United Nations Educational, Scientific and Cultural Organization

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The General Conference of the United Nations Educational, Scientific and Cultural Organization, meeting in Paris from 24 October to 28 November 1978, at its twentieth session,

Considering that, by virtue of Article IV, paragraph 4 of the Constitution, it is for the Organization to draw up and adopt instruments for the international regulation of questions falling within its competence,

Considering that Article VIII of the Constitution provides, inter alia, that each Member State shall report to the Organization, at intervals and in a manner to be determined by the General Conference, on its laws, regulations and statistics relating to educational, scientific and cultural life and institutions,

Convinced that it is highly desirable for the national authorities responsible for collecting and communicating statistics relating to science and technology to be guided by certain standards in the matter of definitions, classifications and presentation, in order to improve the international comparability of such statistics,

Recognizing that the efforts made by Member States to develop science and technology will contribute to strengthening peace and security in the world,

Convinced that co-operation in this field would also advance economic and social progress,

Having before it, as item 34 of the agenda of the session, proposals concerning the international standardization of statistics relating to science and technology,

Having decided at its nineteenth session that this question should be made the subject of an international regulation, to take the form of a recommendation to Member States within the meaning of Article IV, paragraph 4, of the Constitution,

Adopts the present recommendation this 27th day of November 1978.

The General Conference recommends that Member States should ,apply the following provisions concerning international standardization of statistics relating to science and technology, by taking whatever legislative measures or other steps may be required, in conformity with the constitutional practice of each State, to give effect, within their respective territories, to the standards and principles formulated in this recommendation.

The General Conference recommends that Member States bring this recommendation to the attention of authorities and services responsible for collecting and communicating statistics relating to science and technology:

The General Conference recommends that Member States forward to it, by the dates and in the form which it shall prescribe, reports concerning action taken by them upon this recommendation.

I. Scope and definitions

Scope

1. This recommendation relates to statistics designed to provide standardized information in each Member State on certain scientific and technological (S&T) activities, and particularly on research and experimental development (R&D). These statistics should cover all national institutions that perform or finance such activities.

Definitions

2. In compiling the statistics covered by this recommendation, the following definitions should be used:

2.1 **Scientific and technological activities (STA):** systematic activities which are closely concerned with the generation, advancement, dissemination, and application of scientific and technical knowledge in all fields of science and technology. These include such activities as R&D, scientific and technological education and training (STET) and the scientific and technological services (STS), defined in paragraphs (a) to (c) below.

(a) **Research and experimental development:** any systematic and creative work undertaken in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this knowledge to devise new applications. In most fields several categories may be distinguished:

(aa) **Scientific research activities :** any systematic and creative activities aimed at increasing the stock of scientific knowledge and applying it in practice.

Scientific research activities in the natural sciences, technology, and the medical and agricultural sciences: Any systematic and creative activities designed to ascertain the links between, and the nature of, natural phenomena, to generate knowledge of the laws of nature and to

contribute to the practical application of this knowledge of laws, forces and substances.

Scientific research activities in the social sciences and humanities: Any systematic and creative activity aimed at increasing or improving knowledge of man, culture and society, including use of such knowledge for the solution of social and human problems.

In most fields of science, research may be classified as either fundamental or applied:

(i) **Fundamental research:** experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular or specific application or use in view.

(ii) **Applied research:** original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

(bb) Experimental development: systematic work, drawing on existing knowledge gained from research and/or practical experience that is directed to producing new materials, products and devices, to installing new processes, systems and services, and to improving substantially those already produced or installed.

(b)**S&T education and training (STET) at broadly the third level:** all activities comprising specialized non-university higher education and training, higher education and training leading to a university degree, post-graduate and further training, and organized lifelong training for scientists and engineers. These activities correspond broadly to ISCED levels 5, 6 and 7.

(c)**Scientific and technological services (STS):** activities concerned with research and experimental development and contributing to the generation, dissemination and application of scientific and technical knowledge.

(i) S&T services provided by libraries, archives, information and documentation centers, reference departments, scientific congress centers, data banks and information-processing departments.

(ii) S&T services provided by museums of science and/or technology, botanical and zoological gardens and other S&T collections (anthropological, archaeological, geological, etc.).

(iii) Systematic work on the translation and, editing of S&T books and periodicals (with the exception of textbooks for school and university courses).

(iv) Topographical, geological and hydrological surveying; routine astronomical, meteorological and seismological observations; surveying of soils and of plants, fish and wildlife resources; routine soil, atmosphere and water testing; the routine checking and monitoring of radioactivity levels.

(v) Prospecting and related activities designed to locate and identify oil and mineral resources.

(vi) The gathering of information on human, social, economic and cultural phenomena, usually for the purpose of compiling routine statistics, e.g. population censuses; production, distribution and consumption statistics; market studies; social and cultural statistics, etc.

(vii) Testing, standardization, metrology and quality control: regular routine work on the analysis, checking and testing, by recognized methods, of materials, products, devices and processes, together with the setting up and maintenance of standards and standards of measurement.

(viii) Regular routine work on the counselling of clients, other sections of an organization or independent users, designed to help them to make use of scientific, technological and management information. This activity also includes extension and advisory services organized by the State for farmers and for industry but does not include the normal activities of project planning or engineering offices.

(ix) Activities relating to patents and licences: systematic work of a scientific, legal and administrative nature on patents and licences carried out by public bodies.

2.2 **Scientific and technical personnel:** the total number of people participating directly in S&T activities in an institution or unit and, as a rule, paid for their services. This group should include scientists and engineers, and technicians (SET) and auxiliary personnel, as defined in paragraph 4 (a) below.

(a) **Full-time scientific and technical personnel (FT):** personnel who devote almost all their working time to S&T activities.

(b) **Part-time scientific and technical personnel (PT):** personnel whose working time is shared between S&T and other activities.

(c) **Full-time equivalent (FTE):** measurement unit representing one person working full-time for a given period; this unit is used to convert figures relating to the number of part-time workers into the equivalent number of full-time workers. Data concerning personnel should normally be calculated in FTE, especially in the case of scientists and engineers and of technicians.

2.3 **Reference year:** period of 12 consecutive months to which the statistical data relate. When this period carries over from one calendar year to the next, the year in which the period started is to be taken as the reference year.

2.4 **Annual expenditure:** funds actually expended during the reference year for the performance of S&T activities.

(a) **Intramural expenditure:** all payments actually made during a reference year for the performance of S&T activities within a given unit, institution or sector of performance.

(b) **Extramural expenditure:** all payments actually made during a reference year for the performance of S&T activities outside a particular unit, institution or sector of performance, including payments made outside the national economic territory.

(c) **Total domestic expenditure on S&T activities:** all expenditure made for this purpose in the course of a reference year in institutions and installations established in the national territory, as well as installations physically situated abroad: land or experimental facilities rented or owned abroad and ships, vehicles, aircraft and 'satellites used by national institutions. Amounts spent on S&T activities carried out by international organizations established in the country in question are excluded from this total.

2.5 **Institutions carrying out S&T activities:** any institution engaged in S&T activities on a permanent and organized basis. The term `institution' should be taken as covering a 'very broad range of entities having legal, financial, economic, social or political status, such as establishments, enterprises, bodies, organizations, institutes, academies, associations, departments,, ministries, centers, laboratories, etc.

2.6 **Sector of performance:** sector of the national economy comprising a significant number of institutions carrying out S&T activities (as defined in paragraph 2.5) that present a certain degree of homogeneity with respect to the principal function or service provided irrespective of source of funds, the authority to which such institutions are responsible or the category of STA being carried out. According to these criteria, three major sectors of performance can be distinguished : the productive sector, the higher education sector and the general service sector.

2.7 **Fields of activity:** branches of economic activity and fields of science and technology in which R&D and other S&T activities are carried out.

2.8 **Categories of activities:** specific types of endeavours that comprise S&T activities such as R&D, S&T education and training (STET), STS, described in paragraphs 2.1 (a), 2:1 (b) and 2.1 (c).

II. Classification of data

3. **The human and financial resources devoted to S&T activities should be classified:**

(a) By category and subcategory of such, activities

(i) Research and experimental development.

(ii) S&T education and training at broadly the third level (STET).

(iii) Scientific and technological services (as listed in 2.1 (c) (i) to (ix)).

(b) By sector of performance:

(i) **Productive sector comprising:** domestic and foreign industrial and trading enterprises situated within the country which produce and distribute goods and services for sale, and institutions directly serving them with or without contract, whatever their form of ownership (public and private). The S&T activities of these enterprises and institutions closely linked to production are known as 'S&T activities integrated with production'; governmental, non-governmental and non-profit institutions most or all of whose S&T activities indirectly serve one or more of the categories or classes of activities with a two- or three-digit classification in the ISIC. The S&T activities of these institutions which are only indirectly linked to production are known as 'S&T activities not integrated with production'. In countries with a centralized economy, R&D institutes attached to the ministries responsible for the different branches of the national economy should be classified in this category of institutions.

(ii) **Higher education sector, comprising:**
establishments of education at the third level which require as a minimum condition of admission successful completion of education at the second level or evidence of the attainment of an equivalent level of knowledge, together with research institutes, experimental stations, hospitals and other S&T institutions serving such establishments and directly administered by or associated with them.

(iii) **General service sector, comprising:** bodies, departments and establishments subordinate to the central, State (in federal systems), provincial, district or county, municipal, town or village authorities that serve the community as a whole and provide a wide range of services such as administration, maintenance and regulation of public order, public health, culture, social services, promotion of economic growth, welfare and technical progress, etc. ; institutions such as national scientific research and technology councils, academies of sciences, professional scientific organizations and other institutions which serve the whole of the community; institutions whose S&T activities (including R&D) are carried out for the general benefit of agriculture, industry, transport and communications, building and public works or the public electricity, gas and water services-i.e. activities classified under a single-digit reference in the ISIC.

(c) By fields of science and technology in which institutions belonging to the higher education and general service sectors carry out S&T activities and, in particular, R&D

(i) **Natural sciences, including:** astronomy, bacteriology, biochemistry, biology, botany, chemistry, computer sciences, entomology, geology, geophysics, mathematics, meteorology, mineralogy, physical geography, physics, zoology, other allied subjects.

(ii) **Engineering and technology, including:** engineering proper, such as chemical, civil, electrical , and mechanical engineering, and specialized subdivisions of these; forest products; applied sciences such as geodesy, industrial chemistry, etc.; architecture; the science and technology of food production; specialized technologies or interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology, other allied subjects.

(iii) **Medical sciences,** including: anatomy, dentistry, medicine, nursing, obstetrics, optometry, osteopathy, pharmacy, physiotherapy, public health, other allied subjects.

(iv) **Agricultural sciences, including:** agronomy, animal husbandry, fisheries, forestry, horticulture, veterinary medicine, other allied subjects.

(v) **Social sciences and humanities, comprising:**

Group I- Social sciences, including:

anthropology (social and cultural) and ethnology, demography, economics, education and training, geography (human, economic and social), law,

linguistics (excluding language studies based on set texts, which should be classified in Group II under `Ancient and modem languages and literature'), management, political sciences, psychology, sociology, organization and methods, miscellaneous social sciences and interdisciplinary, methodological and historical S&T activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences.

Group II-Humanities, including:

arts (history of the arts and art criticism, excluding artistic `research' of any kind), languages (ancient and modem languages and litera-ture), philosophy (including the history of science and technology), prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, etc., religion, other fields and subjects pertaining to the humanities and interdis-ciplinary, methodological, historical and other S&T activities relating to the subjects in this group.

(d) By branch of economic activity for institutions belonging to the productive sector, in accordance with the `International Standard Industrial Classifi-cation of all Economic Activities' (ISIC). Specific industry groupings at single and selected double digit ISIC levels from the following major divisions should be included :

(i) Agriculture, forestry, hunting and fishing (ISIC: 1).
(ii) Extracting industries (ISIC: 2).
(iii) Manufacturing industries (ISIC: 3).
(iv) Construction (ISIC: 5).
(v) Transport, storage and communication (ISIC: 7).
(vi) Other (ISIC: 4, 6, 8 and part of 9).

4. **The personnel of S&T institutions should also be classified:**

(a) By the work they are engaged in and their qualifications:

(aa) **Scientists and engineers,** comprising persons working in those capacities, i.e. as persons with scientific or technical training who are engaged in professional work on S&T activities, administrators and other high-level personnel who direct the execution of S&T activities. Such personnel should be classified in this category if they have either:

(i) completed education at the third level leading to an academic degree, or

(ii) received third-level non-university education (or training) not leading to an academic degree but nationally recognized as qualifying for a professional career, or

(iii) received training, or acquired professional experience, that is nationally recognized as being equivalent to one of the two preceding types of training (e.g. membership of a professional association or the holding of a professional certificate or licence).

(bb) **Technicians,**comprising persons engaged in that capacity in S&T activities who have received vocational or technical training in any branch of knowledge or technology, in accordance with the following criteria:

(i) that they have completed the second stage of second-level education. These studies are in many cases followed by one or two years' specialized technical studies, which may or may not lead to a diploma;

(ii) that they have received three or four years' vocational or technical education (whether leading to a diploma or not) following completion of the first stage of second-level education;

(iii) that they have received on-the job training (or acquired professional experience) that is nationally recognized as being equivalent to the levels of education defined under (i) or (ii) above.

(cc) **Auxiliary personnel**, comprising persons whose work is directly associated with the performance of S&T activities, i.e. clerical, secretarial and administrative personnel, skilled, semi-skilled and unskilled workers in the various trades and all other auxiliary personnel.

(b) By level of education and by field of study, determined in accordance with ISCED (International Standard Classification of Education), for classifying personnel in the 'aa' and `bb' categories.

(i) **By level of education;**

(aa) Holders of third-level degrees of university type (ISCED : 6-7).

(bb) Holders of third-level diplomas of non-university type (ISCED: 5).

(cc) Holders of diplomas at the second level, second stage (ISCED : 3).

(dd) Other qualifications (ISCED : 1, 2, 9).

(ii) **By field of study:**

Fields of science and technology should be correlated with the classification of fields of study in ISCED, as follows: (NLDR see Figure 1)

(c) By occupation in accordance with the ISCO (ILO-1968).

(d) By number (in FT and PT) for personnel in category (aa).

(e) By nationality, for personnel in categories (aa) and (bb) (merely showing nationals separately from non-nationals).

(f) By ;sex, for personnel in categories (aa), (bb) and (cc).

(g) By age, for personnel-in categories (aa) and (bb), separating them into the following age groups ; for category (aa) : less than 30, 30-39, 40-49, 50-59, 60 and over; for category (bb): less than 30, 30-39, 40-49, 50-59, 60 and over.

5. Each type of national **S&T human resources**, i.e. scientists and engineers and technicians, should be assessed in accordance with the following two criteria; if only one is to be used, criterion (b) is preferable.

(a) **Total stock of SET**, comprising the total number of persons with the necessary qualifications for personnel in categories (aa) and (bb), regardless of economic activity (production, S&T activities, the professions, no gainful employment, etc.), age, sex, nationality or other characteristic.

(b) **Number of economically active SET**, comprising the total number of persons with the necessary qualifications for personnel in categories (aa) and(bb) who are engaged in, or actively seeking work in, some branch of the economy at a given reference date.

6. **Intramural expenditure on S&T activities should be classified:**

(a) By type of expenditure:

(i) **Current intramural expenditure**, comprising all payments made during the reference year for the performance of S&T activities within units, institutions or sectors of performance, whatever the source or origin of funds, covering the cost of labour, minor equipment and expendable supplies and other current expenses, i.e.:
labour costs, comprising wages and salaries, paid in cash or in kind, and all related labour costs, including `fringe benefits' such as bonuses, paid holidays, contributions to pension funds and com-pulsory social security systems, payroll taxes, etc. As far as possible, the cost of personnel in category (aa) should be shown separately from the cost of other personnel;
other current costs, comprising all other current intramural expenditure such as expenditures on office and laboratory supplies, materials, subscriptions to journals, books, rental of buildings, maintenance, computer services, travel and postal services.

(ii) **Intramural capital expenditure**, comprising all payments made during the reference year for the performance of S&T activities and relating to expenditure on major equipment and other capital expenditure. All reserves for depreciation, whether actual or imputed, should be excluded from international statistics on expenditure. Nevertheless, countries that are in a position to furnish such information may do so if they wish. This expenditure comprises:
expenditure on major equipment, comprising the purchase of major installations, machinery and equipment. Expenditure on the purchase of complete libraries, large collections of books, periodicals, specimens, etc. should be included under this heading, especially when made at the time of equipping a new institution. Even if made at any other time, however, purchases of this type could still be shown under capital expenditure;
other capital expenditure, comprising the purchase of land (for building or for testing purposes) and animals (where the unit cost or quantity purchased make it appropriate to include the expenditure in this category) and expenditure on new buildings or large scale improvements, modifications and repairs to buildings and fixed installations, land-improvement work and other expenditure.

(b) By source of funds:

(i) **Government funds**. This category should include funds provided by the central (federal) State or local authorities and originating from the ordinary or extraordinary budget or from extra-budgetary sources. It also covers funds received from public intermediary institutions established and wholly financed by the State.

(ii) **Productive enterprise funds and special funds**. This category should include funds allocated to S&T activities by institutions classified in the productive sector as productive establishments or enterprises and all sums received from the `Technical and Economic Progress Fund', in countries with a centralized economy, and other similar funds.

(iii) **Foreign funds**. This category should include funds received from abroad for national S&T activities, including funds received from international organizations, foreign governments or institutions.

(iv) **Other funds**. This category should include funds that cannot be classified under any of the preceding headings,'e.g. `own funds' of establishments in the higher education sector, endowments and gifts.

(c) By category, for expenditure on R&D

(i) Fundamental research.

(ii) Applied research.

(iii) Experimental development.

7. **National activities in R&D and STS** should be classified by major socioeconomic aims or objectives as listed below, on the basis of funding (ex-ante) or expenditure (ex-post) financed from public funds and, if possible, from all other sources of funds :

(i) Exploration and assessment of the earth, the seas and the atmosphere.

(ii) Civil space.

(iii) Development of agriculture, forestry and fishing.

(iv) Promotion of industrial development.

(v) Production, conservation and distribution of energy.

(vi) Development of transport and communication

(vii) Development of education services.

(viii) Development of health services.

(ix) Social development and socio-economic services.

(x) Protection of the environment.

(xi) General advancement of knowledge.

(xii) Other aims.

(xiii) Defence.

8. **Basic statistical units:** If possible, the basic statistical unit selected to measure the performance of S&T activities should be an establishment-type unit; for example, industrial establishments, research institutes, governmental units and institutes or departments of universities.

III. Presentation of statistical data

9. The statistics covered by this recommendation should be presented in accordance with the definitions and classifications set out therein.

Levels of detail

10. In view of the fact that the statistical systems of Member States are not all at the same stage of development, the data should be presented at two levels of detail or complexity depending on the information available in Member States.

(a) **First level of detail**: a limited quantity of basic information that is indispensable for establishing international comparisons and that should, if possible, be compiled by all Member States.

(b) **Second level of detail**: fuller statistical data, which not all Member States are able to provide but which, taken as a whole, could constitute a guide for those that wish to improve and enlarge their national statistical systems.

Periodicity

11. The basic international statistics should be updated biennially. It would be desirable for Member States that can do so to update certain data annually so that variations in their R&D effort can be seen. Figures for the stock of SET and/or number of economically active SET should be compiled twice during each ten-year period.

Stages for the extension of S&T statistics

12. The compilation of international S&T statistics should be developed in two successive stages, the transition from the first stage to the second being accomplished gradually on the basis of the state of progress of national and international experience. The first stage should cover a period of at least five years starting from the time the General Conference adopts this recommendation. The second stage should be regarded as being of an experimental nature.

(a) **First stage**: During this stage, i.e. during the years immediately following the adoption of this recommendation, international statistics should cover only R&D activities in all sectors of performance, together with the stock of SET and/or the economically active SET. If, of the last two, only one is collected it should preferably be the latter one.

(b) **Second stage**: Before going on to the second stage, it would' be advisable for Member States to ascertain through the UNESCO Secretariat that a sufficiently large number of them are in a position, on the basis of international experience and their own work, to extend statistical observation to the STS and Scientific and Technological Education, and Training at broadly the third level (STET) involved in this stage.
During this stage, the international statistics should be extended to cover STS and STET carried out in institutions in which R&D activities are performed and should be shown either in consolidated form or by STET and by type of STS, depending on the country's capabilities. First an evaluation should be made of STS and STET in all sectors of performance, with the exception of integrated units in the productive sector.
Subsequently, the international statistics relating to STS and STET should be progressively extended to the integrated units in the productive sector and to institutions in all sectors of performance that do not carry out R&D but provide STS and STET in an institutionalized and structured manner. These statistics should be broken down by STET and by type of STS.

13. The information furnished by the statistics of science and technology should be presented with the periodicity and level of detail shown below: (NLDR see Figure 2)

IV. Long-term development of science and technology statistics

14. In order to set themselves goals to aim at in the gradual development of science and technology statistics, Member States should further certain statistical work already under way which should provide a better understanding of present problems in this field of statistics and help to

resolve them. Their efforts should be concentrated on the following items, though these are not set out in any intended order of priority:

(a) Development of co-ordination between science and technology statistics and economic and social statistics, and especially with national accounting systems including the Material Product System.

(b) Development of classifications for financial resources devoted to R&D, in terms of appropriations and expenditure (ex-ante and ex-post analyses), by main national socio-economic aims.

(c) Indicators for the `production' or `output' of S&T activities, especially R&D.

(d) Indicators of the statistical and accounting aspects of technology transfer processes.

(e) Preparation of specific price indexes and exchange rates to serve as suitable deflators for expenditure on S&T activities, and especially on R&D.

(f) Measurement and classification of S&T equipment and installations for R&D activities.

(g) Studies of the effects of fiscal systems on expenditure for S&T activities.

(h) Classification of S&T personnel by occupation and professional status.

The foregoing is the authentic text of the Recommendation duly adopted by the General Conference of the- United Nations Educational, Scientific and Cultural Organization during its twentieth session, which was held in Paris and declared closed,) the-twenty-eighth day of November 1978.

IN FAITH WHEREOF we have appended our signatures.

The President of the General Conference
The Director-General

English	http://unesdoc.unesco.org/images/0011/001140/114032e.pdf#page=188
French	http://unesdoc.unesco.org/images/0011/001140/114032f.pdf#page=197
Spanish	http://unesdoc.unesco.org/images/0011/001140/114032s.pdf#page=195
Russian	http://unesdoc.unesco.org/images/0011/001140/114032rb.pdf#page=181
Chinese	http://unesdoc.unesco.org/images/0011/001140/114032cb.pdf#page=1
Arabic	http://unesdoc.unesco.org/images/0011/001140/114032ab.pdf#page=181
Date of adoption	1978