

### Engineering Report II: Preliminary Data and Data Collection Strategy

Ernesto Fernandez Polcuch Chief of Section Division of Science Policy and Capacity-Building UNESCO



- » A lack of engineers is one of the principal impediments to global economic growth.
- » Data on engineering capacity and competence disaggregated by sex and other variables are necessary to identify issues, such as lacking human resources, professional disparities and gender inequalities.
- » It is essential that data are collected using consistent methods and on a continual basis because trends are even more important than absolute numbers in developing effective policy instruments.
- » Many countries in Africa and Latin America are missing methods for collecting engineering data.
- » Surveys developed by data experts from UIS, UNESCO, ICEE among others, are needed.



The UNESCO Institute for Statistics (UIS) is an official and trusted source of internationally-comparable data on education, science, culture and communication.

The Institute produces a wide range of indicators and collects data for UNESCO and its fields of action by working with national statistical offices, Ministries and other organizations.

UIS mandate "Transforming the SDGs into action"

Cultural Organization

NATURAL SCIENCES Educational, Scientific and

Educational, Scientific and • Development Cultural Organization • Goals

The Institute develops methodologies and standards needed to achieve the SDGs.

UIS is currently based in Montreal, Canada at the École des hautes études commerciales (HEC Montréal).



# **UIS Data from "Education Survey"**

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- Enrollment and Graduates by ISCED level, by broad fields of study and by sex:
  - Number of men and women enrolled in the field of study Engineering, Manufacturing and Construction
  - Number of female and male graduates from the field of study Engineering, Manufacturing and Construction
- Engineering is together with manufacturing and construction!



## **Engineering Education Data in Arab States**

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Development

United Nations

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#### Data Availibility for the Global Indicators by Region





#### Data Availibility for All Regions by Global Indicator

Global Indicators



# UIS Data collection form: "Research and Development Survey"

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#### R5: Researchers by sector of employment, field of R&D and sex

Reference year:

2016

Unit	Sex	Field of R&D	Sector							
			Business enterprise	Government	Higher education	Private non-profit	Not specified	Total		
		Natural sciences								
	Males	Engineering and technology								
		Medical and health sciences								
		Agricultural and veterinary sciences								
		SUB-TOTAL: Natural sciences and engineering (NSE)								
		Social sciences								
		Humanities and the arts								
		SUB-TOTAL: Social sciences and humanities (SSH)								
		Not specified								
		TOTAL researchers								
		Natural sciences								
Headcounts (HC)	Females	Engineering and technology								
		Medical and health sciences								
		Agricultural and veterinary sciences								
		SUB-TOTAL: Natural sciences and engineering (NSE)								
		Social sciences								
		Humanities and the arts								
		SUB-TOTAL: Social sciences and humanities (SSH)								
		Not specified								
		TOTAL recorrelation								



# UIS Data from "Research and Development Survey"

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### % of Female researchers in "Engineering and Technology" (in headcount)

Researchers (HC) - Engineering and technology % (2015)





# UIS Data from "Research and Development Survey"

#### NATURAL SCIENCES

### % of Female researchers in "Engineering and Technology" (in full-time equivalents)

Researchers (FTE) - Engineering and technology % (2015)





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# Factors that can explain the lack and poor quality of data

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# STEM and Gender Advancement (SAGA)

### **Engineering is an essential part of SAGA**

• STI Gender Objective 4.8: Ensure gender equality in S&E professional certifications, in particular in engineering

### World Council of Civil Engineers (WCCE)

• Piloting a survey on certification of engineers

To identify gaps between women and men applying to achieve a professional registration.

### Data collected could be included in the Engineering Report



- NATURAL SCIENCES
- Enables the categorization of STI policies and policy instruments, and indicators
- Assists in identifying gaps in the STI policy mix and aims at encompassing all aspects of gender equality in STI policy making.
- Aims at encompassing all aspects of gender equality in policy making, as identified through research conducted in the framework of SAGA.
- Allows the mapping of existing indicators to gender objectives and facilitate identifying gaps

It has be reviewed by a group of international experts in science policy, indicators and gender equality



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## The Seven Gender Objectives

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4.2

4.3

# 4. Gender equality in career progression for women scientists and engineers (S&E)

#### 4.1 Ensure gender equality in access to job opportunities, recruitment criteria and processes.

Promote equal work conditions through, among others:

- gender balance in remuneration
- preventing gender bias in performance evaluation criteria (including productivity measurement)
- adequate safety and security of fieldwork
- sexual harassment prevention policies and procedures.

Ensure gender equality in access to opportunities in the workplace:

- training and conferences
- research teams, networks (national and international), expert panels and advisory groups
- publications and patent applications, including preventing bias in review
- financial and non-financial incentives
- recognitions, rewards and awards



4.4

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4. Gender equality in career progression for
women scientists and engineers (S&E)

Promote work–life balance through, among others:

- infrastructure for child care
- flexible working hours
- reduction and redistribution of unpaid care and domestic care
- family leave for both parents
- appropriate re-entry mechanisms to the S&E workforce after career break or family leave.
- 4.5 Promote gender equality in international mobility of post-docs and researchers, and facilitate women's return.
- 4.6 Promote gender balance in leadership positions in S&E occupations (including decision making and research).
- 4.7 Promote transformations of STI institutions and organizations (structure, governance, policies, norms and values) aimed at achieving gender equality.
- 4.8 Ensure gender equality in S&E professional certifications, in particular in engineering



## Survey of Drivers and Barriers to Careers in Science and Engineering (S&E Survey)

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- Addresses the lack of information by providing tools to better understand the drivers and barriers to S&E careers and address gender equality in STEM.
- Developed closely in conjunction with the STI GOL
- Surveys both men and women
- The survey can be applied as: an independent survey component within a larger study

### Structure of the survey

- Two versions:
  - individuals enrolled in an education programme individuals in the workforce or out of education
- Bank of questions organized by modules
- Designed to be used in various contexts (must be adapted to the country's needs)
  - must be adapted to population targeted



Postdoctoral environment (the glass-ceiling) Recognition and awards Work conditions and policies Discrimination and harassment Funding opportunities Role models Attitudes and social normsCareer breaks Networking opportunities Implicit gender biases Work and personal life balance Engineering Report II

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EducationTransition to<br/>labour forceLabour force<br/>participationPersonal life choices or constraints

- Education experience and environment
- Postdoctoral experience and environment
- Transition to workforce
- Workforce experience, conditions and policies
- Recognition and awards
- Work-life balance
- Funding

- Time use
- Career breaks
- Work policies
- Discrimination and harassment
- Attitudes and social norms (implicit gender bias)
- Role models
- Respondent's characteristics



# SAGA and engineering data

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- Information at the global level and within countries collected through SAGA surveys (by sex)
  - Access to more detailed information on drivers and barriers faced throughout education and career
  - Access to certification applications, licenses issued etc.

- More information by fields of education and fields of R&D at more detailed level (to disaggregate by sex and broad categories). For example:
  - Field of education: Engineering, manufacturing and construction -> Engineering

#### Information collected could be included in the Engineering Report



# SAGA and engineering organisations

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Most likely, the *SAGA Survey of Drivers and Barriers to Careers in Science and Engineering* will be piloted through several organizations, among them:

The Institution of professional engineers of New Zealand- IPENZ
The Australian Academy of Technology and Engineering (ATSE)

**o** The World Federation of Engineering Organizations (WFEO)





#### http://spin.unesco.org.uy

# Number of Engineering Policy Instruments in Latin America and the Caribbean

					Mexico, 2		Bolivia, 2	
Argentina, 9	Brazil, 8	Panama, 7	Costa Rica, 5	Chile, 5	Colomb 2	D Re 1	Ec 1	El Sa 1



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# **Engineering STI Policy Instruments**



**STI Operational Policy Instrument 4:** 

Secondary Schools Girls' Award Students receive prize money as individuals and are awarded scholarships to study engineering or two other fields, at universities abroad.

Mode of support/Type of mechanism: annual cash prizes and scholarships

1 Instrument



# **Engineering STI Policy Instruments**

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#### STI Operational Policy Instrument 28: BIRD Israel – USA

BIRD activities include matchmaking services between Israeli and American companies. BIRD's scope extends to Communications, Life Sciences, Electronics, Electrooptics, Software, Homeland Security, Renewable and Alternative Energy and other sectors of the hi-tech Industry.

Mode of support/Type of mechanism: a. grants

#### STI Operational Policy Instrument 46: KIDMA – Advancement of Israeli Cyber Security

Programme aiming to promote development of advanced cyber defence solutions and establish cyber-security knowledge centres.

<u>Mode of support/Type of mechanism:</u> a. grants; d. creation of, and support for, technological poles and centres of excellence

#### STI Operational Policy Instrument 47: Masad Program – Dual Cyber R&D

Promote defence R&D and to advance national non-military infrastructures in the cyber field.

Mode of support/Type of mechanism: a. grants

**STI Operational Policy Instrument 48:** Academic–Technological Education Program for Teenagers

Encourage teenagers with extraordinary potential, to become R&D experts in computers, and particularly in cyber

<u>Mode of support/Type of mechanism:</u> k. other: government involvement in the creation and funding of the educational programme

#### STI Operational Policy Instrument 53: STARTERGY Fund

Support for innovative, early stage start-up companies in the fields of energy efficiency, hydrogen technologies, energy storage using electrochemical means and renewable energy (e.g. wind and solar energy).

Mode of support/Type of mechanism: a. grants







# **Other sources**

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- Official statistics not covered by UIS:
  - Census,
  - Workforce statistics,
  - Household surveys
- Data sources not covered by official statistics:
  - Engineering and engineering education organizations
  - Engineering accreditation bodies
  - Engineers certification bodies
  - Universities (including alumni surveys)
- Research
- Develop a "Toolkit for Engineering Indicators" describing sources and proposing methodologies



# Next steps

- NATURAL SCIENCES
- A statistics expert will be engaged (suggestions?) to support authors and survey Member States and sub-regional, regional and global associations for available statistics and indicators from all possible sources, looking for indicators of engineering, by subfields and sex-disaggregated, such as:
  - tertiary enrolment,
  - graduation,
  - professional employment,
  - accreditation,
  - mobility and
  - number of professional engineers.
- (Sub-)regional averages and (sub-)regionally consolidated data will be prepared.
- An overview of all the data sources will be prepared to develop the proposed Toolkit.