



UIS S&T Statistics: international context and issues for discussion

***SEMINAR-WORKSHOP
ON SCIENCE, TECHNOLOGY AND INNOVATION INDICATORS:
TRENDS AND CHALLENGES***

*Moscow, Russia
18-20 September 2007*

- The UNESCO Institute for Statistics (UIS)
- 2004 and 2006 Survey of S&T statistics
- Overview of S&T statistics for CIS
- Conclusions

Contributes data for:

- UNESCO HQs: UNESCO Science Report 2005, UNESCO World Report, International Report on Science Technology and Gender 2007.
- UN Statistical Division: UN Statistical Year Book
- UNDP: Human Development Report
- World Bank: World Development Indicators
- Other

UNESCO International Review of S&T Statistics and Indicators

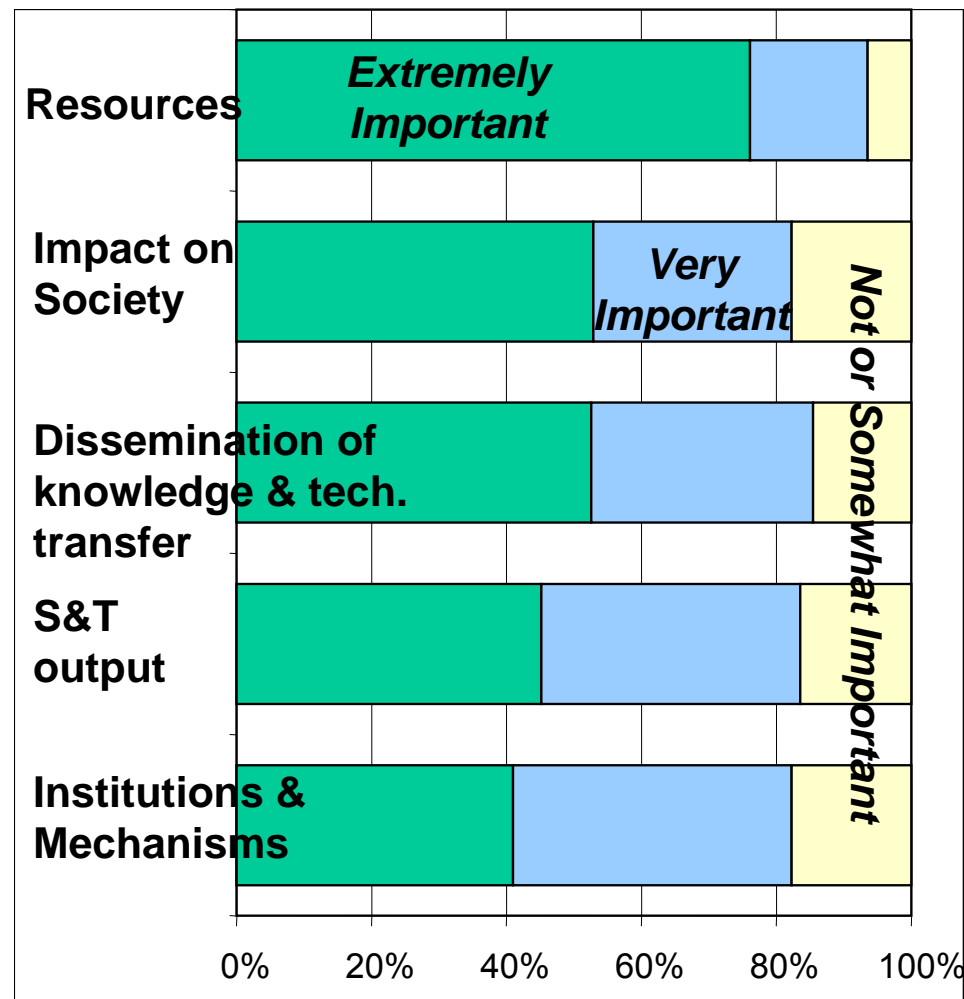
Carried out jointly with UNESCO
Division of Science Analysis and Policy (SC/AP) and
Regional Office for S&T in Latin America and the Caribbean
(ROSTLAC) in 2002/2003.

Objectives:

- To review priority science policy information needs.
- To examine existing S&T statistical and indicator systems.
- To identify key areas for future development of S&T statistics.
- To define the future role and strategy of the UIS.

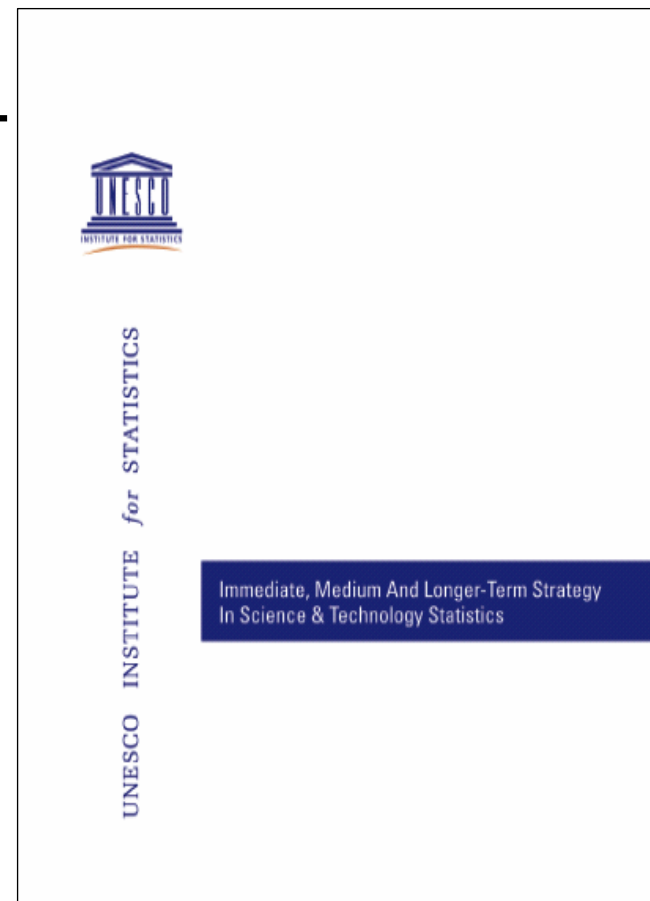
General S&T Policy Issues

ISSUES	Extremely Important	Very Important	Not/Somewhat Important
	%	%	%
Resources	76	17	7
Impact on Society	53	29	18
Dissemination of Knowledge & Technology transfer	53	33	14
S&T output	45	38	17
Institutions & Mechanisms	41	41	18



Immediate term priorities (Human & Financial Resources)

- R&D personnel
- Expenditure in R&D
- Human resources devoted to S&T
- Science education
- Higher education
- International mobility
- Gender



Medium term priorities (Innovation)

- Measurement of innovation in agriculture and other non-manufacturing sectors
- Promoting the use of indicators reflecting sub-national (regional) innovation systems
- Measuring minor or incremental innovation
- Measuring innovative applications of existing products or processes (surveys of use of technologies)
- Output

Longer term priorities (Output & Impact)

- Output:
 - Bibliometric tools adapted for the analysis of scientific output in developing countries
 - Technology output indicators
- Impact indicators:
 - Measuring social impact of S&T,
 - Impact of S&T on agriculture,
 - Public perception of S&T

Ongoing activities

- S&T Survey operation and data guardianship
- Training in S&T statistics: Workshops
- Standard setting/Methodological developments
- Analysis / Publications
- Collaborations / Partnerships

S&T Survey operation and data guardianship

- Conducting global Survey on Statistics of Science & Technology: Biennially – currently second round
- Maintaining database on S&T statistics
- Data publishing on the UIS website
- Contributions to external agencies

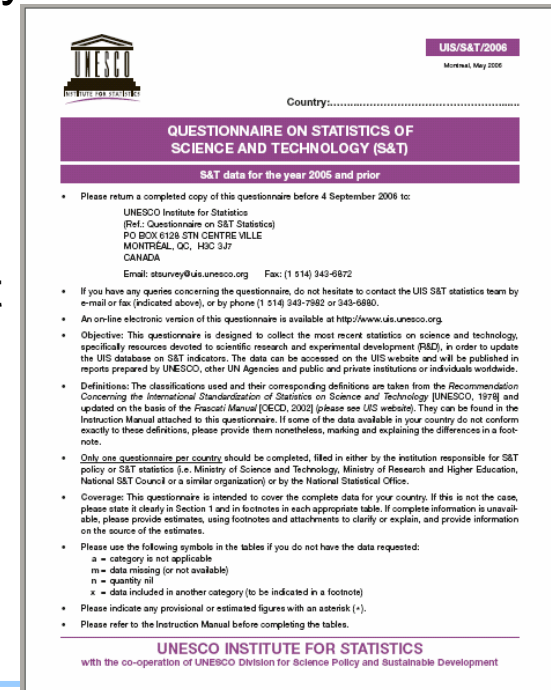
Survey on Statistics of Science & Technology

(continued)

- Questionnaire on Statistics of Science and Technology; Instruction Manual for completing questionnaire.
- Data are collected from each country from either the institution responsible for S&T policy or statistics (e.g. Ministry of Science and Technology, Ministry of Research and Higher Education, National S&T Council or similar organization) or the National Statistical Office; through a single questionnaire which cover data on all institutions carrying out R&D activities in the particular country.

Data collected:

- R&D personnel by occupation & gender
- R&D personnel by sector of employment & occupation
- R&D personnel by sector of employment & gender
- Researchers by formal qualification & sector of employment
- Researchers by formal qualification & gender
- Researchers by fields of science & sector of employment
- Researchers by fields of science & gender
- Total expenditure in R&D by sector of performance
- Total expenditure in R&D by source of funds



The image shows the cover of the questionnaire form. At the top left is the UNESCO logo. At the top right, it says 'UIS/S&T/2006' and 'Montreal, May 2006'. Below that is a line for 'Country:'. The main title is 'QUESTIONNAIRE ON STATISTICS OF SCIENCE AND TECHNOLOGY (S&T)'. Below the title is a purple bar with the text 'S&T data for the year 2005 and prior'. The form contains several bullet points providing instructions and contact information for the UNESCO Institute for Statistics.

UNESCO Institute for Statistics
 (Ref.: Questionnaire on S&T Statistics)
 P.O. BOX 6126 STN CENTRE VILLE
 MONTRÉAL, QC, H3C 3J7
 CANADA

Email: stsurvey@uis.unesco.org Fax: (1 514) 343-6872

• Please return a completed copy of this questionnaire before 4 September 2006 to:
 UNESCO Institute for Statistics
 (Ref.: Questionnaire on S&T Statistics)
 P.O. BOX 6126 STN CENTRE VILLE
 MONTRÉAL, QC, H3C 3J7
 CANADA

• If you have any queries concerning the questionnaire, do not hesitate to contact the UIS S&T statistics team by e-mail or fax (indicated above), or by phone (1 514) 343-7982 or 343-6880.

• An on-line electronic version of this questionnaire is available at <http://www.uis.unesco.org>.

• Objective: This questionnaire is designed to collect the most recent statistics on science and technology, specifically resources devoted to scientific research and experimental development (R&D), in order to update the UIS database on S&T indicators. The data can be accessed on the UIS website and will be published in reports prepared by UNESCO, other UN Agencies and public and private institutions or individuals worldwide.

• Definitions: The classifications used and their corresponding definitions are taken from the Recommendation Concerning the International Standardization of Statistics on Science and Technology (UNESCO, 1974) and updated on the basis of the *Manual (CEC, 2002)* (please see UIS website). They can be found in the Instruction Manual attached to this questionnaire. If some of the data available in your country do not conform exactly to these definitions, please provide them nonetheless, marking and explaining the differences in a footnote.

• Only one questionnaire per country should be completed, filed in either by the institution responsible for S&T policy or S&T statistics (i.e. Ministry of Science and Technology, Ministry of Research and Higher Education, National S&T Council or a similar organization) or by the National Statistical Office.

• Coverage: This questionnaire is intended to cover the complete data for your country. If this is not the case, please state it clearly in Section 1 and in footnotes in each appropriate table. If complete information is unavailable, please provide estimates, using footnotes and attachments to clarify or explain, and provide information on the source of the estimates.

• Please use the following symbols in the tables if you do not have the data requested:
 a = category is not applicable
 m = data missing (or not available)
 n = quantity nil
 x = data included in another category (to be indicated in a footnote)

• Please indicate any provisional or estimated figures with an asterisk (*).

• Please refer to the Instruction Manual before completing the tables.

UNESCO INSTITUTE FOR STATISTICS
 with the co-operation of UNESCO Division for Science Policy and Sustainable Development

S&T Statistics Workshops

Diagnosis:

- Production of S&T statistics in many developing regions (particularly in Africa and Asia) remains low. Capacity building is needed.

UIS Response: Regional workshops

- To increase the number of countries regularly producing quality S&T indicators.
- To create local capacities for the production of such indicators, with the final aim of establishing sustainable local S&T statistics systems
- To promote the use of S&T indicators, seeking comprehension for evidence-based S&T policy making.
- To share experiences with other developing countries in the field of S&T indicators, and to address the problems that countries may have encountered in collecting S&T statistics.
- To gain knowledge about the particular characteristics of S&T statistics data collection and use in the context of countries in the same region.
- To generate initiatives that could be used as a demonstration for good practices in other countries of the region.

S&T Statistics workshops:

- **Southern and Eastern Africa – Uganda, Sept. 2005**
- **South Asia – India, Nov. 2005**
- **South-East Asian – Indonesia, March 2006 (with ISESCO)**
- **Francophone Sub-Saharan Africa (I) – Senegal, Oct. 2006**
- **Central Asia – Kazakhstan, November 2006 (with ISESCO)**
- **MEDA, Francophone – Tunisia, January 2007 (with EU-Medibtikar)**
- **South-East Europe: FYR of Macedonia, March 2007**
- **MEDA, Anglophone – Jordan, April 2007 (with EU-Medibtikar)**
- **Latin America – Brazil, May 2007 (with RICYT)**
- **Eastern Europe – Moscow, Sept. 2007**
- **Upcoming Workshops:**
 - **Francophone Sub-Saharan Africa (II) – Cameroon, Nov. 2007**
 - **Arab States –2007/8?, Pakistan – 2008, Caribbean – 2008?, Pacific – 2009?**

Standard setting/Methodological developments:

- **Measuring Innovation in Developing countries: Annex to the Oslo Manual (2005).**
- **Measuring R&D in Developing countries: Annex to the Frascati Manual (2007/2008).**

Objectives:

- to track the careers of doctoral holders, with the aim of obtaining information on the loss of highly qualified specialists, the so-called ‘brain drain’.
- to design an international survey tool which would help track the careers of doctorate holders which would better inform policy makers worldwide, both at global and local levels.

- Data on the web site.
- UIS Publications (S&T Bulletin):
 - 1st – Investment in R&D;
 - 2nd – Bibliometric Indicators;
 - 3rd – Women in Science(can be downloaded from the UIS website)
- UNESCO Science Report 2005
- International Report on Science, Technology and Gender 2007
- UNESCO World Report
- History of Science Statistics at UNESCO

International Report on Science, Technology and Gender 2007

to be published by

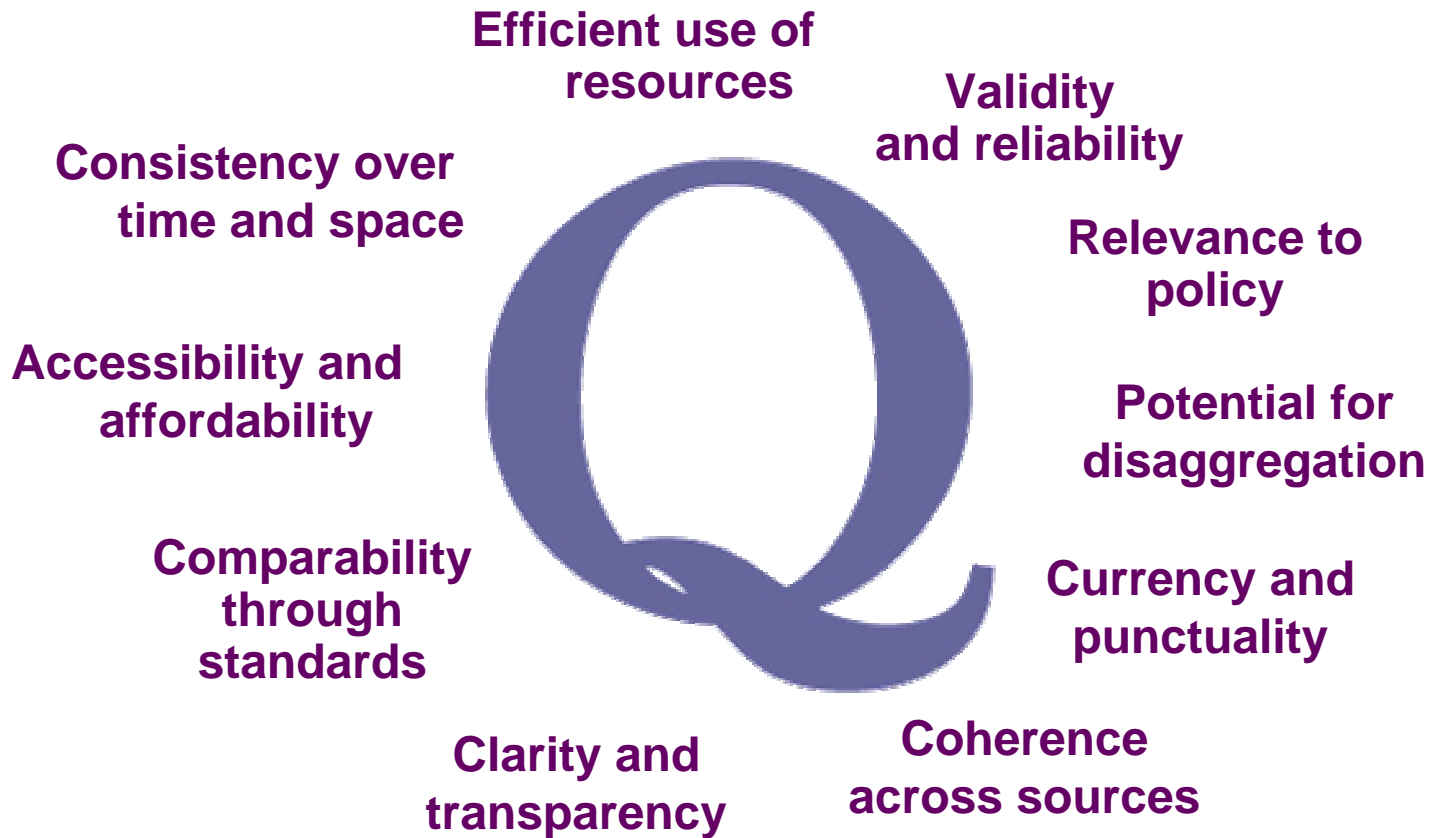
UNESCO Natural Science Sector

- **UIS Contribution: the chapter on ‘Statistics on Science, Technology and Gender (STG)’ with an Annex on statistical overview.**
 - Collaboration with European Commission (Research Directorate-General) and a group of worldwide experts.
- **UIS Bulletin on Women in Science: available on-line in Sept 2006.**

Collaborations / Partnerships

- UNESCO HQs
- UNESCO offices worldwide
- OECD
- Eurostat
- ISESCO
- ALECSO
- ISDB
- Arab Academy of Science
- Medibtikar
- NEPAD / AU / ATPS (Africa)
- RICYT (Latin America)
- Inter-Academy Council
- ASEAN
- IRD (France)
- IDRC (Canada)
- INRS (Quebec)

Quality of data



UIS approach to R&D statistics (currently)

- Applying Frascati Manual (FM) as much as possible.
- Disseminate the FM methodology through workshops
- **Listen to countries** (in workshops) and be attentive to issues where the FM is not suitable for developing countries and look for solutions together with the country professionals.

HOW do we collect data?

- R&D Surveys. Innovation surveys.
Combined R&D-innovation surveys.
-> Good quality questionnaires are needed!
- Administrative data (budget, personnel list)
- S&T management information systems
- Time-use surveys
- Estimations

Different strategies for different sectors:
one size does not fit all!

Survey on Statistics of Science & Technology

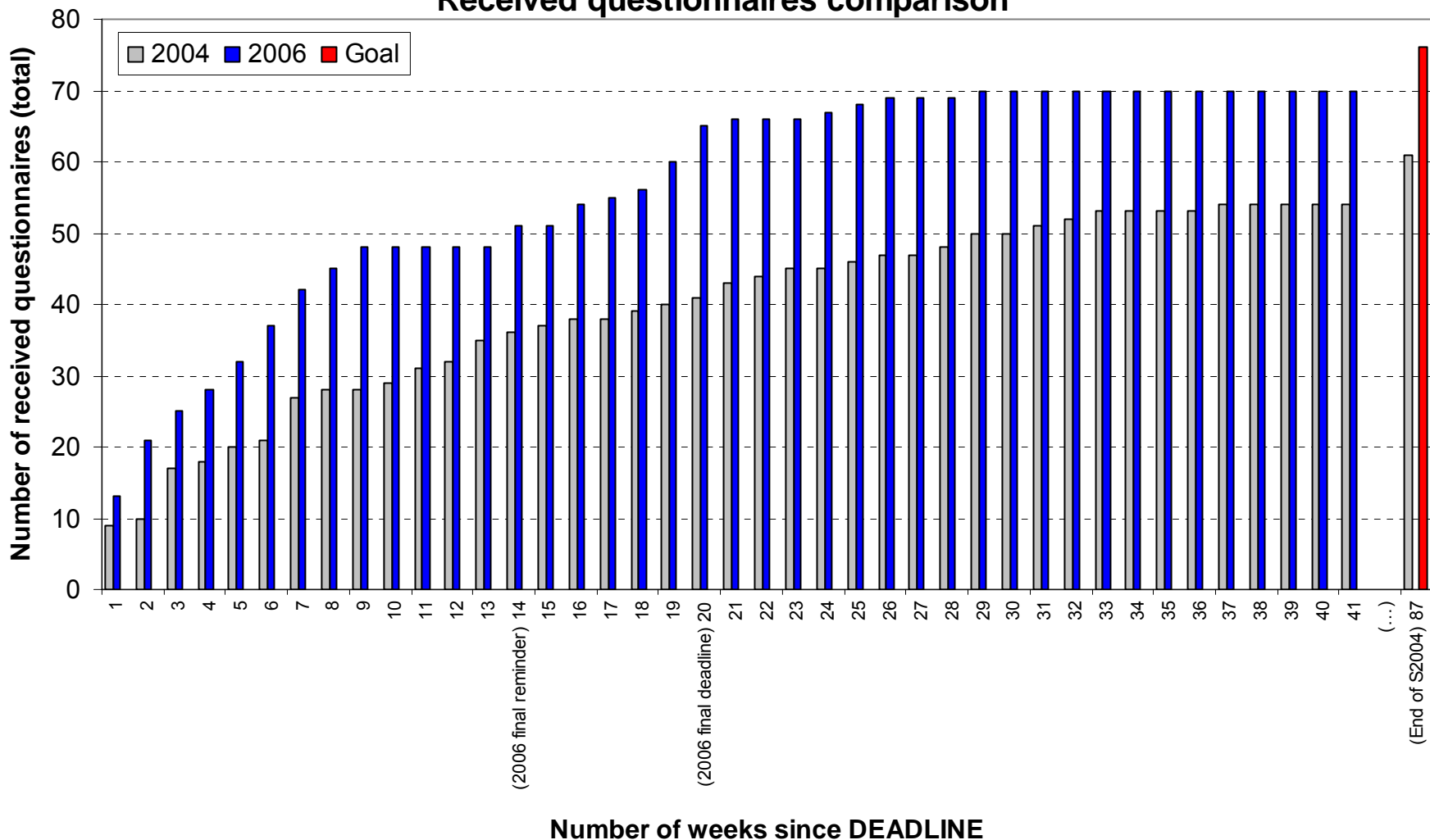
- The 2004 S&T statistics survey was launched in May, 2004. This was the first UNESCO statistical questionnaire to be available for completion on-line via the internet.
- **The 2006 S&T statistics survey was launched in June/July 2006.**
- The latest resulting data were released on the UIS website May 2007
- OECD and EUROSTAT provide data for their Member States. RICYT provides data for Latin America.

Breakdowns required by UIS

- R&D personnel by gender
- R&D personnel by occupation and gender
- R&D personnel by sector of employment and occupation
- R&D personnel by sector of employment and gender
- Researchers by formal qualification and sector of employment
- Researchers by formal qualification and gender
- Researchers by fields of science and sector of employment
- Researchers by fields of science and gender
- Total expenditure in R&D by sector of performance
- Total expenditure in R&D by source of funds

Evolution of 2006 survey

2004 and 2006 Surveys
Received questionnaires comparison



UIS 2004 and 2006 Surveys on R&D Response rates & published data

Regions (Countries and Territories covered)	Responses Q 2004			Responses Q 2006			Published data *		
Sub-Saharan Africa (46)	16	35%	35%	25	54%	57%	22	48%	50%
Arab States-Africa (8)	3	38%		6	75%		5	63%	
Asia (31, excl. Arab States & OECD)	23	72%	59%	21	68%	63%	23	74%	60%
Arab States - Asia (12)	3	25%		6	50%		3	25%	
Americas (19, excl. RICYT & OECD)	5	26%		4	21%		4	21%	
Europe (16, excl. OECD & Eurostat)	9	60%		9	56%		7	44%	
Oceania (17, excl. OECD)	2	12%		0	0%		2	12%	
Sub-total (149)	61	41%		71	48%		66	44%	
<i>Data from other sources:</i>									
OECD + Eurostat (43)	<i>Total coverage</i>			<i>Total coverage</i>			43	100%	
RICYT (23)							18	78%	
Total (215)	124	58%		137	64%		127	59%	

* By June 2007

2004 and 2006 UIS Surveys: Status of CIS countries

	2004 Survey	2006 Survey *
Armenia	Data provided	Data provided
Azerbaijan	Data provided	Data provided
Belarus	Data provided	Data provided
Georgia	Data provided	Data provided
Kazakhstan	Data provided	Data provided
Kyrgyzstan	Data provided	Data provided
Moldova	Data provided	Data not provided
Russia	From OECD	From OECD
Tajikistan	Data not provided	Data provided
Turkmenistan	Data not provided	Data not provided
Ukraine	Data provided	Data provided
Uzbekistan	Data not provided	Data not provided

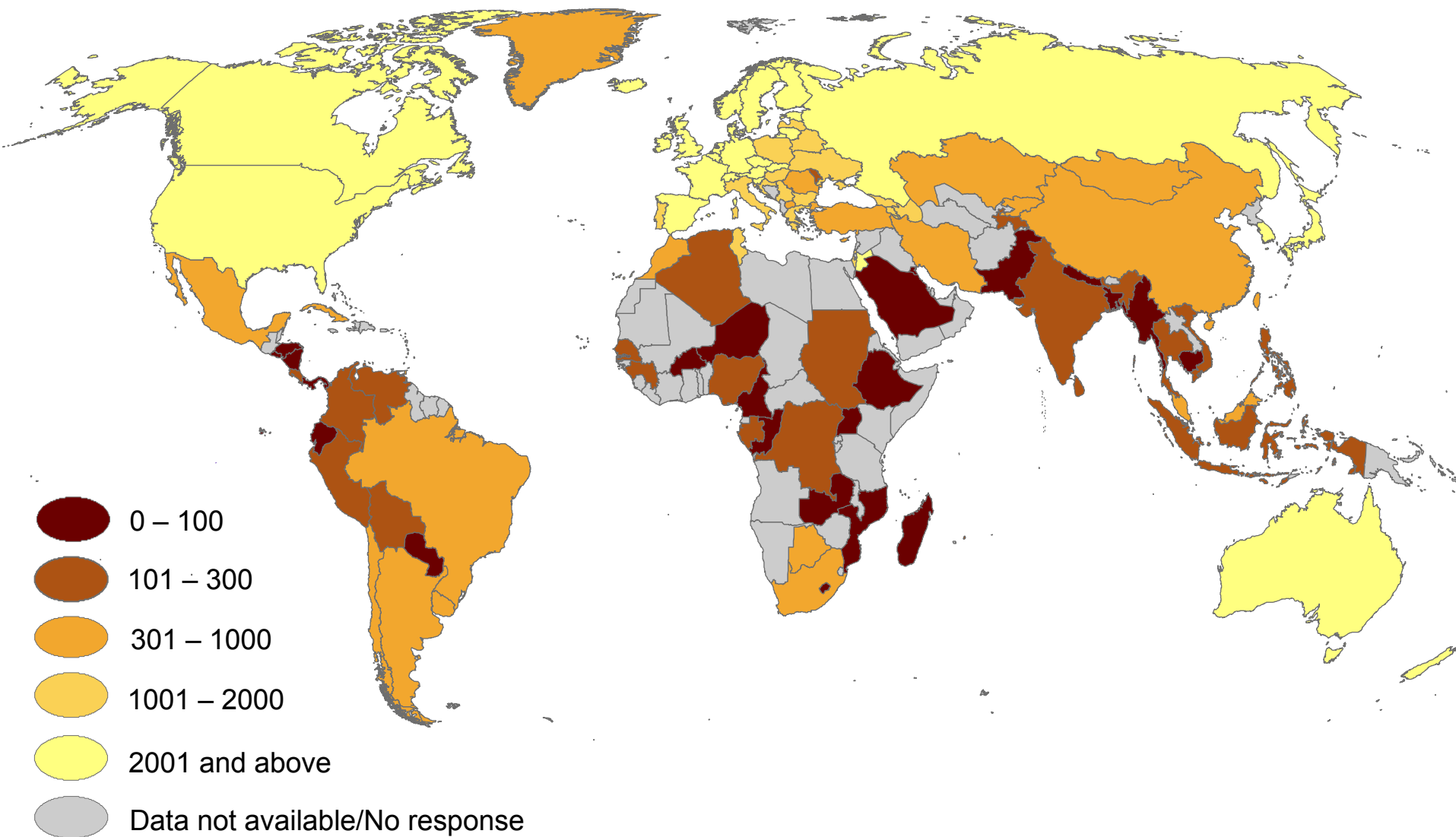
R&D Personnel in CIS, 2005 or latest available year

Country	Year	Total R&D Personnel (FTE)	Researchers (FTE)	Technicians (FTE)
Armenia	2005* (HC)	6,892	5,056	345
Azerbaijan	2005 (HC)	18,164	11,603	1,825
Belarus	2005 (HC)	26,142	18,267	2,112
Georgia	2005 (HC)	13,415	8,112	1,810
Kazakhstan	2005	18,912	11,910	1,270
Kyrgyzstan	2005 (HC)	2,911	2,187	226
Moldova	2002 (HC)	2,201	729	855
Russia	2005	919,716	464,577	79,560**
Tajikistan	2005 (HC)	3,220	1,993	324
Turkmenistan		...	...	...
Ukraine	2005 (HC)	137,564	85,246	20,266
Uzbekistan	2004 (HC)	...	25,556 †	...

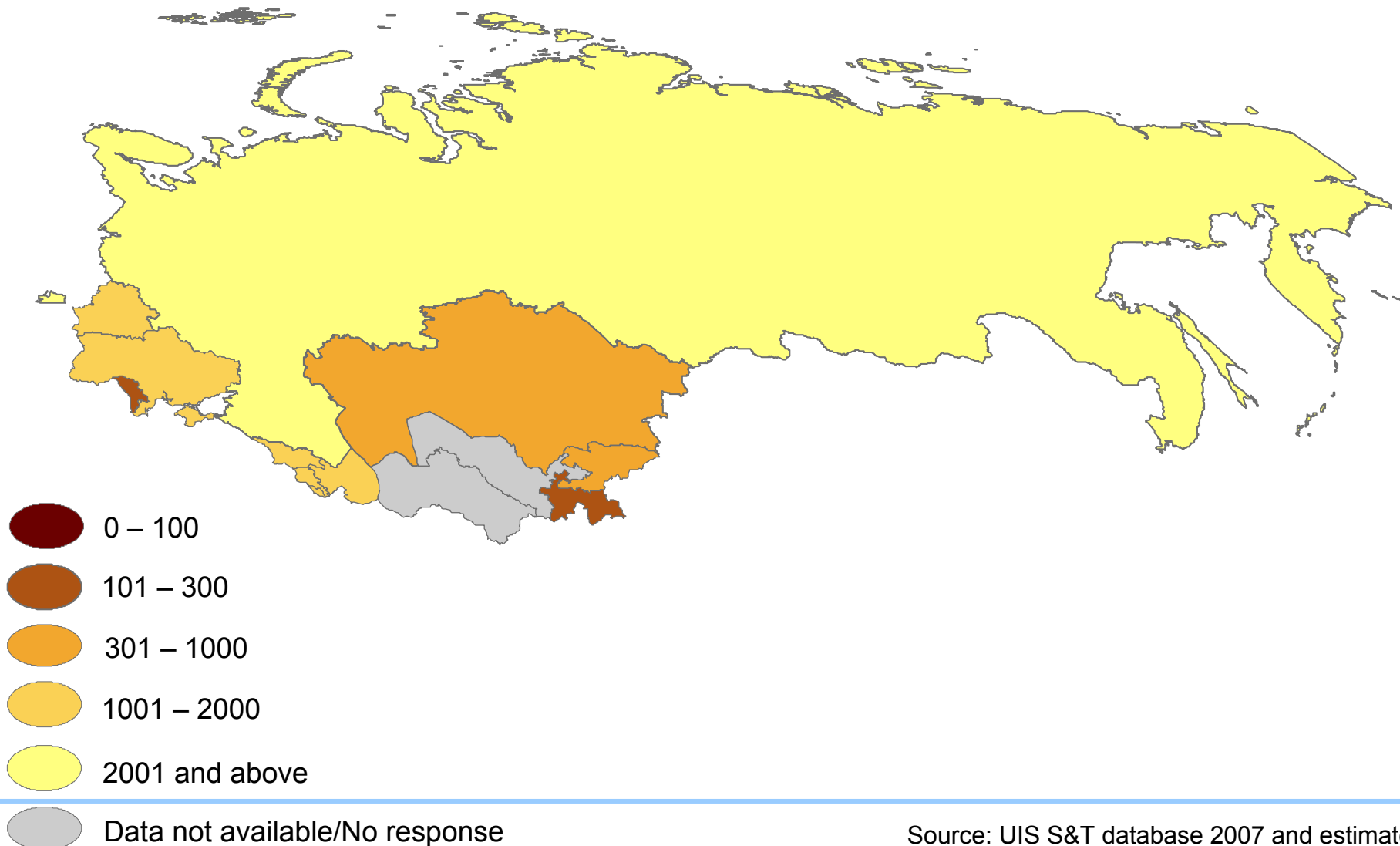
Source: UIS S&T database 2007

FTE: Full-time equivalent, HC: Headcount, * partial data, ** Year is not the same, †not published

Researchers per million inhabitants, 2005 or latest available year



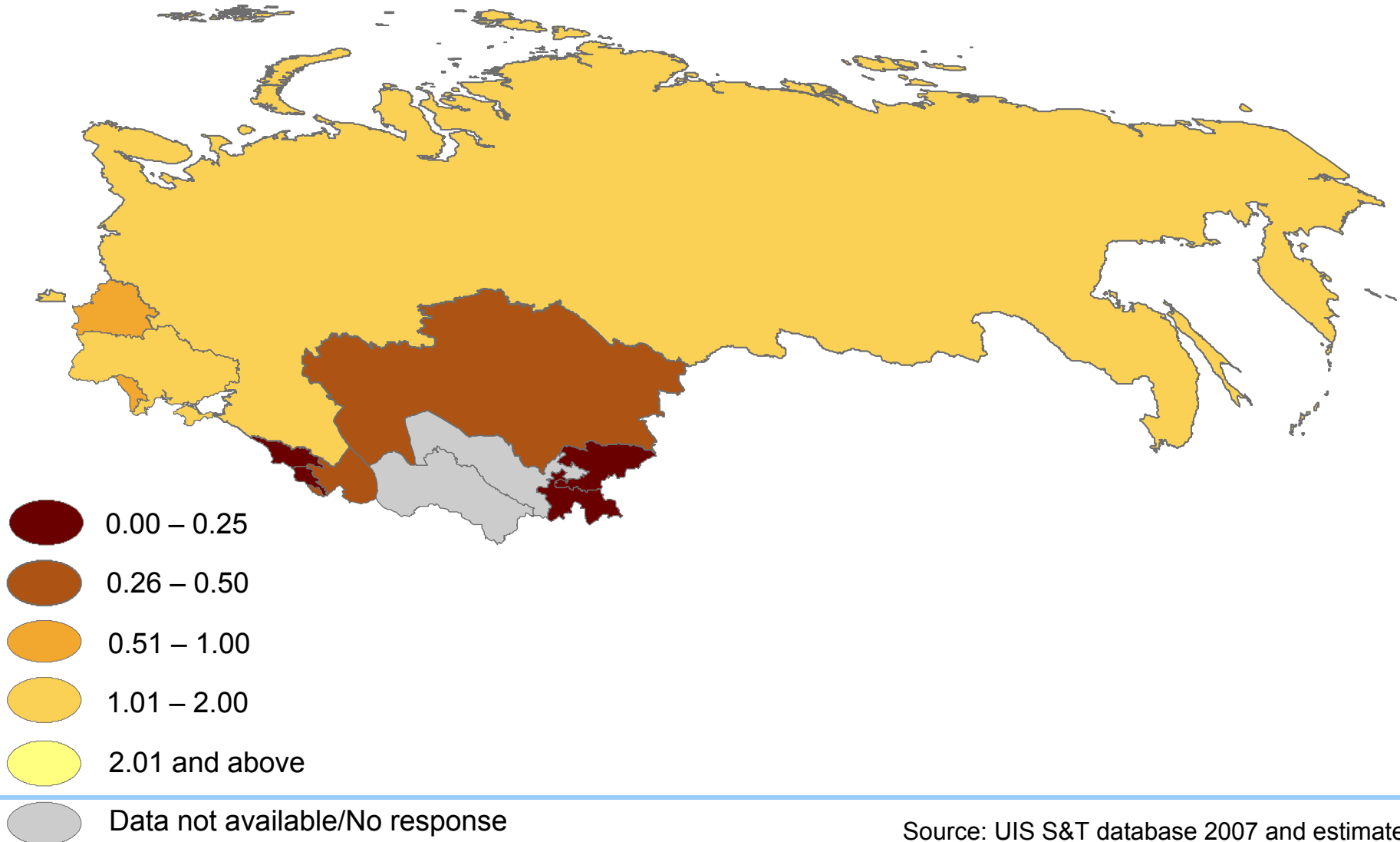
Researchers per million inhabitants in CIS, 2005 or latest available year



Gross Domestic Expenditure on R&D (GERD) in CIS, 2005 or latest available year

Country	Year	GERD ('000) in Local currency	GERD ('000) PPP\$	GERD as a % of GDP	GERD per capita (PPP\$)
Armenia	2005*	4,814,400	32,003	0.21%	10.6
Azerbaijan	2005	27,542	97,588	0.23%	11.6
Belarus	2005	441,491,000	536,659	0.69%	55.0
Georgia	2005	20,520	26,653	0.18%	6.0
Kazakhstan	2005	21,527,364	337,490	0.28%	22.8
Kyrgyzstan	2005	200,400	19,839	0.20%	3.8
Moldova	1997	71,941	46,764	0.81%	10.8
Russia	2005	230,785,200	16,583,964	1.07%	115.8
Tajikistan	2005	6,862	8,402	0.10%	1.3
Turkmenistan		...	...	...	...
Ukraine	2005	4,551,153	3,454,471	1.07%	74.3
Uzbekistan		...	...	...	...

GERD as a percentage of GDP in CIS, 2005 or latest available year



Data availability in participating countries

	AM	AZ	BY	MD	RU	UA
FTE	NO	NO	NO	NO	>HC	>HC
GENDER	OK	OK	Partial	OK		
QUALIFICATIONS	OK	OK	OK	OK		
FIELDS OF SCIENCE	OK	OK	OK	NO		
GERD	OK	OK	OK	Partial		
SECTOR COVERAGE	GOV +HE	GOV +HE +BE	GOV +HE +BE	GOV (Partial)		

Sector specificities

- Armenia: Other sources of funds are “in-house funds”, “customer funds”, “other funds”.
- Moldova: covers only Academy of Science of Moldova.

Sector specificities

- Belarus: “Private non-profit sector includes private non-profit organisations as professional unions, unions, associations, social groups, charity organizations, funds. Excludes organizations financed by government at more than 50%.”

Частный неприбыльный сектор включает частные организации, не ставящие своей целью получение прибыли (профессиональные общества, союзы, ассоциации, общественные, благотворительные организации, фонды); кроме фондов, более чем на половину финансируемых государством, которые относятся к государственному сектору.

Kazakhstan: sources of funds

- own funds
- budget funds
- contractors (clients) funds
- out-of-budget funds
- funds from abroad

Sector specificities: Ukraine

- Source of funds difficult to trace. Budget instead of expenditure.
- “Expenses for performance of R&D are distributed in Ukraine on such sources of financing:
 - own means,
 - means of the state budget,
 - local budgets,
 - means of the budget for the maintenance of the higher education institutions, and also
 - means on sectors (according to yours инструкции).”

Key issues to address

- FULL-TIME EQUIVALENTS: does it make sense? How can we construct it in the frameworks of CIS countries? Can we propose some guidelines?
- Sector breakdown: how to map Frascati Manual sectors to the sectors in the CIS statistical systems.
- How to deal with Business Enterprise sector.
- Backward comparability: how to deal with old data?

- We hope to hear from the experience of Russia and Ukraine.

Mapping sectors: proposed matrix (based on Ukraine)

This column goes to table 3.2
GERD by sector
of performance



		Sources of funds						
		Gov	HE	BE	PNP	Abroad	TOTAL (3.2)	
Sector of performance	Gov	Government institutions' own means + (State budget + Local budget) used by gov. institutions to perform R&D		Funds for research executed by government institutions and paid by Business enterprises	Funds for research executed by government institutions and paid by PNP organizations	Funds for research executed by government institutions and paid by organizations abroad	All funds used by Government institutions to perform R&D, no matter the source	

Proposed matrix

		Sources of funds					
		Gov	HE	BE	PNP	Abroad	TOTAL (3.2)
Sector of performance	HE	budget for the maintenance of the higher education institutions + (State budget + Local budget) used by higher ed. institutions to perform R&D	Higher Education institutions' own means used to perform R&D	Funds for research executed by higher education institutions and paid by Business enterprises	Funds for research executed by higher education institutions and paid by PNP organizations	Funds for research executed by higher education institutions and paid by organizations abroad	All funds used by Higher Education institutions to perform R&D, no matter the source

Proposed matrix

		Sources of funds					
		Gov	HE	BE	PNP	Abroad	TOTAL (3.2)
Sector of performance	BE	(State budget + Local budget) used by business enterprises to perform R&D		Business enterprises' own means + funds for research executed by business enterprises and paid by other business enterprises	Funds for research executed by business enterprises and paid by PNP organizations	Funds for research executed by business enterprises and paid by organizations abroad	All funds used by business enterprises to perform R&D, no matter the source

Proposed matrix

		Sources of funds					
		Gov	HE	BE	PNP	Abroad	TOTAL (3.2)
Sector of performance	PNP	(State budget + Local budget) used by PNP orgs. to perform R&D		Funds for research executed by PNP organizations and paid by Business enterprises	PNP organizations' own means + funds for research executed by PNP orgs. and paid by other PNP orgs.	Funds for research executed by PNP organizations and paid by organizations abroad	All funds used by PNP organizations to perform R&D, no matter the source

Proposed matrix

This column goes to table 3.2 GERD by sector of performance

		Sources of funds					
		Gov	HE	BE	PNP	Abroad	TOTAL (3.2)
Sector of performance	↓						
	TOTAL (3.3)	Government institutions' own means + Total budget for the maintenance of the higher education institutions + Total State budget + Total Local budget	Higher Education institutions' own means	All funds provided by business enterprises, including research conducted by business and paid by their own means.	All funds provided by PNP organizations, including research conducted by PNP organizations and paid by their own means.	All funds provided by organizations abroad	TOTAL

Other issues for discussion

- How to deal with Business Enterprise sector.
- Backward comparability: how to deal with old data?

Conclusions

- Some countries in CIS are having problems in collecting comparable data and making sense of them.
- The available data give initial indications on the structure of S&T systems in various countries. More data would help to paint a clearer picture.
- Lack of data on S&T constrain the ability to design and implement national and regional S&T policies.
- How can we improve the production of basic S&T statistics at country level? How do we establish sustainable S&T statistics systems?



Thank you!

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

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