

# UIS activities in relation to Redefining Scientific and Technological Activities (STA)

*V Taller de Armonización de Indicadores de Ciencia y Tecnología  
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# Redefining Scientific and Technological Activities (STA)

- Why?
- What is it?
- How is it implemented?
- What now?



United Nations  
Educational, Scientific and  
Cultural Organization

UNESCO  
INSTITUTE  
for  
STATISTICS

# Rationale



EN: <http://www.uis.unesco.org/Library/Documents/tech%205-eng.pdf>

SP: [http://www.uis.unesco.org/Library/Documents/TechPaper5\\_RD\\_SP\\_finalwc%20\(2\).pdf](http://www.uis.unesco.org/Library/Documents/TechPaper5_RD_SP_finalwc%20(2).pdf)

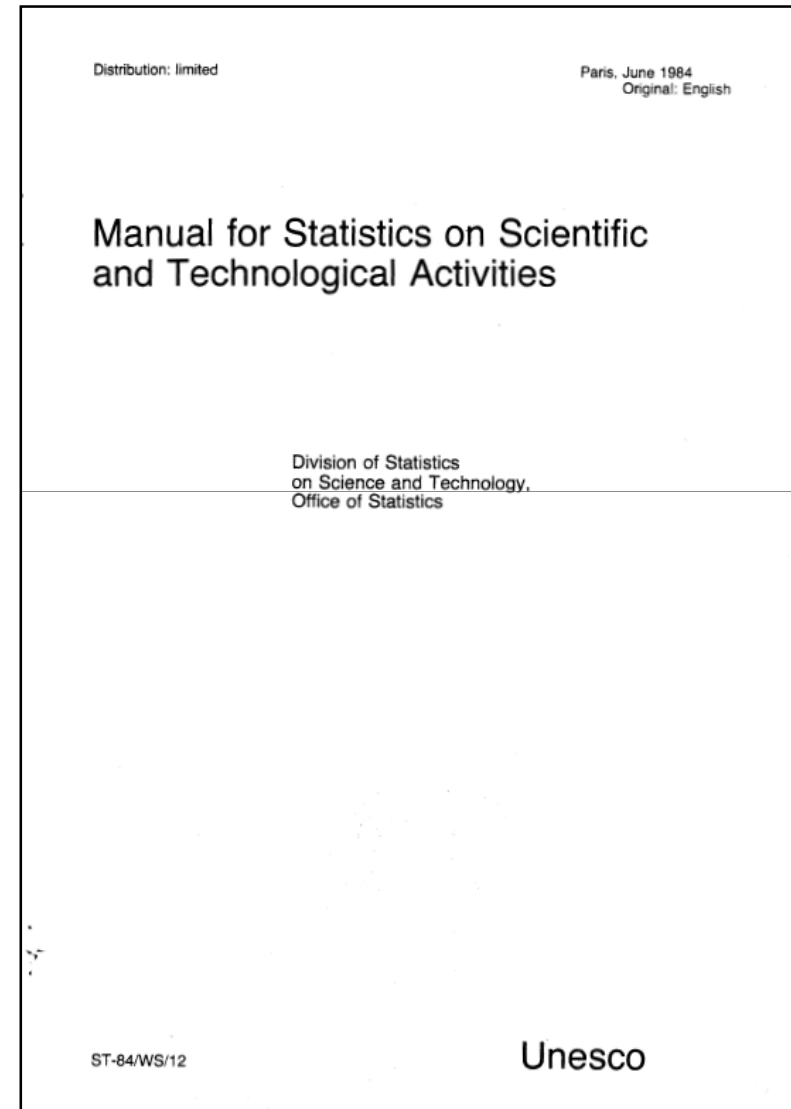
# UIS Technical Paper on Measuring R&D: Challenges Faced by Developing Countries

## Chapter 8: Thinking ahead - Other products, beyond R&D

- Redefine the concepts of scientific and technological education and training at broadly the third level (STET), Scientific and technological services (STS) and S&T activities (STA)
- Better integrate education statistics with R&D statistics
- Hands on guidance
- Metadata
- Model questionnaire

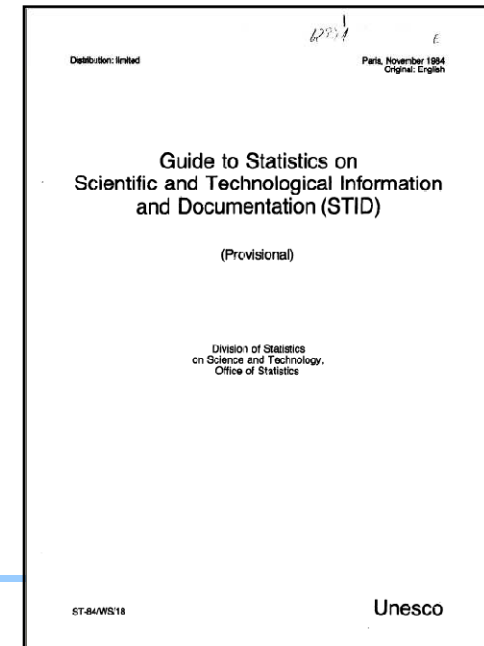
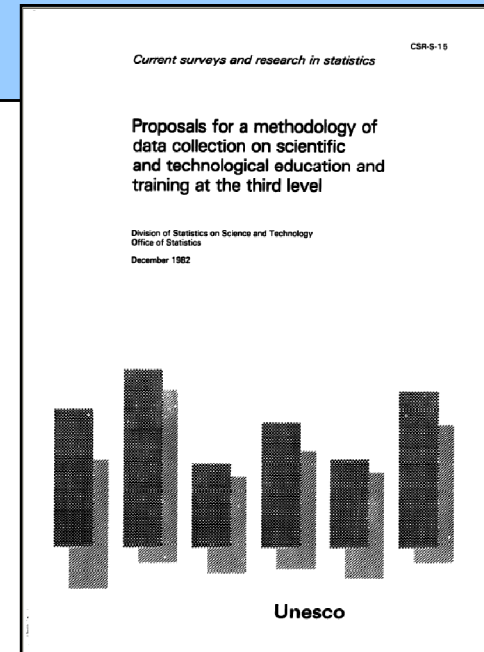
# UNESCO methodologies and frameworks

- Recommendation concerning the International Standardization of Statistics on Science and Technology, 1978
- UNESCO Manual for Statistics on Scientific and Technological Activities ST-84/WS/12, Paris, 1984



# UNESCO methodologies and frameworks cont..

- UNESCO Proposals for a methodology of data collection on scientific and technological education and training (STET) at the third level, CSR-S-15, Paris, 1982.
- UNESCO Provisional guide to statistics on Scientific and Technological Information and Documentation (STID) Activities, ST-84/WS/18, Paris, 1984.



## STA: Definition

**Scientific and Technological Activities (STA)**  
can be defined as all systematic activities which are  
closely concerned with:

**generation, advancement,  
dissemination, and application of  
scientific and technical  
knowledge**

and applies to:

all fields of science and technology ie. NSE and SSH.

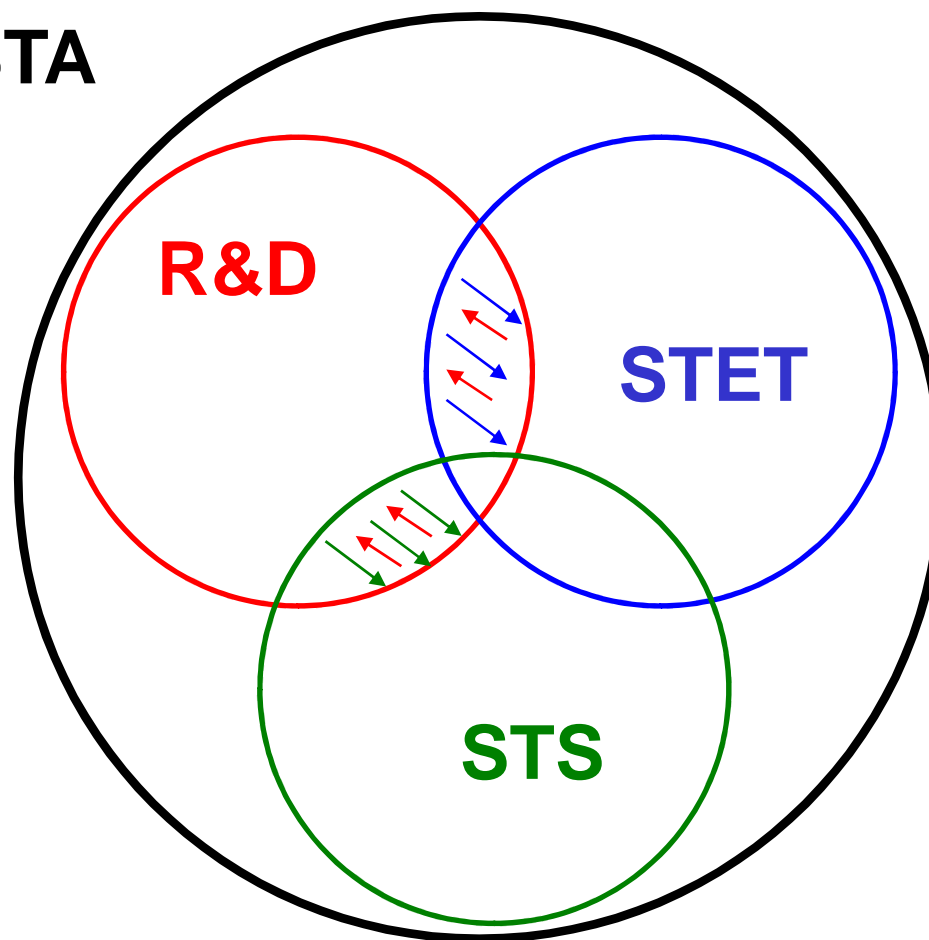
## **Scientific and technological activities comprise:**

- Research and experimental development (R&D)
- Scientific and technical education and training (STET)
- Scientific and technological services (STS)



# An indicators “framework”

**STA**



## R&D: Definition (*Frascati Manual*)

**Research and experimental development (R&D)**

comprise

**creative work undertaken on a systematic basis  
in order to increase the stock of knowledge,  
including knowledge of man, culture and society,  
and the use of this stock of knowledge to devise  
new applications.**

**Basic criterion:** an appreciable element of novelty  
and the resolution of scientific and/or  
technological uncertainty.

## STET: Definition

**Scientific and technological education and training at broadly the third level (STET)** can be defined as all activities comprising:

- Specialized non-university higher education
- All university education
- Organized lifelong training for scientists and engineers

## STS: Definition

**Scientific and technological services (STS)** can be defined as any activities:

- Concerned with scientific research and experimental development
- Contributing to the generation, dissemination and application of scientific and technical knowledge
- Direct or indirect link with R&D, from which they may be distinguished by the fact that they do not have the character of innovation

## Detailed scientific and technological services

- S&T services provided by libraries, archives, information and documentation centres, reference departments, scientific congress centres, data banks and information-processing departments;
- S&T services provided by museums of science or technology, botanical and zoological gardens and other S&T collections (anthropological, archaeological, geological, etc.);
- Systematic work on the translation and editing of S&T books and periodicals;
- Topographical, geological and hydrological surveying; 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;
- Prospecting and related activities designed to locate and identify oil and mineral resources;

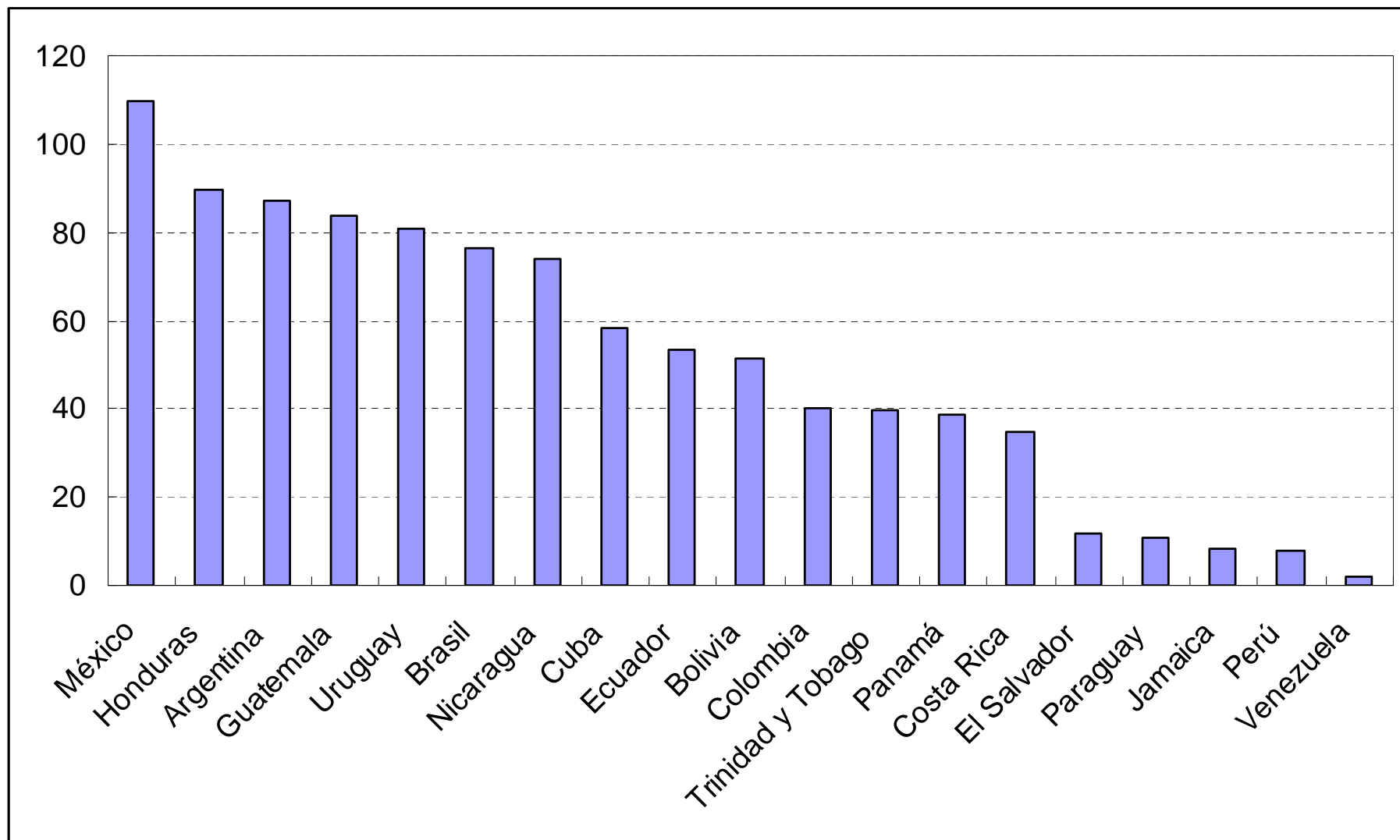
## Detailed scientific and technological services (*cont.*)

- 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.;
- Testing, standardization, metrology and quality control; regular routine work relating to 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;
- 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;
- Activities relating to patents and licences.

## **Frascati Manual: Other related scientific and technological activities (RSA)**

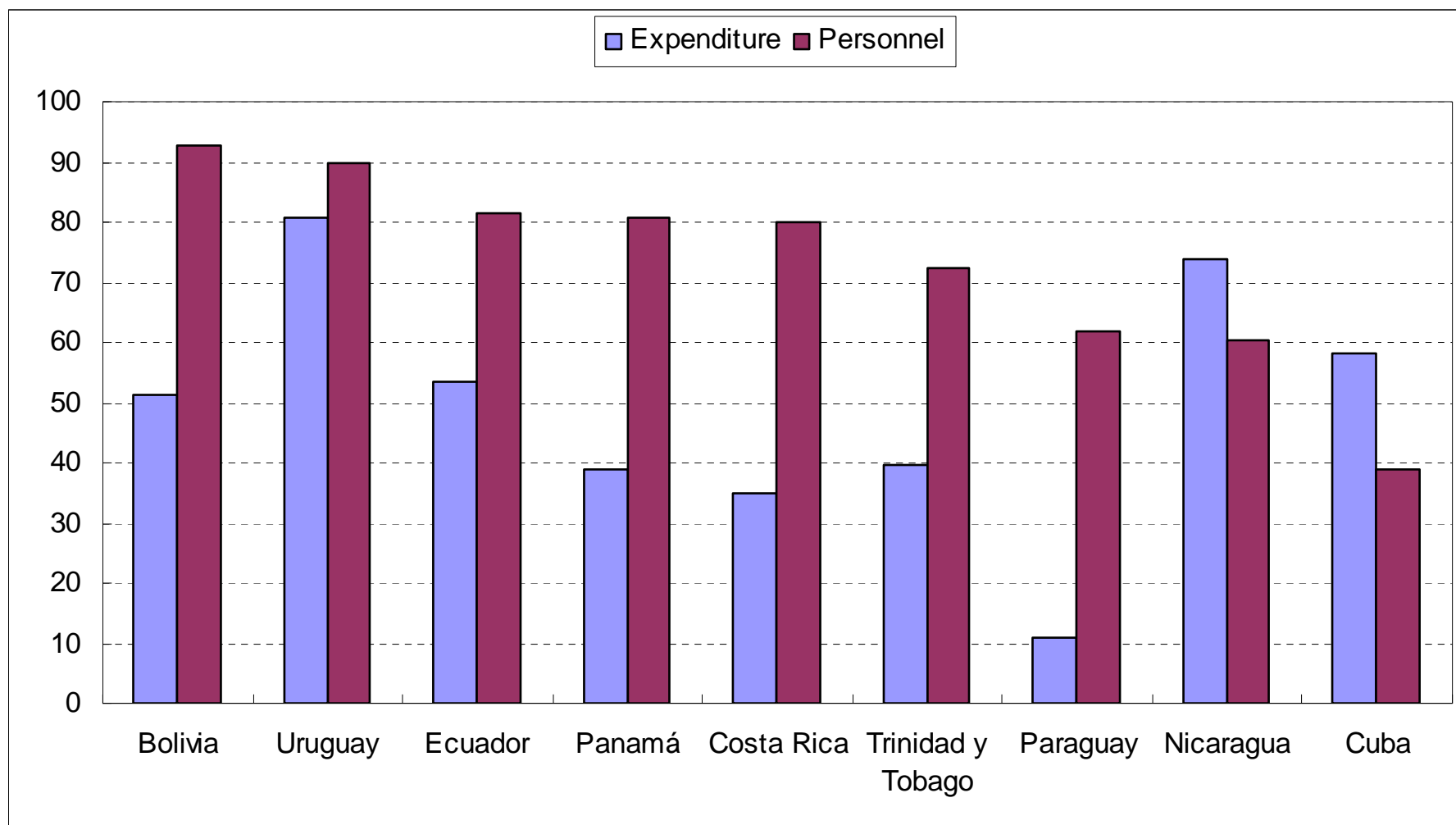
- Scientific and technical information services
- General purpose data collection
- Testing and standardisation
- Feasibility studies
- Specialised health care
- Patent and licence work
- Policy-related studies
- Routine software development

# R&D expenditure as a % of STA expenditure, average 2000-2008





# R&D as a % of STA average 2000-2008



## Issues:

- Significant differences between countries in the contribution of R&D to STA; contribution of STS and STET to STA; substantial variations within countries

## Reasons:

- Unclear definitions; lack of specific guidelines
  - definition of STET would result in the inclusion of the total higher education budget
  - Inclusion of the total budget of the national statistical institute
  - inclusion of total budget of the Ministry of Science and Technology

## Tasks:

- Need further study on STS and STET

## Mini questionnaire on the data collection on STA

1. How are STA data used in your country?
2. Do you include both STS and STET?
3. Looking at the definitions in the Annex, which of the activities are included in your data collection on STA Expenditure?
4. Looking at the definitions in the Annex, which of the activities are excluded in your data collection on STA Expenditure?
5. When collecting STA expenditure data, do you use budget data or performer-based data (such as surveys)?

## Mini questionnaire on the data collection on STA cont...

6. Looking at the definitions in the Annex, which of the activities are included in your data collection on S&T Personnel?
7. Looking at the definitions in the Annex, which of the activities are excluded in your data collection on S&T Personnel?
8. Which definitions or activities are unclear in your opinion? *Combined with next question*
9. Which definitions or activities pose particular problems?

## Mini questionnaire on the data collection on STA **cont...**

10. Are there separate problems for expenditure and personnel?
11. Do you think we should redefine these concepts?
12. Are there activities that should be added to STS?
13. Do you have any suggestions?
14. Do you think STET should be discarded completely, or just redefined?
15. Any other observations, comments, remarks, questions you may have.

## Mini questionnaire on the data collection on STA cont...

- Received replies from 4 LA countries (Brazil, Colombia, Costa Rica and Cuba) and China
- Resend the questionnaire and encourage other countries to reply
- Produce a short report on findings
- Circulate findings
- Inputs to the STA review process

## Mini questionnaire on the data collection on STA: Summary of the results (1)

- There is a policy interest in STS and STET data.
- When countries collect data, most categories are included, but some activities are excluded in some countries, such as translation and editing, routine consulting, compiling statistics, database development and customer activity.
- However, STS and STET are too broad and some services are defined ambiguously.
- Most problems are with STET, less with STS.
- There is a need to redefine both concepts, in particular STET

## Mini questionnaire on the data collection on STA: Summary of the results (2)

- ICT and Internet services should be added
- Information management system is very important for collecting STA data.
- Borderline between R&D and non-R&D not always clear, in particular between experimental development and activities using new technologies.
- A committee of experts from different countries and geographic regions should be established to achieve improvement of statistics and indicators on science and technology.



# Redefining Scientific and Technological Activities (STA)

- UIS called for proposal for ‘Reviewing the concepts of STA’
  - Study on the concept of STA
  - How should the concept of STET be modified?
  - How should the concept of STS be modified?
  - Are separate data collection guidelines needed for STA expenditure and for S&T Personnel?

## Redefining Scientific and Technological Activities (STA)

- Concept paper on “Towards a New Concept of Scientific and Technological Activities, by Benoit Godin and Adam Holbrook, Feb, 2011
- Draft proposal for “Measuring Science, Technology and Innovation Activities” by Adam Holbrook and Benoit Godin, September 2011

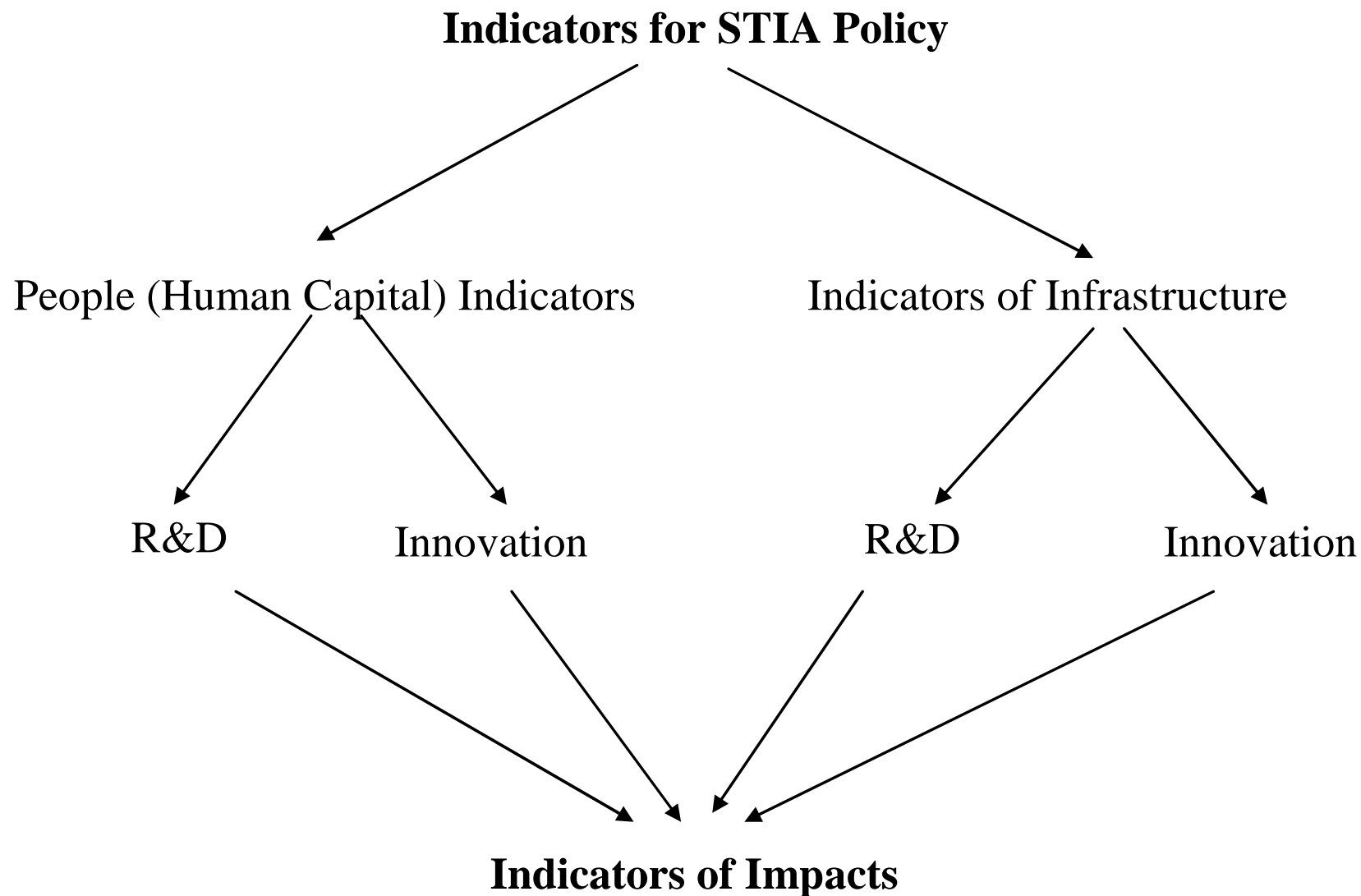


Redefining STS and STET in a framework of a proposal to measuring Science, Technology and Innovation Activities (STIA)

# Proposal for “Measuring STIA”: Conceptual Framework

- **Human capital:** S&T human resources and skills
- **S&T Infrastructure:** ‘S&T services’ (institutions, programs, investments) supporting the adoption of knowledge and technology
- **Diffusion and transfer of knowledge and technology:** end-users of knowledge and technology, mechanisms through which knowledge and technology are transferred, investments made into supporting these activities
- **Innovation:** should include more than market-place innovation. Should it be limited to being first to introduce something new or include imitation too?
- **R&D:** are there other factors that need to be considered in nations with smaller R&D efforts?

# Proposal for “Measuring STIA”: Indicator Framework



# Proposal for “Measuring STIA”: Indicator Framework

## cont...

- STI human capital:
  - All personnel with S&T qualifications (ISCED 5a, 5b, and 6)
  - Human capital trained through non-certificated processes
- STI infrastructure:
  - Support activities for R&D
  - Capital investment in technology-based equipment
  - National R&D and innovation program activities

## Proposal for “Measuring STIA”: Issues related to STI Human capital (STET)

- S&T personnel: persons with S&T qualifications engaged in STIA; persons with S&T qualifications those not engaged in STIA; Expatriate professionals
- ISCED 5a, 5b, and 6: differentiation between formal education and informal training
- Standards for defining how S&T human capital is trained and the expenditures relating to this training
- Definition of S&T personnel: total number of personnel directly participating in S&T activities; not included all people trained through STET, not all STI human capital
- Inventory of S&T human capital
- Brain drain of S&T human capital

## Proposal for “Measuring STIA”: Issues related to STI Infrastructure (STS)

- Human capital requirements for STS activities are necessary to understand the role of the STS activities
- Role of STS in knowledge and technology transfer (KTT): relationship between STS and KTT needs to be defined and refined;
- Review STS categories in light of the scientific and technological development
- Relationship between STS and innovation needs to be defined
- Distinction between STS and the RSA needs to be better defined
- Role of ICT in STS needs to be examined and developed

## Proposal for “Measuring STIA”: Issues related to R&D and Innovation

- R&D: not covered (covered by FM)
- Innovation: measure innovation in special cases
  - Agriculture
  - Renewable resources (forestry, fisheries, renewable energy)
  - Non-renewable resources (minerals and energy resources)
  - Informal sector
  - Public sector



## Proposal for “Measuring STIA”: Diffusion and Transfer of S&T Knowledge and Technology (KTT)

- Not captured under STA and innovation
- Relies on human capital: the relationship between KTT and S&T human capital is difficult to define and quantify
- Borderline issues with innovation
- Knowledge and technology can be transferred by;
  - Formal transfers: intellectual property, licences, patents, drawings, etc.
  - Informal transfers of technology: information diffuses through a variety of channels (for example, imitation of an innovation).
  - Transfers of human capital
  - Transfers that occur when embedded knowledge is transferred (during the acquisition of equipment)

## Proposal for “Measuring STIA”: Diffusion and Transfer of S&T Knowledge and Technology (KTT) cont..

- What can be measured:
  - Patents, licenses, and other codified knowledge
  - Investment in on-the-job training (training that does not lead to a formal certificate from an educational institution)
  - Investment in other informal and non-certificated training of national S&T human capital, both domestically and from overseas

## Way forward

- Further study the proposal and provide UIS comments
- Follow up with mini questionnaire and compile the findings
- Extend the scope of the mini questionnaire to identified countries in other regions
- Share findings of mini questionnaire with consultants
- Further improve the proposal
- Request comments from LAC countries through RICYT ...
- Present the proposal in various workshops, forums, etc. for inputs, comments, discussion, .....
- Present the proposal to UIS STI statistics advisory committee / in an expert meeting (201?)

# Thank you!

<http://www.uis.unesco.org>

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