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**RECOMMENDATIONS FOR STRENGTHENING THE SYSTEM OF STATISTICS
AND INDICATORS FOR SCIENCE, TECHNOLOGY AND INNOVATION
IN LATIN AMERICA AND THE CARIBBEAN**

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I. INTRODUCTION

The Statistical Conference of the Americas of the Economic Commission for Latin America and the Caribbean, as the senior official statistical agency in the region, is in the best position to consider the situation of the system of statistics and indicators for science, technology and innovation (STI) on both a national and an international scale and to incorporate the activity into its cooperation programmes when that is possible and appropriate. This would be in keeping with the recognized importance of science, technology and innovation in the economic and social development of Latin America and the Caribbean.

A background paper on statistics and indicators for science, technology and innovation in Latin America and the Caribbean describes the experience of the countries that are more advanced in the measurement of science, technology and innovation (STI) and its implications for Latin America and the Caribbean, the basic methodological factors that need to be taken into account and the present situation, including the limitations observed in the region.

On the basis of the above paper, the Conference might consider different organizational and methodological recommendations, at both the national and the international levels, for setting up a work programme to improve the availability and quality of statistical information on STI and to rationalize the production of such data by integrating them into the national statistical systems and through international coordination. It is important to make use of the experience already acquired in the region, in particular within the Ibero American Network of Science and Technology Indicators (RICYT).

Given the varying levels of the national systems of STI statistics and indicators in the region, where some countries have a very comprehensive information base, some have very recent or limited experience, and others have practically no information of this kind, action should be taken in stages, taking into account the priorities of individual countries and the pace at which they are able to work.

This document offers some recommendations which the Conference might consider with a view to drafting a set of organizational and methodological measures for national statistical systems and putting underway a coordinated international work programme.

II. ORGANIZATIONAL RECOMMENDATIONS AT THE NATIONAL LEVEL

In the Latin American and Caribbean region, the production of STI statistics and indicators is usually decentralized and is often separate from the organization of the national statistical system. A few relatively low-cost organizational measures which are complementary to the methodological recommendations could help to improve the use of technical and economic resources and help consolidate STI statistics as a fully-integrated subsystem within the national statistical system.

The establishment of strategic alliances between the statistical system and the STI system, so as to provide for the shared use of human and technical resources, would also help to improve STI statistics.

The following measures have to do with rationalizing the production of statistics and formalizing this activity within the framework of official statistics.

1. Establishing a national inventory of STI statistics and indicators

In view of many sources of information on STI and of information categories (already described in the background paper: statistics on context, input, patents and bibliometry, technological innovation, information technologies, higher education etc.) it would seem advisable to establish national inventories of STI statistical operations. These inventories could draw on the progress made by other organizations, such as OECD, RICYT and UNESCO, as well as the data currently being produced in the individual countries. This would facilitate user access to statistical sources of interest and make it easier to discover gaps and duplication.

A common questionnaire to be used in all countries to identify the basic characteristics of those operations (such as content, producing agency, type of operation, coverage and categories, periodicity, dissemination) would facilitate the task of coordinating production.

As the lead agencies of the national statistical systems, the statistical offices are in the best position to compile such inventories, which could be developed in collaboration with the administrative units responsible for gathering information on STI in each country. The national inventories could then be used to compile a global inventory for the entire Latin American and Caribbean region.

2. Prioritizing the production of STI statistics according to user needs

The various national and international users of STI statistics and indicators should be identified in the context of a careful study by producers of statistics, in order to balance the demand for information with the allocation of public resources. As in other areas of statistics, it would be useful to study each country's potential for establishing a national working group on STI statistics and indicators which would bring together producers of basic statistics, users (science and technology policymakers, analysts) and respondents (industrial sectors, higher education sectors, and agencies responsible for the protection of intellectual property, among others).

The working group's programme might include a review of existing processes for production of STI statistics and indicators and their relationship with the statistical infrastructure (methodology, directories, nomenclatures and classifications used), as well as other basic operations (such as business statistics and education statistics) and with aggregate operations (national accounting). The group could also evaluate priorities in the demand for information and the allocation of resources to meet that demand. In this way, the national groups could disseminate at the local level knowledge on STI statistics and indicators that is already available at the international level.

Some national statistical systems have already implemented formal procedures for adapting statistics production to user needs. These formal procedures include the organization of forums (higher, national, or inter-sectoral statistical councils) which bring together providers, producers and users of statistics and have the competence to decide on and approve the work plans of statistical offices and other agencies of the national statistical system.

In each statistical system, the participation in these councils of representatives of the national STI system should be encouraged. It should be borne in mind that:

- (i) it is essential to be aware of national policies for STI prior to planning the production of STI statistics; and
- (ii) information on the national organization of STI which needs to be quantified (agents, relationships, activities) provides the framework for interpreting the indicators.

3. Formalizing a national STI statistics plan

Countries which already have a national statistical plan should consider including activities in the field of STI statistics, as follows:

- (i) defining and scheduling the statistical operations to be carried out;
- (ii) assigning responsibilities to the different agencies and establishing collaboration mechanisms for the different phases of the statistical process (maintenance of directories, design of samples and questionnaires, preparation of data, processing of information, dissemination);
- (iii) assessing needs for resources; and
- (iv) developing tools for evaluating implementation of the plan.

The following arguments may be made in favour of formalizing measurement activities under a national statistical plan:

- (i) The allocation of public resources to statistical operations—including the shared use of statistical infrastructure (such as directories)— must in some cases be approved by an appropriate legal act (this is often the case with the national statistical plans, which at least are binding for the organizations of the national statistical system); and

- (ii) Only the statistics included in the plan have the legal support needed to ensure that response is compulsory and that the records are confidential. A legal obligation to respond to questionnaires would easily improve the quality of data by increasing the response rate.

III. RECOMMENDATIONS ON METHODOLOGY

In their capacity as the lead agencies of the national statistical systems, the national statistical authorities represented at the Statistical Conference of the Americas of ECLAC, might study the following recommendations for increasing the availability of STI statistics in each country and improving the quality of those that already exist.

1. Increasing the availability of STI statistics

(a) Promoting the use of existing administrative sources

Almost all the countries of the region have administrative sources of data which can provide useful information on the situation and development of STI at the national level. Using these sources for statistical purposes is usually less costly than conducting surveys. The statistical authorities could evaluate —perhaps by delegating the task to an organization that has had experience with each individual source— the quality and international comparability (reference population, definitions, updating procedures, data processing, classifications used and other metadata) of the information obtained from these administrative sources.

The following national administrative sources (which may have useful information on the STI system) should be taken into account in the production of statistical information:

- (i) Administrative records on higher education, particularly at the tertiary level (master's and doctorate programmes) as a measure of scientific potential;
- (ii) Records on industrial patents and other types of intellectual property protection as a measure of the results of the STI system;
- (iii) Data on foreign trade, to be used in producing a technological balance of payments which would make it possible to measure dependency on external STI;
- (iv) Records on research projects completed or underway; and
- (v) Records of facilities (such as laboratories and libraries) which contribute to research work.

The use of international administrative sources or databases could also be promoted, as they could provide useful information at the national level (although their actual use would be delegated to specialized international organizations or networks such as the Ibero American Network of Science and Technology Indicators):

- (i) Private bibliometric databases;
- (ii) Private databases on information and communication technologies, in particular those already available on the Internet;

- (iii) Data from international organizations such as the World Intellectual Property Organization (WIPO), the International Telecommunication Union (ITU) or ECLAC (databases on industrial competitiveness).

- (b) Carrying out new statistical operations

To the extent that resources are available, and only after viewing existing information gaps, the national statistical systems could, in collaboration with national STI systems, increase the amount of information available by planning the new statistical operations that have been requested by users.

In parallel, the national statistical offices and the national offices for science and technology could evaluate the feasibility of integrating questions on STI into the usual surveys sent out to businesses. The increased complexity of the questionnaires and the added workload for respondents would need to be reviewed.

When designing new operations, the scope of the study should be defined (in collaboration with the authorities responsible for science, technology and innovation), either by providing for coverage of all sectors of implementation or carefully selecting some of the most relevant. Firms could be ranked with a view to conducting research only on certain sub-groups. Experience shows that it is the larger firms or those that engage in specific economic activities that are the most active in the field of STI.

- (c) Improving the dissemination of STI statistics and indicators

In order to improve the dissemination of national STI statistics, the national statistical offices and the offices for science and technology could support summary publications which include information compiled from various sources, along with methodological notes designed to enable users to assess the quality of the data provided.

2. Improving the quality of existing statistics

Those countries that have already begun to produce STI information could concentrate their efforts on improving statistical quality. This being understood to include accuracy, timeliness, coverage, compatibility with existing economic and social information, and international comparability. Some of the methodological recommendations the Conference might wish to consider would be those designed to improve coverage, data collection and processing procedures, to enhance integration with other national statistics and to improve international comparability.

- (a) Improving the coverage of STI statistics

There are gaps in the coverage of the STI statistics available in the region, mainly in the business sector. More research is needed, given the growing importance of the business sector in the development of science, technology and innovation. The statistical offices might promote the improvement of their business directories, as well as the use of such information in designing STI operations.

To the extent permitted by law, when another agency is responsible for such legal operations, collaboration agreements should be encouraged, in order to avoid duplication of effort when creating new directories.

(b) Improving tools and procedures for collecting and processing information

In view of the difficulty inherent in STI concepts and the need to minimize the respondents' workload, the tools to be used for collecting information must be designed very carefully. The forms used should be appropriate for each implementation sector, so as to make the respondents' task easier.

In general, training of the human resources concerned (both staff of producing agencies and respondents) would improve the quality of STI statistics.

(c) Facilitating the integration of STI statistics in the official statistics system

The quality of STI statistics and indicators also depends on their being integrated into the social, economic and environmental statistics produced in each country. In order to improve integration and thus enhance the calculation of indicators with the required quality, national authorities might consider taking the following measures:

- (i) using existing directories of common responding agencies;
- (ii) harmonizing definitions of concepts with those used in other economic and social statistics;
- (iii) using compatible classifications for economic activities, products, scientific disciplines and schooling, among others; and
- (iv) sharing databases.

IV. RECOMMENDATIONS FOR AN INTERNATIONAL STI STATISTICS PROGRAMME IN LATIN AMERICA AND THE CARIBBEAN

In addition to the actions recommended on a national scale, the Statistical Conference of the Americas of ECLAC is in an ideal position to launch a regional STI statistics programme in Latin America and the Caribbean which would promote coordination of the activities of international authorities (agencies and networks) working in this field.

1. Improving the availability and dissemination of international STI statistics

From the international perspective, the Conference could promote the development of inventories of STI statistics and indicators for the Latin American and Caribbean region, based on national inventories.

The statistical authorities should analyse the initiative planned by the governments of the region (referred to the document: "Latin America and the Caribbean in the transition to a knowledge-based society: an agenda for public policy", Florianopolis, June 2000) to establish a regional observatory for science and technology, a proposal that is compatible with the current efforts of RICYT. Other regional activities for compilation and dissemination of statistics would facilitate the work of users.

At the same time, the Conference could establish mechanisms for coordinating requests for information made by international organizations, in order to avoid unnecessary duplication of questionnaires (such action has been very successful in the European region).

2. Promoting international comparability

The Conference could promote the international comparability of STI statistics and indicators in the following ways:

- (i) disseminating manuals on methodology that are already available, through the Technical Secretariat of the Statistical Conference of the Americas of ECLAC;
- (ii) supporting other international harmonization initiatives, particularly those aimed at adapting the above-mentioned manuals—which are usually designed for the more advanced countries (OECD)—for the countries of the region.

Taking into account past experience, the Conference could support the initiatives for adapting the Frascati Manual (OECD) and the Oslo Manual (OECD) for compiling statistics on research and development and on technological innovation, in that order, which are underway in RICYT.

In addition, these methodology manuals on STI statistics which are available and widely used in the more developed countries also provide for integration into broader statistical systems (in particular, the System of National Accounts), and thus facilitate the aforementioned objective.

Providing support for the RICYT and encouraging statistical offices to participate in its activities (seminars and courses, drafting and adaptation of manuals), or in the follow-up to its activities (www.ricyt.edu.ar) could facilitate efforts to improve international comparability.

3. Improving the coordination of international statistical activities

Careful international coordination is needed, given the number of agencies and initiatives involved in STI measurement in Latin America and the Caribbean and the scarcity of resources.

The Conference could include in its work programme mechanisms for follow-up of international coordination of STI statistical work, requesting information from international agencies and networks on their activities. In particular, the Conference could support the efforts to coordinate methodologies being carried out by RICYT.

The European experience, which is described in the background paper, shows that international coordination improves the use of resources for methodological work, national data gathering and coordination of international working groups and meetings.

The main coordination tool in the European region is Integrated Presentation. This format is used in the Annex to present a non-exhaustive description of the activities of some of the organizations that are working in the field of STI statistics in Latin America and the Caribbean.

The Conference might also consider including a module on STI statistics and indicators in the Programme of International Statistical Work for Latin America and the Caribbean, 2001-2002, which is prepared on a periodic basis with support from ECLAC.

In coordinating technical assistance activities for countries in this field, a roster of experts in STI statistics and indicators, organized by topics, could be drawn up for the region and disseminated to the national systems. A link could be established with the Web page on international cooperation on statistics of the National Institute of Statistics and Informatics (INEI) of Peru.

In the same way, national and international authorities which offer training on a regular basis in the field of statistics could consider the possibility of including STI statistics in their programmes, in a coordinated manner.

Annex I

**INTEGRATED PRESENTATION OF THE INTERNATIONAL WORK PROGRAMME
OF SOME ORGANIZATIONS INVOLVED WITH STI STATISTICS AND
INDICATORS IN LATIN AMERICA AND THE CARIBBEAN**

1. Ibero American Network of Science and Technology Indicators (RICYT)

(a) Areas of work:

The Ibero American Network of Science and Technology Indicators (RICYT) works in four main areas:

1. In the first area, standardization, reflection and research, the aim is to develop and bring together information in order to construct a body of reliable and internationally comparable indicators. Within this framework, an effort is also made to incorporate new subjects into the area, in close collaboration with academic researchers. The main activities carried out are the Ibero-American and inter-American workshops (with the participation of experts from all the countries of the region, as well as regional and international speakers) and topical workshops on input indicators, technological innovation, the social impact of STI, bibliometric indicators and STI human resource indicators.

2. In the field of statistical information production, RICYT has set up an annual operation for collecting information from all the countries of the region, which provides the basis for publications.

3. The third area is organized in the form of internships, training seminars and technical assistance. The internships offer the opportunity for experts from the region to participate in activities carried out by extra-regional institutions, through a system of open invitation and selection of candidates. The host institutions are the *Observatoire des Sciences et des Techniques* of France, the Simon Fraser and Polytechnic Universities of Canada, the National Science Foundation of the United States, the National Statistical Office, the *Agencia Nacional de Evaluación y Prospectiva* and the *Centro de Información y Documentación Científica* of Spain, and the Observatory for Science and Technology of Portugal. The seminars are held in different countries in the region and are subregional in scope. The technical assistance missions take place at the request of the countries.

4. The fourth area, dissemination of information, includes the publication of scientific papers and documents and translations of manuals, particularly those of the Frascati family, as well as the production of the monthly bulletin *Indicios* and maintenance of the Web page.

(b) International questionnaires

Ibero-American/Inter-American science and technology indicators. Data requested by the Ibero American Network of Indicators for Science and Technology (yearly)

(c) Meetings and workshops planned, training seminars

(i) Internships:

Fourth RICYT internship programme in national agencies and OECD

(ii) Workshops and seminars:¹

Second workshop on bibliometric and scientific activity indicators (Madrid, February 2000)

Third Ibero-American and inter-American workshop on innovation indicators (Bogotá, D.C., June 2000)

Third workshop on indicators of the social impact of science and technology on social development (Buenos Aires, December 2000)

Subregional workshop on training in science and technology indicators for the Caribbean (Saint George, Grenada, December 2000) (RICYT/CCST)

Third workshop seminar on science and technology indicators (Lima, 17 and 18 July 2000)

Application of the logframe approach for strengthening the Peruvian statistical system for science and technology (Lima, 19 and 20 July 2000) (RICYT/ECLAC/National Council of Science and Technology (CONCYTEC) of Peru)

Subregional training workshop on science and technology indicators for the Andean countries (La Paz, September 2000)

Subregional training workshop on science and technology indicators for Central America (San Salvador, July 2000)

Workshop on information society indicators, in cooperation with the Observatory of Science and Technology of Portugal

Fifth inter-American and Ibero-American workshop on science and technology indicators (Montevideo, 2001)

(iii) Technical assistance missions (as requested by the countries)

Design and application of a pilot survey for the Caribbean countries (Barbados, Guyana, Jamaica, St. Lucia, Trinidad and Tobago)

Pilot project in three countries on the construction of information society indicators (2001)

¹ Activities for the 2000 programme are presented. The 2001 programme will be similar; details were unavailable at the time of drafting this document.

(d) Manuals planned:

Latin American manual of innovation indicators (Bogotá Manual)

Latin American manual of indicators of the social impact of science and technology (planned for 2001-2002)

(e) Data dissemination

Ibero-American/inter-American science and technology indicators (annual, hard copy and Web page: www.ricyt.edu.ar)

Main Ibero-American/inter-American science and technology indicators (yearly, hard copy and Web page: www.ricyt.edu.ar)

2. Conference of Iberoamerican Authorities on Informatics (CAIBI)

(a) Areas of work

The areas of work of the Conference of Iberoamerican Authorities on Informatics for the 1999-2000 biennium include a module on indicators of information and communication technologies (ICT). Responsibilities are assigned to the general secretariat (exchange of information, proposals on indicators to be compiled, analysis and tabulation, and dissemination on the Internet).

The Chairperson of the Steering Committee of the Statistical Conference of the Americas of ECLAC, in his concurrent capacity as Chairperson of CAIBI, requested the statistical authorities of the region to provide support for the compiling of ICT statistics and indicators by providing methodological material such as definitions and classifications.

(b) International questionnaires

The indicators will be requested from member countries of CAIBI in a questionnaire (the variables included are listed in the document entitled "Las estadísticas e indicadores de ciencia, tecnología e innovación en América Latina y el Caribe").

(c) Meetings and workshops planned, training seminars

Eighteenth plenary session of CAIBI

(d) Manuals planned

The manual *Métrica de la sociedad de la información* is a guidebook for the compilation of ICT statistics and indicators.

(e) Data dissemination

The general secretariat is responsible for disseminating the tables produced. The executive secretariat will arrange for their dissemination on the Web (www.map.es/csi/caibi).

3. Caribbean Council for Science and Technology (CCST)

(a) Areas of work

Recognizing the importance of STI in the development of the Caribbean subregion, CCST focuses on carrying out science extension programmes and on providing assistance with the design and analysis of STI policies. The elements of its work programme therefore include collaboration with national and regional STI agencies and furthering technical cooperation among countries of the region, as well as promoting new technologies and the development of areas of expertise.

A fundamental element of the work programme has to do with STI indicators, and a seminar will be held on the compilation and dissemination of STI indicators and the history of their development.

CCST works on the identification of relevant indicators to help decision-makers in taking strategic action to assist in the development of profitable activities in sustainable environments that are characteristic of the subregion.

(c) Meetings and workshops planned, training seminars

Subregional workshop on training in science and technology indicators for the Caribbean (Saint George, December 2000) (RICYT/CCST)

4. European Commission (European Union-Mercosur-Chile Programme)

(a) Areas of work

In the framework of the European Union-Mercosur-Chile statistical cooperation programme, working groups are being considered on statistics on business competitiveness and productivity and on nomenclature and classifications. Given the content of this work, it may be related to the production of STI statistics.

(b) Meetings and workshops planned, training seminars

Two annual meetings of the working groups

One training seminar for each group