

## Right to Science Indicators: Methodological Notes

*Andrea Boggio*  
*Bryant University*

May 28, 2018

The Right to Science Indicators measure the degree of realization of the Human Right to Science (hereinafter, Right to Science). It is a measure of the extent to which states are fulfilling their obligation to respect, to protect and to fulfill—and ultimately realize—the Right to Science. States assume this obligation by becoming parties to international treaties. Each human right comes with a set of prescriptions for States that are particular to the human rights. These prescriptions are referred to as the “normative content” of a right. General comments, which convey the official interpretation of treaty bodies of the provisions of its respective human rights treaty, are key instruments in defining the normative content of a right. When first published the Right to Science Indicators in June 2018, the United Nations was in the process of discussing a draft of the General Comment for the Right to Science. Although not yet published, Mikel Mancisidor, Rapporteur for the new CESCR General Observation on the Right to Science, presented drafts of the General Comment at various public meetings. According to his presentations, the Right to Science possesses five dimensions:

1. Access to benefits
2. Opportunities to participate
3. Scientific freedom
4. Enabling environment
5. International cooperation

The General Comment identifies specific obligations for each dimension. The Right to Science Indicators measure the degree to which states have discharged these obligations. To do so, we have identified data that enable us to conduct such measurements. Based on available data, we have compiled a list questions to which data can answer. For each answer, we have identified scores by assigning points to the collected data (data are in numeric or textual form). Then we have add scores. The resulting number constitutes the total score for each countries. We have converted the total scores to a 0 to 100 scale and visualized them on a map and a chart, which ranks countries by degree of realization of the Right to Science. Countries with the highest scores are countries in which the right is realized to the greatest extent. The following five sections present the questions, data sources, data, and scored for each of the five dimensions.

## 1. Access to benefits

| <i>Question</i>   | <i>Data source</i>  | <i>Scores</i>   |                       |
|---|---|---|-----------------------|
|   |   | <i>Data</i>   | <i>Points</i>         |
| What is the percentage of population ages 25 and over that attained or completed a doctoral degree or equivalent?                             | UNESCO Institute for Statistics<br><a href="https://data.worldbank.org/indicator/SE.TER.CUAT.DO.ZS">https://data.worldbank.org/indicator/SE.TER.CUAT.DO.ZS</a>  | < 0.37<br>0.37 - 0.66<br>0.66 - 0.95<br>0.95 - 1.44<br>> 1.44         | 0<br>1<br>2<br>3<br>4 |
| What is the percentage of population that uses the Internet?  | International Telecommunication Union, World Telecommunication/ICT Development Report and database<br><a href="https://data.worldbank.org/indicator/IT.NET.USER.ZS?view=map&amp;year=2015">https://data.worldbank.org/indicator/IT.NET.USER.ZS?view=map&amp;year=2015</a> | < 15.51<br>15.51 - 34.67<br>34.67 - 51.35<br>51.35 - 67.06<br>> 67.06 | 0<br>1<br>2<br>3<br>4 |
| What is the quality of math and science education on a scale from 1 to 7 being "excellent"?   | World Economic Forum, Executive Opinion Survey, The Global Competitiveness Report 2017-2018   | < 3<br>3.1 - 5.0<br>> 5.1   | 0<br>1<br>2           |
| To what extent is the Internet used in schools for learning purposes? [1 = not at all; 7 = to a great extent]                                 | World Economic Forum, Executive Opinion Survey, The Global Competitiveness Report 2017-2018   | < 3<br>3.1 - 5.0<br>5.1 - 7.0   | 0<br>1<br>2           |
| What is the scientific literacy of 15-year-old students as measured by the Programme for International Student Assessment (PISA)(mean score)? | OECD (2018), Science performance (PISA) (indicator)<br>doi: 10.1787/91952204-en   | <460<br>461-520<br>>521   | 0<br>1<br>2           |

## 2. Opportunities to participate

| <i>Question</i>   | <i>Data source</i>   | <i>Scores</i>                                    |                  |
|---|--|--|------------------|
|   |  | <i>Data</i>                                      | <i>Points</i>    |
| Does the law mandate nondiscrimination based on gender in hiring?                       | World Bank: Women, Business and the Law<br><a href="http://databank.worldbank.org/data/reports.aspx?source=2&amp;series=SG.LAW.NODC.HR&amp;country=#">http://databank.worldbank.org/data/reports.aspx?source=2&amp;series=SG.LAW.NODC.HR&amp;country=#</a> | No<br>Yes  | 0<br>1           |
| What is the percentage of females employed with advanced degrees out of total employed? | 2017 Global Innovation Index<br><a href="https://www.globalinnovationindex.org/analysis-indicator">https://www.globalinnovationindex.org/analysis-indicator</a>  | < 30<br>30.1 - 50.0<br>50.1 - 75.0<br>75.1 - 100 | 0<br>1<br>2<br>3 |

### 3. Scientific freedom

| <i>Question</i>  | <i>Data source</i>  | <i>Scores</i> |               |
|--|---|---------------|---------------|
|  |   | <i>Data</i>   | <i>Points</i> |
| Is basic research using germline modification in human embryos/gametes permitted? [Limited = Only permitted on supernumerary embryos or on IVF embryos (if research benefits that embryo)] | Data collected in 2018 as part of research coordinated by Andrea Boggio (Bryant University), Bartha M. Knoppers (McGill), Jessica Almqvist (Autónoma University in Madrid), Cesare Romano (Loyola Law School, Los Angeles).<br>Research funded by a Santadander grant. <sup>1</sup> | Yes           | 3             |
|  |   | Limited       | 1             |
|  |   | No            | 0             |
| Is pre-clinical research using germline modification technologies in animals permitted?  |   | Yes           | 3             |
|  | Restricted  | 1             |               |
|  | No  | 0             |               |
| Is clinical research using germline modification technologies in humans permitted?   | Research funded by a Santadander grant. <sup>1</sup>  | Yes           | 3             |
|  |   | Restricted    | 1             |
|  |   | No            | 0             |
| Are clinical applications of research using germline modification technologies (i.e., to initiate a pregnancy with edited embryos or with edited gametes) permitted?                       |   | Yes           | 3             |
|  | Restricted  | 1             |               |
|  | No  | 0             |               |
| Is research on GMOs permitted in the laboratories?   | Data were collected in 2018 by EuropaBio, the European Association for Bioindustries ( <a href="http://www.europabio.org/">http://www.europabio.org/</a> )  | Yes           | 3             |
|  |   | No            | 0             |
| Is notification to start research on GMOs in laboratories required?  |   | No            | 1             |
|  |   | Yes           | 0             |
| Is research on GMOs frequent?  |   | Yes           | 1             |
|  |   | No            | 0             |

<sup>1</sup> Data collected by Dianne Nicol (University of Tasmania), Guido Pennings (Ghent University), Rosario Isasi (University of Miami), Erika Kleiderman and Lingquiao Song (McGill University), Alessandro Blasimme, Efy Vayena, and Dorothee Caminiti (ETH Zurich), Timo Faltus (Martin-Luther-Universität Halle-Wittenberg), Gali Ben-Or (Knesset Legal Department), Vardit Ravitsky (Université de Montréal), Ludovica Poli (Turin University), Tetsuya Ishii (Hokkaido University), María de Jesús Medina Arellano (Universidad Nacional Autónoma de México), Calvin Ho (National University of Singapore), Hannah Kim (Yonsei University), Iñigo de Miguel Beriain and Carlos María Romeo Casabona (Universidad del País Vasco), Heidi C. Howard and Santa Slokenberga (Uppsala University), Alta Charo (University of Wisconsin).

|  |  |                      |        |
|--|--|----------------------|--------|
| Are GM crop field trials (the limited release into the environment for research purposes) permitted? |  | Yes<br>No            | 3<br>0 |
| Is authorization to start a GM crop field trial required?  |  | No<br>Yes/prohibited | 1<br>0 |
| Are GM crop field trials frequent?   |  | Yes<br>No/prohibited | 1<br>0 |
| Is cultivation of GM crops (for commercial purposes) in open field permitted?                        |  | Yes<br>No            | 3<br>0 |
| Is authorization to start open-field cultivation of GM crops required?                               |  | No<br>Yes/prohibited | 1<br>0 |
| Is open-field cultivation of GM crops frequent?  |  | Yes<br>No/prohibited | 1<br>0 |
| Can GM crop commodities that are harvested in other countries be imported?                           |  | Yes<br>No            | 3<br>0 |
| Is authorization to import GM crop commodities required?   |  | No<br>Yes/prohibited | 1<br>0 |
| Is the import of GM crop commodities frequent?   |  | Yes<br>No/prohibited | 1<br>0 |

#### 4. Enabling environment

| Question  | Data source   | Scores  |                       |
|---|---|---|-----------------------|
|   |   | Data  | Points                |
| How many scientific and technical journal articles are published each year in physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences? [Data: Thousands of publications] | National Science Foundation, Science and Engineering Indicators<br><br>Source:<br><a href="https://data.worldbank.org/indicator/IP.JRN.ARTC.SC">https://data.worldbank.org/indicator/IP.JRN.ARTC.SC</a> | < 5.36<br>5.36 - 21.13<br>21.13 - 40.97<br>40.97 - 69.43<br>> 69.43 | 0<br>1<br>2<br>3<br>4 |
| What is the percentage of GDP allocated to Research and Development?  | UNESCO Institute for Statistics<br><br><a href="https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS">https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS</a>                                      | < 0.38<br>0.38 - 0.87<br>0.87 - 1.50<br>1.50 - 2.46<br>> 2.46       | 0<br>1<br>2<br>3<br>4 |
| How many published articles have received at least H citations in the period 1996–2014?   | 2017 Global Innovation Index<br><br><a href="https://www.globalinnovationindex.org/analysis-indicator">https://www.globalinnovationindex.org/analysis-indicator</a>                                     | < 30<br>30.1 - 50.0<br>50.1 - 75.0<br>75.1 - 100                    | 0<br>1<br>2<br>3      |
| What is the quality of scientific research institutions? [1 = extremely poor—among the worst in the world; 7 = extremely good—among the best in the world]  | World Economic Forum, Executive Opinion Survey, The Global Competitiveness Report 2017-2018   | < 3<br>3.1 - 5.0<br>5.1 - 7.0                                       | 0<br>1<br>2           |
| To what extent do business and universities collaborate on research and development (R&D)? [1 = do not collaborate at all; 7 = collaborate extensively]   | World Economic Forum, Executive Opinion Survey, The Global Competitiveness Report 2017-2018   | < 3<br>3.1 - 5.0<br>5.1 - 7.0                                       | 0<br>1<br>2           |
| What is the average university ranking score of countries based on their top 3 universities?  | 2017 Global Innovation Index<br><br><a href="https://www.globalinnovationindex.org/analysis-indicator">https://www.globalinnovationindex.org/analysis-indicator</a>                                     | < 30<br>30.1 - 50.0<br>50.1 - 75.0<br>75.1 - 100                    | 0<br>1<br>2<br>3      |
| To what extent are scientists and engineers available? [1 = not available at all; 7 = widely available]   | World Economic Forum, Executive Opinion Survey, The Global Competitiveness Report 2017-2018   | < 3<br>3.1 - 5.0<br>5.1 - 7.0                                       | 0<br>1<br>2           |

|  |   |                        |             |
|--|---|------------------------|-------------|
| How many professionals are employed as researchers (per 1000 employed)?                    | OECD (2018), Researchers (indicator)<br>doi: 10.1787/20ddfb0f-en            | <4.9<br>5-9.99<br>>10  | 0<br>1<br>2 |
| How many professionals are employed by government as researchers? [% of total researchers] | OECD (2018), Government researchers (indicator)<br>doi: 10.1787/c03b3052-en | <9.9<br>10-19.9<br>>20 | 0<br>1<br>2 |

## 5. International cooperation

| <i>Question</i>   | <i>Data source</i>  | <i>Scores</i>                 |               |
|---|---|-------------------------------|---------------|
|   |   | <i>Data</i>                   | <i>Points</i> |
| To what extent are talented people attracted from abroad? | World Economic Forum, Executive Opinion Survey, The Global Competitiveness Report 2017-2018 | < 2<br>2.1 - 4.0<br>4.1 - 7.0 | 0<br>1<br>2   |