ASTI – GUIDELINES FOR QUESTIONNAIRE COMPLETION

FOR FOCAL POINTS AND AGENCIES PARTICIPATING IN THE 2024 PILOTS

APRIL 2024

CONTENTS

1. INTRODUCTION

The Agricultural Science and Technology Indicators (ASTI), formerly managed by the International Food Policy Research Institute (IFPRI), has been a global leader in compiling and analyzing agricultural research data for over two decades. It focuses on institutional developments, investments, human resource capacity, and research outputs in low- and middle-income countries (LMICs), and functions through a vast network of national research agencies, regional coordinating bodies, and international institutions.

ASTI (https://www.asti.cgiar.org/) is now being transferred to the Food and Agriculture Organization of the United Nations (FAO), which is an opportunity to revitalize the program, broaden its scope, and propel it to new levels of success. As part of this process, there is a need to redesign and strengthen the data collection, analysis, and dissemination processes while aligning them with FAO statistical standards.

A first revised questionnaire and a new data collection approach are being tested in 11 country pilots in 2024. These Guidelines have been prepared specifically for these pilots.

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ASTI collects and processes its datasets using standard procedures and definitions developed by the Organization for Economic Co-operation and Development (OECD) and the United Nations Educational, Science, and Cultural Organization (UNESCO). These are described in the Frascati Manual[1].

Data is collected through questionnaires sent to the agencies performing agricultural research in each country. Each country has a focal organization that coordinates the data collection, and there are focal points in each contributing agency.

These Guidelines aim at clarifying the scope of the ASTI data collection and at providing the key concepts and definitions, to make sure questions in the survey are clearly understood and data is collected in a suitable way and is inputted in the correct form.

The Guidelines are meant to be read by the agency focal point before completing the ASTI survey and to be consulted during the data collection for guidance. They are complemented by the individual notes and data checks present in the questionnaire itself.

[1] OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/9789264239012-en

2. SCOPE OF ASTI

The scope of the ASTI database is Agricultural Research and Development (ARD), and more precisely ARD performed in National Agricultural Research Systems (NARS), although data for international research is also monitored in ASTI.

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. 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 has traditionally focused 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 has initiated analysis on agricultural R&D outputs in select regions.

This section of the guidelines aims at clarifying the scope of Research and Development on the one hand and agriculture on the other. Since boundaries are in some cases blurred, clarifications and examples are provided.

2.1 RESEARCH AND DEVELOPMENT (R&D)

Research is the creative work and original investigation undertaken on a systematic basis to gain knowledge. Development is the application of research findings or other scientific knowledge for the creation of new or significantly improved products, applications, or processes.

ASTI adopts the definition provided in the Frascati manual, which speaks more precisely of "research and *experimental* development": the "D" in R&D refers to experimental development:

> **Research and experimental development (R&D)** comprise creative and systematic work undertaken in order to increase the stock of knowledge […] and to devise new applications of available knowledge.
>
> *Frascati manual*

Still according to the Frascati manual, "*R&D is always aimed at new findings, based on original concepts (and their interpretation) or hypotheses. It is largely uncertain about its final outcome (or at least about the quantity of time and resources needed to achieve it), it is planned for and budgeted (even when carried out by individuals), and it is aimed at producing results that could be either freely transferred or traded in a marketplace. For an activity to be an R&D activity, it must satisfy five core criteria.*"

In order to be considered research, activities must be: **novel, creative, uncertain, systematic, transferable and/or reproducible**.

The term R&D covers three types of activity: basic research, applied research and experimental development. ASTI surveys do not ask to distinguish between these types of research, but defining them is useful because put together they define the full scope of ARD.
Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. **Applied research** is original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective. **Experimental development** is systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes.

Among the categories that do not fall under R&D, the most important ones 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. [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.]
- 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.

To support agencies in clearly setting the scope of R&D for data collection, here are some examples and hints regarding inclusion and exclusion, taken from the Frascati manual:

- An experimental development project aimed at creating knowledge in support of the development of new concepts and ideas related to the design of new products or processes should be included in R&D.
- Routine changes to products or processes are excluded, but new methods developed to perform common tasks are included. As an example, data processing is not an R&D activity unless it is part of a project to develop new methods for data processing.
- Uncertainty is a key criterion when making a distinction between R&D prototyping (models used to test technical concepts and technologies with a high risk of failure, in terms of applicability) and non-R&D prototyping (preproduction units used to obtain technical or legal certifications).
- An important criterion is that R&D activities have to be a formal activity that is performed systematically: the purpose of the R&D project and the sources of funding for the R&D performed should be identified.
- Keeping daily records of temperatures or of atmospheric pressure is not R&D, but a standard procedure. The investigation of new methods of measuring temperature is R&D, as is the study and development of new models for weather prediction.
- The concept of experimental development should not be confused with "product development". Experimental development is just one possible stage in the product development process: during the experimental development stage new knowledge is generated, and that stage comes to an end when the R&D criteria (novel, uncertain, creative, systematic, and transferable and/or reproducible) no longer apply.
- Care must be taken to exclude activities that, although part of the innovation process, do not satisfy the criteria required to be classified as R&D. For example, patent application and licensing activity, market research, manufacturing start-up, and tooling up and redesign for the manufacturing process are not in their own right R&D activities and cannot be assumed to be part of an R&D project.
- It is difficult to define where the education and training activities of higher education staff and their students end and R&D activities begin, and vice versa. R&D's elements of novelty distinguish it from routine teaching and other work-related activities. The adoption of the key R&D criteria can be supplemented, in this sector, by a consideration of the institutional role played by some actors. Research activity performed by doctoral students should be included in the overall R&D performed by the Higher Education sector. Of course, the time spent by the university staff to undertake tasks that are not related to research should be excluded from the estimation of the actual R&D performance.
- General-purpose data collection and documentation should not be included, but data collected solely or primarily as part of the R&D process are included in R&D. The activities of a scientific and technical information service or of a research laboratory library that is maintained predominantly for the benefit of the research workers in the laboratory should be included in R&D. The activities of a firm's documentation centre open to all the firm's staff should be excluded from R&D.
- Traditional knowledge: As a general rule, where activities associated with traditional knowledge form part of an R&D project, the effort (financial and in terms of human resources) should be counted as R&D. Otherwise they should be excluded.

Borderline R&D / Innovation cases according to the Frascati manual:

Table 2.3. **Borderline between R&D, innovation and other business activities**

Item	Treatment	Remarks
Prototypes	Include in R&D	As long as the primary objective is to make further improvements.
Pilot plant	Include in R&D	As long as the primary purpose is R&D.
Industrial design	Split	Include design required during R&D. Exclude design for production process.
Industrial engineering and tooling up	Split	Include "feedback" R&D and tooling up industrial engineering in innovation processes. Exclude for production processes.
Trial production	Split	Include if production implies full-scale testing and subsequent further design and engineering. Exclude all other associated activities.
Pre-production development	Exclude	
After-sales service and trouble-shooting	Exclude	Except "feedback" R&D (to be included).
Patent and licence work	Exclude	All administrative and legal work needed to apply for patents and licences (delivering documentation as an outcome of R&D projects is R&D). However, patent work connected directly with R&D projects is R&D.
Routine tests	Exclude	Even if undertaken by R&D personnel.
Data collection	Exclude	Except when an integral part of R&D.
Routine compliance with public inspection control, enforcement of standards, regulations	Exclude	

Table 1. From Frascati manual 2015, page 61.

2.2 AGRICULTURE

R&D that falls within the scope of ASTI is in the field of agriculture, which ASTI defines as follows:

Agricultural research within the scope of ASTI:

- Includes: crops, livestock, forestry, fisheries, natural resources, and the socioeconomic aspects of primary agricultural production.
- Also includes: on farm storage and processing of agricultural products.
- Excludes: postharvest or food processing research off farm.

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.

2.3 "NATIONAL"

The concept of "national" refers to domestically targeted research activities that are funded or executed by the research agencies within a particular country. Therefore, research activities undertaken 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.

3. DEFINITIONS AND GUIDANCE FOR THE QUESTIONNAIRE

3.1 RESEARCH PERFORMERS, INSTITUTIONAL UNITS, INSTITUTIONAL SECTORS

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. 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.

The definition of **institutional units** that are involved in the performing of R&D activity is of fundamental importance to the collection, reporting and interpretation of R&D statistics. An institutional unit is a national accounting concept and is defined as "an economic entity that is capable, in its own right, of owning assets, incurring liabilities, and engaging in economic activities and transactions with other entities" (EC et al., 2009: 61, para 4.2). In the R&D case, institutional units have to be capable of decision making in respect of the conduct of R&D, from the allocation of financial resources for internal or external use, to the management of R&D projects.

A **reporting unit** is the entity from which the required statistics are collected. It may consist of multiple reporting units in the institution where survey questionnaires are completed. In the case of administrative data, the reporting unit would correspond to the unit that is represented by the individual record. The choice of reporting units will vary from sector to sector and from country to country, depending on institutional structures, the legal framework for data collection, traditions, national priorities and survey resources. If the required statistics are

obtained from a survey, the reporting unit is the respondent. In some countries, data may be collected from R&D units; in others, it may be gathered at a more aggregate level. This manual can make no overarching recommendation concerning the reporting unit to be applied by each individual country.

Research performers that are expected to contribute data to ASTI belong to different **institutional sectors**, and the data collected changes slightly for each sector. The Frascati manual draws upon the approach of the System of National Accounts (SNA) to identify four mutually exclusive institutional sectors to characterise and classify R&D performing institutions:

- Business enterprise
- Higher education
- Government
- Private non-profit

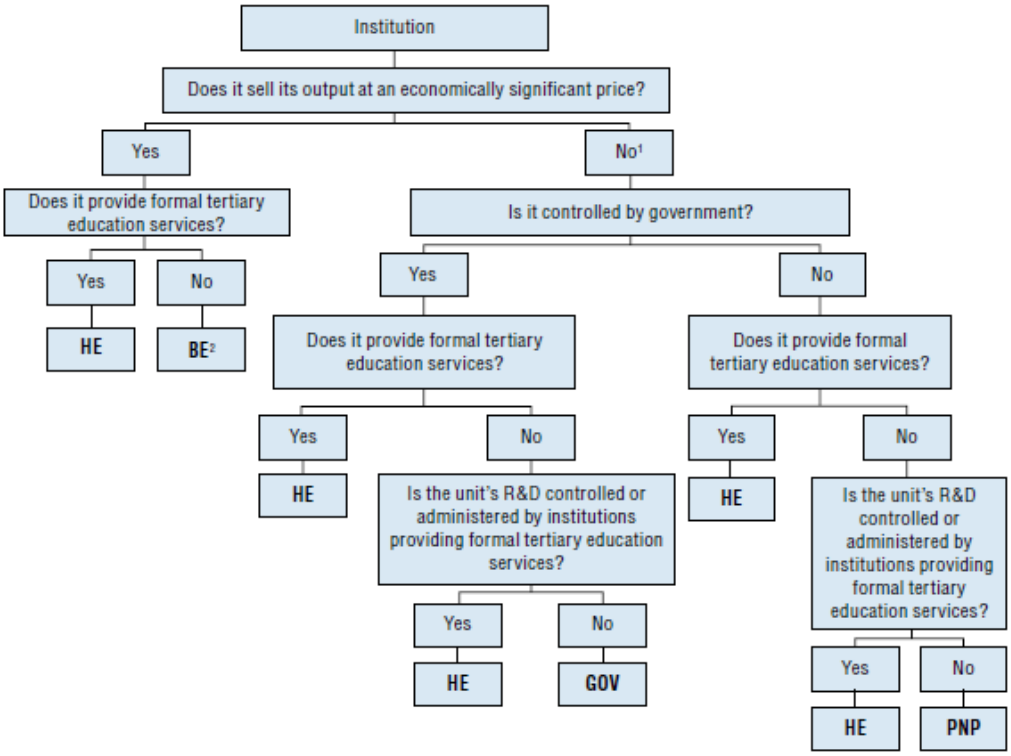
While four of the sectors can be related to those of the SNA, the Higher education sector, because of its policy relevance, is unique to the Frascati manual and is made up of institutions that can be in any of the SNA sectors.

Sector and institutional classifications for measuring resources invested in agricultural R&D		
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	
4. Private for-profit	4a. 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
	4b. 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

Table 2. Compiled by authors from the Frascati Manual 2002.

The Frascati Manual developed a decision tree to assist statisticians in assigning the proper institutional classification:

Figure 3.1. **Decision tree for allocating institutional units to the main sectors in this manual**



Key:

BE	Business enterprise sector
HE	Higher education sector
GOV	Government sector
PNP	Private non-profit sector

1. NPIs primarily serving businesses (e.g. trade associations, etc.) are classified in the Business enterprise sector, following the SNA convention of classifying those into the SNA Corporations sector.
2. This sector can be further subdivided into public and private Business enterprises, depending on whether the institution is controlled by government or not. This is analogous to the SNA treatment of public and private corporations.

Fig 1. From the Frascati Manual 2015, page 91.

In some of these cases ASTI follows the Frascati Manual's institutional classification; but in other cases it has developed its own classification scheme. For example, 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 research for the general public. Following the Frascati Manual, ASTI also classifies CNRA as a government agency.

Challenge: Obtaining complete and accurate agricultural R&D investment data for private for-profit 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.

3.2 SURVEY FRAMEWORK

Four survey forms are used: one for large government and nonprofit agencies, one for small 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.

REPORTING INTERVAL

- **Time series**: data gathered on an annual basis (HR totals, financial resources)
- **Benchmark years data**: data collected less frequently but regularly during the year of assessment (research focus and age brackets of researchers; student numbers in higher education institutions...)

TIERS

Tier 1 variables will consist of core data on agricultural r&d investments and human resource capacity, and will be collected through FAO questionnaires, administered on an annual basis to the designated national focal points in coordination with the National Statistical Offices (NSOs). The data will be structured in accordance with FAOSTAT standards, detailed with standardized metadata and disseminated through this platform. They will undergo a thorough cleaning and harmonization process using validated outlier detection strategies. The processed data will be stored in the FAOSTAT archives and subject to annual updates.

Tier 2 variables are more nuanced variables related to the institutional setup of agricultural R&D, research capacity, investment, funding sources, commodity and thematic focus, and other specific demands emerging from stakeholders. These data will be collected every 3-5 years (benchmark years).

While tier-1 data is always time-series data (has an annual reporting interval) and tier-2 data has always a benchmark-year reporting interval, there can be time-series data that is not tier 1 and is collected only at benchmark year but reported retrospectively for each previous year.

Time-series data are collected for three main indicators: research staff totals + proportion of time spent on research (to calculate the FTEs), research investments, and research funding. 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.

This comprehensive survey design framework summarizes which questions are included in which form for which group, the reporting interval and the tier:

Survey question (area)	Time-series (t), benchmark year (b), or one-time (o)	Large government agencies (GOVT)	Small government and nonprofit agencies (SMALL)	Higher education (HE)	Private (PS)	Tier
Contact details of the R&D agency	b	√	√	√	√	2
Supervising authority	b	√	√	√		2
Establishment year of agency	o	√	√	√		
Year in which agency became involved in R&D	o	√	√	√	√	
Quantification of time input	t	√	√	√	√	1
Researchers by gender and degree	t	√	√	√	√	1
Researchers by gender and position	b	√	√	√		2
Researchers by degree and age bracket	b	√				2

Researchers by gender and age bracket	b	√				2
Number of technical, administrative, and other support staff	b	√				2
Expenditures by cost category	t	√	√	√	√	1
Funding by source	t	√				2
List of research programs and number of researchers assigned to them	b	√		√		2
Breakdown of research by commodity area	b	√	√	√	√	2
Breakdown of research by thematic area	b	√	√	√	√	2
Agency's focus on addressing: equality and diversity, climate change, environmental sustainability	b	√				2
PhD programs and number of students	b			√		2
MSc programs and number of students	b			√		2
BSc programs and number of students	b			√		2

3.3 HUMAN RESOURCES AND RESEARCH FOCUS

ASTI calculates its human resources data in full-time equivalents (or "FTEs").

*The **Full-time equivalent (FTE)** of R&D personnel is defined as the ratio of working hours actually spent on R&D during a specific reference period (usually a calendar year) divided by the total number of hours conventionally worked in the same period by an individual or by a group.*
In order to be included in the R&D personnel totals, an individual should make an appreciable contribution to the R&D performed. Therefore, for both internal personnel and external personnel, it is recommended to express FTEs in decimals and to check for the significance of the contribution to a unit's R&D performance by individuals spending less than 0.1 FTE on R&D on an annual basis (i.e. 10 per cent of the total working time, which is about 20 working days per year).
Total R&D personnel in FTE terms includes the R&D performance, on an annual basis, by all individuals – internal R&D personnel and external R&D personnel, including volunteers – who contributed to the intramural R&D of a statistical unit, an institutional sector or a country.

Frascati manual

N.B.: The ASTI survey does not ask for FTEs: FTEs are calculated combining the data collected as "headcount" and the data collected as percentage of time spent on activities.

The ASTI questionnaire includes questions that ask either for percentage of time - then calculated as FTE – or for headcount.

3.3.1 QUESTION 1 IN "HUMAN RESOURCES": TIME SPENT ON RESEARCH VERSUS OTHER ACTIVITIES.

ASTI's method of calculation of the FTEs 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.

Question 1 in the "Human resources" section is the key question that asks for the overall percentage of time devoted to agricultural research. In all other questions asking for percentages of time, the percentage is assumed to be relative to the overall time spent on agricultural research as set in question B1.

By collecting information not only on research time but also on time spent on activities such as administration, training, extension, teaching, and others, ASTI aims to gain a more accurate understanding of the actual research focus of these agencies. For private companies, it is recommended to adhere to the original FTE percentage question for more straightforward reporting of time allocation.

See "how to collect / estimate HC and time-use data" below for some recommendations on how to collect / estimate this data.

3.3.2 HEADCOUNT QUESTIONS IN "HUMAN RESOURCES"

These questions classify and characterize human resources against categories defined as follows:

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).

All questions referring to researchers refer to professional researchers working on actual research in agriculture as defined by ASTI (research on crops, livestock, forestry, fisheries, and natural resources, as well as on-farm postharvest research). If the number is a headcount, also researchers working partially on agricultural research should be counted; if it is in NFE, only the fraction they work in agricultural research.

Frascati manual: "*Researchers are professionals engaged in the conception or creation of new knowledge. They conduct research and improve or develop concepts, theories, models, techniques instrumentation, software or operational methods.*"

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. Frascati manual: "*Technicians and equivalent staff are persons whose main tasks require technical knowledge and experience in one or more fields of engineering, the physical and life sciences, or the social sciences, humanities and the arts. They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods and the use of research equipment, normally under the supervision of researchers.*"

• 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.

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 médicine vétérinaire, DESS, DEA, master, maîtrise, ingénieur*
- *BSc = Licence*

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

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.

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.

3.4 RESEARCH FOCUS

The “Research focus” section collects data on the focus of the research conducted. It does so through four questions: one on number (headcount) of researchers working on specific research programs, and three on percentages of researchers’ time spent respectively on: specific commodities, specific thematic areas, and a few selected cross-cutting themes.

The total of the focus percentages has to be always 100%, and the 100% is relative to the overall proportion of time dedicated to agricultural research, as reported in question B1.

Research programs

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

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).

Commodities include more than twenty field and horticultural crops, five livestock items, pastures and forages, forestry, and fisheries commodities. 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 “non commodity” category.

Commodities used to be grouped in a way that is not aligned with the UN reference classification (the Central Product Classification): the previous groupings have been left as they were, but behind the scenes the commodities have been also re-grouped in alignment with the CPC groups. In this way, comparisons with other systems that use the CPC will be possible. The names of the commodities are not exactly those used in the CPC, but a 1-1 mapping has been implemented behind the scenes also for comparison purposes.

Thematic areas have been revised to include new areas that either were missing or are of special interest to the stakeholders who provided feedback; care was also taken that the area could be roughly aligned to the OECD Fields of Research and Development (FORD) classification referred to in the 2015 Frascati manual and in turn aligned with UNESCO’s “Recommendation Concerning the International Standardisation of Statistics on Science and Technology”. Both those classifications are however too broad, while the ASTI are much more granular.

3.4.1 HOW TO COLLECT / ESTIMATE HC AND TIME-USE DATA

The Frascati manual provides some recommendations on how to collect HC data and collect or estimate FTE data. For the purpose of completing the ASTI survey, agencies do not need to calculate the FTEs, but they need to provide percentage of time spent on certain types of activities / area, which will be used to calculate the FTE. Therefore, the recommendations for the collection / estimation of FTE data can be adapted to the collection / estimation of percentage of time spent.

The general recommendations for these data are:

- Direct collection of R&D personnel data is the recommended methodology to be used for the production of both FTE and HC data series.
- When no direct data collection is possible, an estimation process can be undertaken in order to derive FTE and HC indicators from administrative data.
- Either ex-ante or ex-post, R&D personnel data must be consistent with R&D expenditure data, principally with the categories of "labour costs" and "other current costs-external R&D personnel".

Producing HC statistics

The preferred approach for measuring headcount data for R&D personnel should be as of a given date (first option). Preferably, the point in time should be the same for all reporting units within all sectors of the reporting country.
The recommendations for providing HC statistics in the survey are as follows:

- Identify total R&D personnel including internal personnel engaged in R&D and all external R&D personnel contributing to intramural activities. (Regarding the total number of internal personnel, it is recommended to use, as a reference, up-to-date administrative registers and, for the business sector, official business registers when available.)
- Compile and report the data on internal R&D personnel separately from the data on external R&D personnel (both compensated and unpaid personnel). Separate totals should be compiled for students working in R&D who are part of the external R&D personnel totals.
- Produce separate HC time series for the two groups of the R&D personnel. A number of basic features of this group of workers should be available to the statistical unit since they include internal personnel working in the unit and involved in R&D, as well as external R&D personnel who have contributed "on site", or at least in close geographical proximity, to the unit's R&D activities. If this is not possible, compile such data at least for the internal R&D personnel who have contributed to intramural R&D in the reference period.
- When reporting headcount aggregate numbers, it is likely that individuals who contribute to the R&D of two or more statistical units (either business enterprises or other institutions) will be double-counted. The indicator may be interpreted as a sum of jobs. Working in terms of FTE totals provides a more accurate estimate of the human resource input to R&D.

The Frascati manual

Collection / estimation of time-use data

This can be done using information available at the level of the institution (e.g. from administrative data) or sometimes at the level of individuals (e.g. time-use surveys). Time-use surveys can be a useful source of data in the absence of other robust data sources. The first step for estimating percentages of time use is to collect detailed information (from administrative sources if survey data are not available) on the actual or contractual (normative/statutory) involvement of R&D personnel in intramural R&D. This approach could be straightforward when estimating public research institutions (or universities) totals since working roles and employment statuses in those sectors are often formally defined.

The ASTI survey has four time-use questions: if time-use surveys are not feasible, administrative and budget data assigning percentages of researchers' time (e.g. person/month) to specific programs/projects can help to estimate the percentages. Respondents are asked to illustrate the method used to estimate this data.

3.5 FINANCIAL RESOURCES

ASTI collects data on national agricultural R&D spending in local currency units.
For regional and international comparisons, this financial data is then converted into a common currency. To do this, ASTI first deflates research expenditures in current local currency units and then converts these amounts into a common currency unit using the "PPP index" or "purchasing power parity index."

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 years starts July 1, all costs incurred in 2009 are to be reported under 2010.

From the Frascati manual: "*Intramural R&D expenditures are all current expenditures plus gross fixed capital expenditures for R&D performed within a statistical unit during a specific reference period, whatever the source of funds. Funding for, or expenditure on, extramural R&D (that is, R&D performed outside the statistical unit) is not included in intramural R&D performance totals. Such funding for R&D received from others should be reported as a separate category in*

order to have full information on each unit's access to R&D. Such funds would also be reported in the receiving units' R&D intramural performance total, and therefore the exclusion of funding for extramural R&D is to avoid double counting."

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 and private foundations. 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.

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.