between years means that timeseries data is available for the first or second year.

CHALLENGE: Boundaries of ASTI datasets

ASTI has chosen to limit itself to agricultural R&D rather than expanding to include indicators on the multiple dimensions of the agricultural innovation process. It is, however, piloting an agricultural innovation system framework for use as an analytical tool at the sector and commodity level. Appropriate national-level measures for agricultural innovation remain difficult to develop. Even the role of agricultural R&D warrants further study, especially with regard to the contribution of R&D to agricultural innovation performance. There is no clear consensus as to how such research can best be done. Analysis on these issues, though important, is not ASTI’s core business.

ASTI focuses on measuring inputs into agricultural R&D, rather than outputs or outcomes. It recognizes, however, that the latter are key supplementary indicators for assessing agricultural R&D performance. R&D outputs are notoriously difficult to measure at the national level and over time, in addition to being hard to compare internationally. ASTI currently plans to initiate analysis on agricultural R&D outputs using a case-study approach.

IMPLEMENTATION OF NATIONAL SURVEY ROUNDS

ASTI conducts national survey rounds in close collaboration with “focal points,” most of which are located in national agricultural research institutes. In some cases, the national focal point is a consultant or agency other than the national agricultural research institute itself. In a few instances, it is a regional organization, which may be responsible for multiple countries. At the start of each national survey round a complete list is compiled of all agencies involved in agricultural research and development (R&D). Each agency is approached to participate. Three survey forms are used: one for government and nonprofit agencies, one for institutions of higher education, and one for the private sector. Each type of form has different sets of questions. Those for government and nonprofit agencies are the most detailed. In general, the forms have four sections:

- **Institutional details.** This section requests basic information such as address, affiliation, and organizational structure.

- **Human resource information.** Questions here relate to the number of researchers and technicians employed, degree levels, the proportion of time that various staff spend on research, the age distribution of research staff, the number of women researchers, and support staff by various categories.
- **Financial information.** This section requests details on research expenditures by cost category and sources of funding.
- **Research focus.** The survey forms request details on the commodities, themes and program focus of the research conducted.

Time-series data are collected for three main indicators: “research investments,” “research funding sources,” and “research staff totals.” The remaining indicators are collected for particular benchmark years for use in cross-country comparisons. Additional qualitative information is gathered during country visits through in-depth meetings with various agencies. These provide a fuller picture of developments in agricultural R&D than could be generated with quantitative data alone.

CHALLENGE: Declining survey responsiveness

During the most recent survey round in Sub-Saharan Africa, ASTI experienced more difficulty in obtaining survey responses than in previous rounds. This appeared to be due to an increasing number of agencies involved in agricultural R&D, many of which are institutions of higher education whose mandates are not primarily research. Furthermore, there seemed to be an increasing demand on agencies to provide quantitative information, often paired with poor data management and a lack of monitoring and evaluation (M&E) systems.

THE OECD FRASCATI MANUAL AS BASIS

ASTI collects and processes its datasets using standard procedures and definitions developed by the Organisation for Economic Co-operation and Development (OECD) and the United Nations Educational, Science, and Cultural Organization (UNESCO). These are described in the *Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development*. The manual was originally published in 1963 as a handbook for science and technology studies in OECD countries. It has since become the global standard for both national and international organizations and has been revised numerous times. The manual, along with other publications in “the Frascati Family,”¹ is a key tool for understanding the role of science and technology in economic development.

CHALLENGE: Suitability of the *Frascati Manual* for use in developing countries

The procedures and definitions in the *Frascati Manual* were developed by and for industrialized countries. They are therefore not always directly applicable to R&D statistics in the developing world. While ASTI’s methodology is largely based on procedures in the *Frascati Manual*, it has made some adjustments to align its data collection activities better with the nature of its subject-matter: measuring agricultural R&D indicators in developing countries.

¹These OECD reports are *Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development* (2002) <[web link](#)>, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data* (2005) <[web link](#)>, and *Manual on the Measurement of Human Resources Devoted to S&T: Canberra Manual* (1995) <[web link](#)>.

II. GENERAL DEFINITIONS AND PROCEDURES

WHAT IS RESEARCH AND DEVELOPMENT?

The *Frascati Manual* (2002) <[web link](#)> defines R&D as “creative work undertaken on a systematic basis in order to increase the stock of knowledge..... and the use of this stock of knowledge to devise new applications.” It goes on to categorize R&D as basic research, applied research, and experimental development. ASTI currently does not divide R&D into these more specific areas. The manual also lists a number of areas that are not considered to fall under the definition of R&D. The most important of these categories in relation to agricultural R&D are the following four:

- **Education and training.** However, research conducted by PhD students at universities, is included, if possible.
- **Science and technology information services.** Specialized activities to collect, code, record, classify, disseminate, translate, analyze, and evaluate data are considered R&D only when they are conducted primarily for the purpose of R&D support.
- **General purpose data collection.** In relation to the agricultural sector, this means that topographical mapping and geological, oceanographic, and meteorological surveying are not defined as R&D, though such activities are often conducted within fisheries, forestry, and natural resource management agencies.
- **Administration and other support activities.** Activities related to the financing of R&D and indirect support are not included. However, administration and clerical activities that are exclusively for R&D are included. For example, administration of an agricultural research institute is considered to be part of R&D.

CHALLENGE: What activities do and do not support R&D?

It is sometimes difficult to identify which activities should be included and which should be omitted from agricultural R&D statistics. No all-encompassing definition exists. For example, ASTI includes agricultural extension and training in its R&D statistics only when it is done by an agency that is focused entirely on R&D.

WHAT IS A RESEARCH PERFORMER?

ASTI measures the human and financial resources invested by “performers” of agricultural R&D. The “performer” is the entity that carries out the research, not the funder of the research. Public-sector agricultural R&D agencies often derive funding from multiple sources, including the private sector. In such cases, the government R&D agency is considered the performer, not the private-sector enterprise funding the research.

WHAT CONSTITUTES NATIONAL RESEARCH?

Up until now ASTI has focused on national agricultural research systems. The concept of “national” refers to domestically targeted research activities that are funded or executed by the public or private sector within a particular country. Therefore, research activities done by international and bilateral research agencies are excluded unless they are executed by national institutes. Also excluded are research activities undertaken by short-term development projects.

CHALLENGE: Including R&D beyond the national level

Research conducted by international entities and foreign-owned organizations plays an important role in developing countries. To incorporate these contributions, the *Frascati Manual* recommends creation of a “foreign institution” sector. This category is particularly relevant for the agricultural R&D sector, which includes the 15 centers of the Consultative Group on International Agricultural Research (CGIAR), various other international organizations, and a number of foreign governmental and nonprofit agencies that have research units in developing countries. ASTI has maintained data on CGIAR research spending, but not on CGIAR human resources (the latter are collected through the CGIAR Gender and Diversity Program). The “foreign institution” category is expected to become increasingly relevant for the ASTI data with the ongoing enhancement of regional agricultural research. In Africa, in particular, plans are being made to create agricultural R&D “centers of excellence.”

WHAT IS INCLUDED UNDER AGRICULTURE?

ASTI defines agricultural research to include research on crops, livestock, forestry, fisheries, natural resources, and the socioeconomic aspects of primary agricultural production. Also included is research concerning the **on-farm** storage and processing of agricultural products, commonly referred to as postharvest or food-processing research. R&D in the agrochemical industry, agricultural machinery, and the food processing industry **off farm** is not included in the current ASTI data (these are better reported under those industries). Also not included are the more discipline-oriented basic research activities undertaken by departments such as microbiology and zoology, except when this work has a clear focus on agriculture. Strict delineations, however, cannot always be made.

CHALLENGE: Food-processing R&D in advanced developing countries

A large number of agricultural R&D agencies, especially those in the more advanced developing countries, conduct research related to food processing and agribusiness concerns. Strictly speaking, these R&D activities should be reported under the manufacturing sector instead of under agriculture.

WHAT CONSTITUTES PUBLIC AND PRIVATE RESEARCH?

ASTI groups “performers” of agricultural R&D into two sector categories (public sector and private sector) and five institutional categories (Table 2). Thus, “public sector” agricultural research is considered to include government agencies, institutions of higher education, and nonprofit institutions. The “private sector” includes businesses and public (for-profit) enterprises. Public enterprises exist in only a handful of countries, most of which are in Asia (for example, China and India).

Table 2. Sector and institutional classifications for measuring resources invested in agricultural R&D

Sector categories	Institutional categories	Definitions
Public sector	1. Government	Research organizations directly administered by the national government, typically as a department or arm of a ministry
	2. Higher education	Academic agencies that combine university-level education with research; they include agricultural faculties, as well as specialized R&D institutes administered by universities
	3. Nonprofit	Agencies not directly controlled by the national government and without an explicit profit-making objective; in the agricultural sector these agencies are often linked to producer organizations or commodity boards
Private sector	4. Business	Entities with the primary aim of producing goods and services for profit; some of these companies have a R&D unit dedicated to agricultural research, though R&D is generally not their main activity
	5. Public enterprises	Enterprises that are owned by government units; their primary activity is typically the marketing and sale for profit of goods and services, which are often produced by private enterprises

Source: Compiled by authors from the *Frascati Manual 2002* <[web link](#)>.

CHALLENGE: Blurring institutional boundaries

Increasing diversity in the structure of agricultural research agencies has made it more difficult to classify an R&D unit as “government,” “higher education,” or “nonprofit.” In addition, the boundaries between public and private research are becoming increasingly blurred. The *Frascati Manual* developed a decision tree to assist statisticians in assigning the proper institutional classification. Nonetheless, some ambiguous situations remain. In some of these cases ASTI follows the *Frascati Manual*’s institutional classification; but in other cases it has developed its own classification scheme:

- A number of government research agencies have a semi-public or a semi-autonomous status. Their administrative control is nongovernmental, but they continue to depend on government for funding. Examples include the Colombian Corporation for Agricultural Research (CORPOICA) and the National Institute for Agricultural Research (INIA) in Uruguay. ASTI follows the *Frascati Manual* in classifying these institutions as government agencies. The National Agricultural Research Center (CNRA) in Côte d’Ivoire, on the other hand, is largely funded by the private sector. Although ostensibly a private company, CNRA still falls under the supervision of the Ministry of Higher Education and Scientific Research, from which it derives the public share of its funding, and is mandated to undertake public research. Following the *Frascati Manual*, ASTI also classifies CNRA as a government agency.

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- ASTI classifies all nonprofit institutions as public-sector agencies. However, the latest edition of the *Frascati Manual* fine-tunes the definition of private-sector agencies to include R&D units linked to producer organizations or commodity boards. This is unlike earlier editions, which classified such agencies as public sector. ASTI argues that most research done under the auspices of producer organizations or commodity boards is funded by a tax on production or exports. Government legislation is usually needed to establish such a tax scheme and to make the tax compulsory for all farmers. Revenues from such taxes can also be seen as public-sector resources (like regular income taxes) and not as private-sector revenues. Therefore, ASTI continues to classify R&D units of producer organizations and commodity boards as nonprofit organizations and part of public-sector agricultural R&D.
- ASTI counts nongovernmental organizations (NGOs) as nonprofit, public-sector agencies.

CHALLENGE: Private-sector coverage

Obtaining complete and accurate agricultural R&D investment data for private enterprises is very difficult. Many private companies are reluctant to share information on their agricultural R&D resources and investments due to confidentiality concerns. In addition, private research activities in low-income and middle-income countries tend to be small in scale and ad hoc, making it difficult for surveyors to capture full information. Obtaining private-sector data requires an approach that is very different from ASTI's usual survey work.

III. HUMAN RESOURCE DEFINITIONS AND PROCEDURES

PROFESSIONAL RESEARCH STAFF

Professional research staff are counted as all individuals employed in a formal research position within an organization and holding at least a BSc degree or equivalent (that is, at least three, but usually four, years of full-time university training). This includes long-term consultants and contractual research staff, as well as managers (for example, directors, deputy directors and heads of research program). Only staff on-post should be reported (that is, excluding any staff away on long-term unpaid leave and positions approved but not filled).

TECHNICAL AND OTHER SUPPORT STAFF

ASTI identifies three levels of support staff:

- **Technical support staff.** Those who directly support the design and conduct of agricultural research activities but do not hold a formal research position are classified as technical support staff. These employees have at least a secondary education level (i.e., high-school or middle-school) plus additional technical training. Some technical support positions may require a university degree. Examples of these are laboratory and field technicians and station managers.
- **Administrative support staff.** Personnel who carry out secretarial and administrative tasks and have at least a secondary education plus additional professional training are classified as administrative support staff. Examples are accountants, computer personnel, personnel managers, and secretaries.
- **Other support staff.** Included in this category are various remaining staff positions not classified in any of the above categories. Examples are drivers, laborers, and guards.

CHALLENGE: Professional research staff versus support staff holding a university degree

In some countries, an expanding pool of support staff (technicians, research assistants, and laboratory assistants) have obtained bachelor's, master's and even occasionally, doctorate degrees, but do not hold an official researcher position. This may be because at least a master's degree is required for scientific posts, for example, as at the Senegalese Agricultural Research Institute (ISRA). Or promotion opportunities may be limited due to a fixed number of approved scientific positions combined with an increasing access to degree training for junior staff, for example, as at Uganda's National Agricultural Research Organisation (NARO). In contrast to the situation in Uganda and Senegal, technical support staff at Tanzania's Directorate of Research and Development (DRD) are promoted to the researcher level upon obtaining their bachelor's degree.

ASTI accounts for such differences by collecting technician data by degree level. This also recognizes that technical staff with a bachelor's degree are a component of the future pool of agricultural scientists.

TIME SPENT ON RESEARCH VERSUS OTHER ACTIVITIES

ASTI calculates its human resource and financial data in full-time equivalents (or “FTEs”). Its method takes into account the proportion of time that researchers spend on R&D versus other activities. University employees, for example, spend the bulk of their time on activities other than research, such as teaching, administration, and student supervision. These hours are excluded from ASTI calculations of human resources invested in agricultural R&D. Thus, four faculty members estimated to spend 25 percent of their time on research would individually represent 0.25 FTE and collectively be counted as 1.0 FTE.

DEGREE QUALIFICATIONS

ASTI collects time-series data on university qualifications of professional research and technical support staff by degree (PhD, MSc, and BSc). If the degree-level equivalent is unclear, the following scale is applied:

- **Research doctoral degrees (e.g., PhD, DSc).** Equivalent to more than six years of full-time university education, including a doctoral thesis.
- **Master’s degrees (e.g, MSc, MEcon, MPhil).** Equivalent to five to six years of full-time university education.
- **Bachelor degrees (e.g., BSc, BVM, BPhil).** Equivalent to at least three (but usually four) years of full-time university education. This category also includes staff with honors degrees.

CHALLENGE: Degree levels in non-anglophone countries

ASTI collects data on the number of researchers with PhD, MSc, and BSc degrees. However, universities in many countries offer a much larger variety of academic degrees. Classifying these degrees into the simple PhD-MSc-BSc system is not always easy. Although France has harmonized its academic degree system with those of other European countries, the university systems in many former French colonies in Africa are still based on the old French system. Some small differences remain across francophone African countries, but as a general rule, degrees from francophone universities correspond to the following PhD-MSc-BSc equivalents:

- PhD = Doctorat
- MSc = Doctorat de médecine vétérinaire, DESS, DEA, master, maîtrise, ingénieur
- BSc = Licence

Degree systems in Spanish- and Portuguese-speaking countries are similar to those in the anglophone world.

EXPATRIATE RESEARCH STAFF

Many African agricultural research systems were staffed by expatriates in the 1960s. After independence, most countries made great strides in nationalizing their research capacity. The share of expatriate workers in African agricultural R&D gradually declined and is now negligible in most places. There are countries, however, where expatriates still play a key role in national agricultural research. As expatriates are paid by their mother institutes, expatriate salaries do not show up on the payroll of national agricultural research institutes.

Nonetheless, it is important to capture the number of expatriate researchers (in FTEs) active in a country to get a complete picture of agricultural R&D investment and capacity.

ASTI defines an expatriate researcher as a person sent by a development cooperation or international agency to carry out long-term research (one year or more) at an agricultural research agency in a developing country. ASTI estimates the average cost of an expatriate researcher based on salaries and benefits of outposted CGIAR staff. This assumes that that most expatriate researchers from North America, Europe, and Australia receive similar salaries and benefits.

CHALLENGE: Foreign researchers working abroad independently

The expatriate category excludes foreign researchers working independently at another institute within the region; for example, a Ugandan researcher taking up employment at a research institute in a neighboring country. Furthermore, the salaries and benefits earned by outposted researchers differ, depending on the expatriate's country of origin and the place of employment. For example, the case of a North Korean researcher working at the Guinean Agricultural Research Institute (IRAG) is quite different from a CGIAR researcher working in Africa. Adjustments have to be made to accurately calculate the average cost of these expatriate researchers. It is therefore important to collect information on the country of origin of foreign researchers working abroad.

GENDER

Professional research staff and technician data by degree are classified by gender. The breakdown of research staff by gender is one of ASTI's least ambiguous indicators and therefore requires no further explanation.

COMMODITY AND THEMATIC FOCUS OF PROFESSIONAL RESEARCH STAFF

ASTI collects detailed information on the number of researchers working in specific commodities (about 40) and thematic areas (about 20). These include more than twenty field and horticultural crops, five livestock items, pastures and forages, forestry, marine fisheries, inland fisheries, agricultural engineering, off-farm postharvest R&D, natural resources, and socioeconomics. Nonetheless, it is not always possible to associate all researchers with one of the commodity-specific categories. For example, a soil scientist working as part of a wheat research program would fall under the wheat commodity category, but if the soil scientist was not part of a commodity program, the researcher would be recorded in the natural resources category.

In addition, ASTI requests a list of the agency's formal research programs, along with a breakdown of the number of FTEs of professional research staff assigned to each.

DEMOGRAPHIC STRUCTURE OF PROFESSIONAL RESEARCH STAFF

Age is an increasingly important indicator because many research agencies, especially in Sub-Saharan Africa, have an aging pool of scientists with many staff set to retire in the coming years. ASTI is therefore collect data on the number of professional staff by age group (“30 years and younger,” “31–40 years,” “41–50 years,” “51–60 years,” “61 years and older”), by degree.

STUDENT ENROLLMENTS AND GRADUATES

ASTI recently expanded its data coverage to include the number of students enrolled in and graduated from institutions of agricultural higher education. This provides an indication of the future pool of agricultural scientists and professionals in developing countries.

IV. FINANCIAL RESOURCE DEFINITIONS AND PROCEDURES

SPENDING

ASTI requests survey respondents to provide actual expenditure figures, not budgeted or projected expenditures. Spending data is recorded in thousands in the current local currency in the reporting year.

If the financial year does not match the calendar year, expenditures are reported in the calendar year that covers most of the financial year. For example, if the 2009/10 financial year starts April 1, all costs incurred in 2009 are to be reported under 2009. If the 2009/10 financial year starts July 1, all costs incurred in 2009 are to be reported under 2010.

COST CATEGORIES

ASTI collects three categories of detailed cost data from government and nonprofit agencies:

- **Salaries.** All staff remuneration expenditures are reported here such as wages, pension plan contributions, insurance premiums, child education and housing allowances. This category also includes the labor cost of temporary staff like day laborers and long-term consultants, which is often mistakenly included under operating expenditures.
- **Operating and program expenditures.** Items such as gasoline, electricity, stationery, books, agricultural inputs, staff training, travel, and per diem expenses are included here. Running costs and maintenance of buildings, cars and equipment are reported here as well.
- **Capital expenditures.** All expenditures related to the purchase or rental of items that last longer than a year are reported in this category. Examples are research equipment, furniture, computers, cars and vehicles, land and buildings. Depreciation costs (and interest charges) for past capital investments are also included here.

CHALLENGE: Devaluation and redenomination of currencies

ASTI collects time-series data on expenditures and funding sources in thousand local currency units. Changes in a currency (such as devaluations or redenominations) therefore make collecting financial data complex. For example, in July 2007, Ghana replaced the old Ghanaian cedi with the new Ghanaian cedi at an exchange rate of 1 to 10,000. In such a case it is important to make sure that all participating agencies express spending in the same currency units.

The introduction of a new currency (such as the euro in 2002) can also complicate the collection of time-series data. It is important to be certain in what currency historical data are provided.

In a few exceptional cases, it may be impossible to collect data in local currency units. Hyperinflation in Zimbabwe in 2006–2009, for example, rendered data collected in Zimbabwean dollars useless.

FUNDING SOURCES

All funds actually received within a (fiscal) year are to be reported, not budgeted or projected funds. Sources of funding are indicated for all salary, operational, and capital expenditures. Funding source categories are as follows:

- **Government core allocations.** This category is made up of direct institutional funding derived from a central budget, such as funds provided by a supervisory ministry for day-to-day operations and salaries.
- **Other government allocations.** This category is for reporting government funding that complements annual appropriations from national budgets, for example, in the form of competitive funds and science and technology funds.
- **Loans from multilateral donors.** Loans, for example, from the World Bank, are reported here.
- **Grants from multilateral and bilateral donors.** This category is for reporting grants from multilateral donors, such as the World Bank (excluding its loans), the African Development Bank, FAO, and the European Union, and from bilateral donors, such as USAID, JICA, GTZ, and the Government of France. Grant providers may also be regional or international organizations and entities, such as CGIAR centers, FARA, ASARECA, CORAF/WECARD, and SADC.² Or grants may be awarded by private foundations such as the Bill & Melinda Gates Foundation.
- **Commodity levies and producer organizations.** Funding provided through commodity taxes levied on agricultural production and exports are reported here.
- **Sale of goods and services.** Income to be reported in this category includes earnings from contract research for public and private enterprises.
- **Other.** Funds from sources other than the above categories should be reported here.

² FAO is the Food and Agriculture Organization of the United Nations, USAID is the United States Agency for International Development, JICA is the Japan International Cooperation Agency, GTZ is the German Agency for International Cooperation, FARA is the Forum for Agricultural Research in Africa, ASARECA is the Association for Strengthening Agricultural Research in Eastern and Central Africa, CORAF is the Central African Council for Agricultural Research and Development, and SADC is the Southern African Development Community.

CHALLENGE: Mismatching cost and funding categories

Agencies' financial reporting systems do not always match the classifications used by ASTI. This can make it difficult to extract data according to the definitions outlined above. If necessary, follow-up queries should be submitted to clarify the details underlying the financial data provided. Footnotes can be used if the definition of a data category differs from ASTI's usual practice.

Expenses incurred and funding received may not match in a given year, as funding for multi-year projects may reach institutions at the start of a project and budgeted costs may not yet be realized at year's end. Occasionally large discrepancies are found between funding and spending data. Often, these are due to agencies having forgotten to report the source of salary outlays (in many cases, salaries are funded from a different government source than operating and capital expenditures). In many other cases, discrepancies are more difficult to explain and require additional delving into the financial records of the agency.

CHALLENGE: Funding for research within institutions of higher education

Research expenditure data has been difficult to compile for the higher education sector. The data obtained in the past were often limited to spending explicitly earmarked as research—such as the operational costs associated with university research or project funds received from an external source. For ASTI's purposes, a more comprehensive accounting is needed of R&D costs including salaries, rent, and utilities appropriately prorated to reflect the share of total faculty time spent on research. ASTI estimates expenditures for higher education R&D using the average expenditure per researcher for government agencies and nonprofit institutions and scaling that figure by the total number of research FTEs employed by the higher education institutions in the sample.

CHALLENGE: Loans and grants from donors

National governments often finance various agencies with money borrowed from development banks such as the World Bank to fund agricultural research. Given that ASTI conducts surveys at the agency level, it can sometimes be difficult for an agency to differentiate between government funding and funding from donors and development banks.

V. ASTI DATA MANAGEMENT TOOL

FORTHCOMING

VI. GENERATION OF ASTI DATASETS AND REPORTS

FULL-TIME EQUIVALENTS

ASTI presents its time-series data on human and financial resources for agricultural R&D in full-time equivalents (FTEs). These account for the proportion of time scientists actually spend on R&D activities. It is especially important to accurately report the time spent on research by professional staff at universities, as academic staff have a considerable number of non-research tasks, such as teaching, administration, and student guidance. These other activities are omitted from the R&D resource calculations. Faculty members typically spend just 25 percent of their time on research and are therefore represented as 0.25 FTE.

PURCHASING POWER PARITIES VERSUS MARKET EXCHANGE RATES

Differences in price levels from country to country make international comparisons of economic data highly complex. No fully satisfactory method has yet been devised to compare consumption and expenditure trends across countries. At present, the preferred conversion method for calculating the relative size of economies and other economic data, such as agricultural R&D spending, is the “PPP index” or “purchasing power parity index.” Purchasing power parities (PPPs) measure the relative purchasing power of currencies. PPP indexes are compiled using the local prices of a wide range of goods and services. They are in turn used to convert current prices within individual countries into a common currency. In contrast, official exchange rates tend to understate values in economies with relatively low price levels and to overstate those in economies with relatively high price levels.

ASTI collects data on national agricultural R&D spending in local currency units, which must be converted into a common currency before regional and international comparisons can be made. To do this, ASTI first deflates research expenditures in current local currency units and then converts these amounts into a common currency unit using PPPs. The base year was selected as 2005 to correspond with the latest benchmark PPP indexes released by the World Bank.

ASTI country-specific publications present investment data in constant (currently for base year 2005) local currencies and PPP dollars. Its country, regional and global reports use constant PPP dollars. The ASTI website, however, also provides the investment data in current local currencies and in 2005 US dollars using market exchange rates.

INTENSITY RATIOS OF SPENDING

One way to quantify a country’s public agricultural R&D investments in an internationally comparable manner is to measure total public agricultural R&D spending as a percentage of agricultural gross domestic product (AgGDP). This relative measure indicates the intensity of investment in agricultural research, not just the total amount of research spending.

CHALLENGE: Assessing intensity within a wider economic context

Intensity ratios are a good indicator of research investment levels. However, they do not take into account the policy and institutional environment in which agricultural research takes place or the size and structure of a country's agricultural sector and economy. These factors may be influential. For example, small countries need relatively higher research investments because they do not benefit from the economies of scale that larger countries enjoy. Similarly, countries with greater agricultural diversity or more complex agroecological conditions may have more complex research needs, requiring higher funding levels (Beintema and Stads 2008b).

FROM INSTITUTIONAL SURVEY DATA TO NATIONAL TRENDS

FORTHCOMING (covering secondary resources and estimation procedures).

FROM NATIONAL TRENDS TO REGIONAL AND GLOBAL TRENDS

In addition to country notes, ASTI produces regional synthesis overviews. Between 2001 and 2010, national survey rounds were conducted in more than 60 low-income and middle-income countries. The overall country coverage in the various regions was relatively high, but ASTI has not been able to achieve complete country coverage in any of the developing regions. Regional totals are therefore estimated by scaling up from the country samples prepared from the ASTI datasets and secondary sources. For the 2000 update, spending totals were estimated for countries that were excluded in the ASTI survey rounds, which represented 21 percent of the reported Sub-Saharan Africa total, 11 percent of the Asia–Pacific total, 14 percent of the Latin America and Caribbean total, 43 percent of the Middle East and North Africa total, and 16 percent of the high-income country total.

CHALLENGE: High dependency on secondary data for non-ASTI regions

ASTI relies on a number of secondary sources to calculate public agricultural R&D spending levels. For China it uses national science and technology indicators published by the Ministry of Science and Technology. For OECD member states it uses information published by the Organisation for Economic Co-operation and Development (OECD). Data for various Eastern European and former Soviet Union countries is provided by Eurostat as well as other secondary sources. The OECD science and technology indicators have been an ongoing source of global data on public-sector agricultural research spending. Unfortunately, the coverage and quality of the OECD data for the agricultural sector has decreased substantially over time, perhaps reflecting the declining role of agriculture in the OECD countries' economies.

VII. GENERATION REPORTS FOR ADVOCACY AND ANALYSIS

FORTHCOMING