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Higher Education

Higher Education in Science and Engineering

Technical Appendix

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This publication is part of the *Science and Engineering Indicators* suite of reports. *Indicators* is a congressionally mandated report on the state of the U.S. science and engineering enterprise. It is policy relevant and policy neutral. *Indicators* is prepared under the guidance of the National Science Board by the National Center for Science and Engineering Statistics, a federal statistical agency within the National Science Foundation. With the 2020 edition, *Indicators* is changing from a single report to a set of disaggregated and streamlined reports published on a rolling basis. Detailed data tables will continue to be available online.

Table of Contents

Methodology Notes for International Degree Data	5
Degree Fields and Levels	5
OECD	6
Eurostat	7
Other Countries and Economies	8
Notes	9
List of Tables	
SAHED-1 Crosswalk of S&E fields for international higher education data, by selected region, country, or economy and field	5
SAHED-2 Example OECD first degree data reporting: Degrees awarded by Russia, by level and category of education: 2013–18	7

Technical Appendix

Methodology Notes for International Degree Data

International data for first degrees and doctoral degrees for the *Higher Education in Science and Engineering* report were retrieved from several sources. Data were sourced from the Organisation for Economic Co-operation and Development (OECD), Eurostat, and several national and regional statistical offices. These methodology notes provide details on the degree field classifications, degree-level definitions, and sources used for the international higher education data.

Degree Fields and Levels

Fields of degree used in the international section of this report are based on the most recent coding system of the **International Standard Classification of Education (ISCED)**, ISCED Fields of Education and Training 2013 (ISCED-F 2013), to facilitate international comparisons. **Table SAHED-1** shows the crosswalk of science and engineering (S&E) degree fields used to map degree data from regional and national data sources to the fields used in this report. Comparing degree fields across higher education systems with different degree taxonomies may require classification decisions that unavoidably result in either overcounting or undercounting of degree fields of interest. For example, degrees in political science and sociology are reported under the law field by China, but data are not published for these fields individually. Political science and sociology are typically included within social and behavioral sciences, but this report does not classify degrees awarded in law within social and behavioral sciences for China because the law field also includes traditional legal disciplines.

Table SAHED-1

Crosswalk of S&E fields for international higher education data, by selected region, country, or economy and field

(List of fields)

<i>Indicators 2022</i>	China ^a	India	OECD and Eurostat, ISCED 1997 (select years 2012 and earlier)	OECD and Eurostat, ISCED-F 2013 (2013 and later)	Taiwan
Physical and biological sciences and mathematics and statistics	Science	Science	42 Life sciences	05 Natural sciences, mathematics, and statistics	Life sciences
			44 Physical sciences		Environmental studies
		Marine science/oceanography	46 Mathematics and statistics		Physics, chemistry, and earth sciences
Computer sciences	NA	IT and computer	48 Computing	06 Information and communication technologies	Information and communication technology
Agricultural sciences	Agriculture	Agriculture	6 Agriculture	08 Agriculture, forestry, fisheries, and veterinary	Agriculture
		Veterinary and animal sciences			Forestry
		Fisheries science			Fisheries
Social and behavioral sciences	Economics	Social science	31 Social and behavioral science	03 Social sciences, journalism and information	Social and behavioral sciences
		Library and information science	32 Journalism and information		Journalism and library information
		Journalism and mass communication			
Engineering	Engineering	Engineering and technology	5 Engineering, manufacturing, and construction	07 Engineering, manufacturing, and construction	Engineering Manufacturing and processing

Table SAHED-1

Crosswalk of S&E fields for international higher education data, by selected region, country, or economy and field

(List of fields)

<i>Indicators 2022</i>	China ^a	India	OECD and Eurostat, ISCED 1997 (select years 2012 and earlier)	OECD and Eurostat, ISCED-F 2013 (2013 and later)	Taiwan
					Architecture and construction engineering

NA = not available.

ISCED = International Standard Classification of Education; ISCED-F = ISCED Fields of Education and Training; IT = information technology; OECD = Organisation for Economic Co-operation and Development.

^a China data include computer sciences under engineering.

Source(s):

Organisation for Economic Co-operation and Development (OECD), OECD.Stat; Eurostat, Education and training database; National Bureau of Statistics of China, *China Statistical Yearbook* (various years); People's Republic of China, Ministry of Education data (various years); Ministry of Education, *Educational Statistics of the Republic of China (Taiwan)* (various years); Government of India, Ministry of Human Resource Development, Department of Higher Education, All India Survey on Higher Education (various years).

Science and Engineering Indicators

Levels of degree for international degree data in this report are based on the ISCED 2011 system. Doctoral degrees correspond to ISCED 2011 level 8 (doctoral or equivalent). First degrees may correspond to ISCED 2011 level 6 (bachelor's or equivalent) or include a combination of degrees at ISCED 2011 levels 6 and 7 (master's or equivalent), depending on the data source. Some countries grant bachelor's degrees and "long first degrees." These degrees typically take at least 5 years to complete and involve training at a level comparable to a master's degree in the United States. Similar to bachelor's degree programs, long first degree programs only require completion of secondary education to enroll, and completion of a program provides the first opportunity to enter the labor market with an academic credential at the tertiary level (excluding shorter-duration, occupationally focused programs).¹ The United States does not report long first degrees. Combined bachelor's and master's programs in the United States may provide roughly similar educational training to long first degrees, but there are very few such programs, and institutions award both degrees to these joint program graduates.

Where data are available, national totals for first degrees presented in the International S&E Higher Education section of the report equal the sum of first degrees at the bachelor's level and long first degrees. For countries such as the United States that do not report data specifically for first degrees, first degree totals are bachelor's degrees.

OECD

Unless otherwise specified, international degree data in the report were retrieved from the OECD statistical database, **OECD.Stat**. The data reported by OECD come from an annual collection of education data conducted jointly by the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics, OECD, and Eurostat (UOE data collection). OECD degree data for 2013 and later years use current ISCED codes (ISCED 2011 levels of education, and ISCED-F 2013 fields of education). OECD data for 2012 and earlier years have been partially updated to the current classifications, but much of the data in earlier years are still based on ISCED 1997 codes. The transition in the data reporting includes changes in the degree fields and levels. These changes may lead to limitations in year-to-year comparability for first degrees for some countries, but they do not appear to pose methodological concerns for constructing an uninterrupted time series for doctoral degrees.

The crosswalk of fields of degree between early (ISCED 1997) and later (ISCED-F 2013) years of OECD data is included in **Table SAHED-1**. This mapping applied to first degrees and doctoral degrees.

Mapping of levels of degree required different approaches for first degrees and doctoral degrees. OECD doctoral degrees were specified as ISCED 1997 level 6 (advanced research programs) for 2012 and earlier and ISCED 2011 level 8 (doctoral or equivalent) for 2013 and subsequent years. Mapping first degrees was a more complex process. Under the ISCED 1997 classification system, short-cycle tertiary education (comparable with an associate's degree), bachelor's degrees, and master's degrees are collectively categorized under level 5. To identify the ISCED 1997 level 5 degrees comparable with first degrees under the ISCED 2011 system, level 5 degrees were refined using two additional criteria:

- Program destination: A (theoretically based programs that give access to advanced research qualifications or professions with high-skill requirements);² and
- Program orientation: first degree or qualification orientation.

First degrees under the ISCED 2011 system were specified as the sum of first degrees at level 6 (bachelor's or equivalent) and long first degrees at level 7 (master's or equivalent). If data were unavailable for first degrees at level 6, the sum of all level 6 degrees and level 7 long first degrees was used.

OECD Data Quality Notes

This report uses OECD degree data as provided by the OECD.Stat database. The change to ISCED 2011 levels of degree may have led to irregular reporting of first degree data during the transition in 2013 and subsequent years. The conventions used in this report for presenting first degrees led to a significant drop in the number of first degrees reported by OECD for Russia, from 1,406,050 in 2012 (ISCED 1997 system) to 129,375 in 2013, the first year of ISCED 2011 reporting. Reporting of degrees has continued to change across levels and categories of education in subsequent years. Degrees by level and category for Russia are presented in **Table SAHED-2** to illustrate the changes in reporting.

Table SAHED-2

Example OECD first degree data reporting: Degrees awarded by Russia, by level and category of education: 2013–18

(Number)

Level and category of education	2013	2014	2015	2016	2017	2018
ISCED 2011 level 6 (bachelor's degree or equivalent)						
All degrees	129,375	120,172	214,497	589,754	762,577	732,625
First degrees	NA	NA	NA	589,754	762,577	732,625
ISCED 2011 level 7 (master's degree or equivalent)						
All degrees	1,269,594	1,170,798	1,011,659	710,717	398,502	236,864
Long first degrees	NA	1,114,277	936,278	633,316	316,032	99,051

NA = not available.

ISCED = International Standard Classification of Education; OECD = Organisation for Economic Co-operation and Development.

Source(s):

Organisation for Economic Co-operation and Development (OECD), OECD.Stat.

Science and Engineering Indicators

Eurostat

The **Eurostat Data Explorer** was used to retrieve degree data on European Union (EU) countries that are not OECD members and not included in the OECD statistical database. These countries include Bulgaria, Croatia, Cyprus, Malta, and Romania. In some instances, Eurostat was used to supplement missing data for countries with data otherwise sourced from OECD. This approach was taken because the Eurostat database consistently provided the same data for OECD countries with joint coverage across the data sources. The consistency between the databases is unsurprising given that both rely on the same joint UOE data collection.

The Eurostat database uses the same ISCED system for levels and fields of education as the current OECD database. However, Eurostat provides totals for entire ISCED levels only, without the ability to identify the subset of first degrees at a given level. Specifically, there is no method to include only long first degrees at ISCED level 7 (master's degree or equivalent) without including all degrees at ISCED level 7. Therefore, totals for ISCED level 6 (bachelor's degree or equivalent) were used for first degrees for the select non-OECD EU members listed previously.

Other Countries and Economies

China

Degree award data for China for 2000–15 come from the **China Statistical Yearbook of the National Bureau of Statistics of China** and remain unchanged from *Indicators 2020*. New years of data come from annual tables published by the **Ministry of Education**. Data for first degrees were retrieved from table “Number of Regular Students for Normal Courses in HEIs (Higher Education Institutions) by Discipline” and data for doctorates were retrieved from table “Number of Postgraduate Students by Academic Field (Total).”

India

Degree award data for India were retrieved from the India Department of Higher Education's **All India Survey on Higher Education**. Data for India in this report will not match data reported in *Indicators 2020*, which were retrieved from OECD when available. OECD has since ceased publication of higher education degree data for India; thus, a national-level data source was required.

Japan

Data for Japan for 2000–13 remain unchanged from previous editions of *Indicators*. These data were retrieved from the Ministry of Education, Culture, Sports, Science and Technology Survey of Education. Data for 2014 and later were sourced from OECD. The OECD database was not used for prior years because its coverage of higher education for Japan is limited for earlier years. The change in data source from 2013 to 2014 led to a significant drop in the number of degrees in the social and behavioral sciences—and, thus, in overall S&E degrees.

Taiwan

All years of data for Taiwan use the Ministry of Education Main Statistics, Summary of Tertiary Education Institutes file. Data for all years have been updated since *Indicators 2020*. Changes in Taiwan's classification of degree fields from 2016 to 2017 have caused some changes in the distribution of degrees reported among S&E fields, most notably an increase in computer sciences and a shift of degrees from agricultural sciences to life sciences.

Notes

1 For a detailed discussion on classifying educational programs to ISCED levels, see OECD. 2018. *OECD Handbook for Internationally Comparative Education Statistics 2018: Concepts, Standards, Definitions and Classifications*. Paris, France: OECD Publishing. Available at <https://doi.org/10.1787/9789264304444-en>. Accessed 24 June 2021.

2 In contrast, shorter-duration ISCED 1997 5B programs focus on acquiring occupation-specific skills and credentials and include the equivalent of associate's degrees.