

A Proposal for Indicators of the Human Right to Science

Andrea Boggio and Brian Gran

15.1 INTRODUCTION

The human right to science has a long history. First recognized through Article 27 of the Universal Declaration of Human Rights, this right was codified in Article 15 of the International Covenant on Economic, Social and Cultural Rights (ICESCR) in 1966. However, until recently, international bodies and scholars have not paid the requisite attention to this right. As a result, our understanding of its normative content is relatively underdeveloped. We do not yet fully apprehend its potential to bring about positive change to individuals' lives and the communities in which they live. This right has the potential to bolster freedoms indispensable to science and culture, for example through education and through creative work. It may strengthen the freedom for scientists to collaborate and disseminate their research while protecting everyone from scientific harms.

As more scholarly attention is paid to this right, evidenced by the chapters collected in this volume, efforts must include the development of indicators to measure State Parties' compliance with the obligations set by the ICESCR. A call to "identify appropriate indicators and benchmarks, including disaggregated statistics and time frames" is also included in General comment No. 25 on Science and economic, social and cultural rights.¹ According to the document, State parties must develop indicators and benchmarks that will "allow them to monitor effectively the implementation" of the right to science. In general, indicators are useful in assessing whether improvements are made over time, as well as how units, such as nation states, are performing in comparison to each other. Hunt contends that human rights indicators can enable a state to assess its progress toward implementation of a particular human right.² This is valuable, Hunt notes, to officials who can then adjust regulations and policies. Such assessments can be important when structures

¹ UN Committee on Economic, Social and Cultural Rights, "General Comment No. 25 on Science and Economic, Social and Cultural Rights Art. 15.1.b, 15.2, 15.3 and 15.4, E/C.12/GC/25," 2020 [hereinafter, General Comment No. 25].

² Paul Hunt, Report of the Special Rapporteur on the right of everyone to the enjoyment of the highest attainable standard of physical and mental health. E/CN.4/2006/48, March 3, 2006.

and processes are changed in the hopes of producing superior outcomes. People want to know whether modifications to laws and policies lead to improved outcomes. They want to know whether the application of additional resources leads to improved outcomes.

Indicators may provide evidence that changes are working, and also when they are not. Yet it is possible to place undue reliance on indicators, even to become “seduced” by indicators.³ Experts have raised questions about the use of indicators, particularly when examining human rights. They have criticized the potential for infatuation with indicators, as well as ignorance of valuable information that can shed light on and provide evidence of compliance with human rights obligations.

This chapter contributes to this movement by proposing a set of compliance indicators in respect of the human right to science. Developing these indicators is useful given that responsibilities and duties that State Parties bear in relation to the right to science are still relatively underdeveloped. The indicators we propose are an effort to better articulate these responsibilities and duties. They contribute to advancing the discussion of the normative content of the right and potentially to how State Parties report their compliance with their treaty obligations to the CESCR. This chapter therefore seeks to contribute to the volume’s overarching objective of investigating the human right to science. Considering the right’s importance, and that it has often been overlooked by scholars and policymakers, including the United Nations, the time has come to examine it more deeply and critically.

Following a review of the emergence of human rights indicators, this chapter examines utility of, and types of, indicators for economic, social, and cultural rights. It then examines indicators in relation to the human right to science, proposing a matrix of indicators of this innovative right (see Appendix A). The chapter concludes with a discussion of the utility of such indicators. What can indicators accomplish? What are downsides to establishing indicators for the human right to science?

15.2 THE EMERGENCE OF HUMAN RIGHTS INDICATORS

Human rights monitoring bodies have been recommending the use of indicators to monitor compliance with and progress towards the realization of economic, social, and cultural rights for over thirty years. In its General Comment No. 1 (1989) on reporting by States parties, the UN Committee on Economic, Social and Cultural Rights (CESCR) called on States “to identify specific benchmarks or goals against which their performance in a given area can be assessed” and “communicate them as part of their reporting duties.”⁴ The goal of this exercise, according to the CESCR, was “to effectively evaluate the extent to which progress has been made towards the

³ Sally Engle Merry, *The Seductions of Quantification: Global Governance, Human Rights, and the Rise of Indicator Culture* (Chicago, London: University of Chicago, 2016).

⁴ UN Committee on Economic, Social and Cultural Rights, *General Comment No. 1: Reporting by States Parties*, July 27, 1981, E/1989/22.

realization of the obligations contained in the Covenant.”⁵ Similar objectives appear in the work of other UN treaty bodies, human rights special procedures such as special rapporteurs, the Universal Periodic Review of the UN Human Rights Council, and in the recommendations of these bodies to the State Parties.

The emergence of human rights indicators is part of broader interest in indicators as tools for policymaking and political decision-making. Human rights indicators belong to a particular subset of indicators, legal governance indicators, which purport “to measure practices or perceptions of good governance rules of law, corruption, regulatory quality, and related measures.”⁶ The UNDP World Development Report, Freedom House’s Freedom in the World, the World Justice Report’s measurement of the rule of law, and the World Bank’s Doing Business Index are examples of well-known efforts to measure governance outcomes using legal indicators. Indicators of legal governance are used to measure the “implementation of human rights standards and commitments, to support policy formulation, impact assessment and transparency.”⁷ Measuring the gap between universally acknowledged standards and implementation efforts of national governments will contribute to the realization of the human right to science. Further, because indicators can measure such gaps for different countries over various time points, researchers can employ indicators to draw geographical and chronological comparisons of efforts to realize the human right to science.

The popularity of indicators has generated interest among social scientists.⁸ This literature describes indicators as the “technology of global governance.”⁹ Global governance is defined as “the means used to influence behavior, the production of resources and the distribution of resources” beyond a single state.¹⁰ According to Miller and Rose, “technologies” are mechanisms that constitute the process of governance. Indicators, scholars contend, have surged to the status of “technology” of global governance, and are used to set standards and to make decisions concerning governance matters that transcend a single state. Indicators have acquired this status for two reasons: they are efficient and consistent tools,¹¹ and appear, at least on

⁵ Ibid. at para. 6.

⁶ Kevin E. Davis, Benedict Kingsbury, and Sally Engle Merry, “Introduction: The Local-Global Life of Indicators: Law, Power, and Resistance,” in *The Quiet Power of Indicators: Measuring Governance, Corruption, and Rule of Law*, ed. Sally Engle Merry, Kevin E. Davis, and Benedict Kingsbury, Cambridge Studies in Law and Society (Cambridge: Cambridge University Press, 2015), 1.

⁷ United Nations, Office of the High Commissioner for Human Rights, “Human Rights Indicators,” www.ohchr.org/EN/Issues/Indicators/Pages/HRIndicatorsIndex.aspx.

⁸ Merry, *The Seductions of Quantification: Global Governance, Human Rights, and the Rise of Indicator Culture*; Kevin E. Davis et al., *Governance by Indicators: Global Power Through Classification and Rankings, Law And Global Governance* (Oxford University Press, 2012).

⁹ Kevin E. Davis, Benedict Kingsbury, and Sally Engle Merry, “Introduction: Global Governance by Indicators,” in *Governance by Indicators: Global Power through Quantification and Rankings*, ed. Kevin E. Davis et al. (Oxford: Oxford University Press, 2012), 10–18.

¹⁰ Davis, Kingsbury, and Merry, 10–12.

¹¹ Ibid., 17. The authors note that “[t]he striking increase over the decades since 1990 in the creation and use of indicators as forms of knowledge for global governance arguably reflects the greater demand for

their face, to be inherently bureaucratic rather than political, and thus devoid of the problems and contestations typically associated with political decisions in the global arena. These two reasons explain the success of indicators, a phenomenon captured effectively by Sally Engle Merry with the expression “seductions of quantification.”¹² Insights arising from Merry’s and others’ work¹³ are important to place human rights indicators in historical context and assess their role in human rights discourses. However, before we turn to human rights indicators, we want to first define what indicators are.

15.3 DEFINING INDICATORS

The Office of the United Nations High Commissioner for Human Rights (OHCHR) has defined indicators as “specific information on the state or condition of an object, event, activity or outcome that can be related to human rights norms and standards; that addresses and reflects human rights principles and concerns; and that can be used to assess and monitor the promotion and implementation of human rights.”¹⁴ An influential definition comes from Paul Hunt, former UN Special Rapporteur on the Right to Health: “a human rights indicator derives from, reflects and is designed to monitor realization or otherwise of a specific human rights norm, usually with a view to holding a duty-bearer to account.”¹⁵

More generally, Davis, Kingsbury, and Merry, propose that an indicator can be defined as follows:

A named collection of rank-ordered data that purports to represent the past and projected performance of different units. The data are generated through a process that simplifies raw data about a complex social phenomenon. The data, in this simplified and processed form, are capable of being used to compare particular units of analysis . . . , synchronically or over time, and to evaluate their performance by reference to one or more standards.¹⁶

readily available and easily used comparative knowledge to inform decision-making as well as the increasing supply of information.”

¹² Merry, *The Seductions of Quantification: Global Governance, Human Rights, and the Rise of Indicator Culture*.

¹³ Markku Lehtonen, Léa Sébastien, and Tom Bauler, “The Multiple Roles of Sustainability Indicators in Informational Governance: Between Intended Use and Unanticipated Influence,” *Sustainability Governance and Transformation 2016: Informational Governance and Environmental Sustainability* 18 (February 1, 2016): 1–9, <https://doi.org/10.1016/j.cosust.2015.05.009>.

¹⁴ United Nations, Office of the High Commissioner for Human Rights, *Human Rights Indicators: A Guide to Measurement and Implementation* (New York: United Nations Human Rights, Office of the High Commissioner, 2012), 16 (hereinafter “OHCHR Guide”).

¹⁵ Paul Hunt, WHO Workshop on Indicators for the Right to Health, A Background Note (2003), cited in AnnJanette Rosga and Margaret L. Satterthwaite, “The Trust in Indicators: Measuring Human Rights,” *Berkeley Journal of International Law* 27, no. 2 (2009): 254. Hunt was one of the early proponents of indicators of human rights; his work concentrated on the right to health.

¹⁶ Davis, Kingsbury, and Merry, “Introduction: The Local-Global Life of Indicators: Law, Power, and Resistance,” 4.

This definition captures two important aspects of indicators: they are constructs and they simplify complex phenomena. Indicators are constructs in the sense that they do not exist in nature but are designed by human beings for a specific purpose, namely, to measure performance of units of analysis in reference to certain standards. A human right can be the unit of analysis, its realization the performance to be measured.

Further, indicators try to simplify complex phenomena. Human rights are multi-dimensional legal artefacts for which realization depends upon the activation of various institutional domains. Indicators are tools used to reduce the inherent complexity of each human right into “units” that lend themselves to measurement. Simplification is thus instrumental to measurement. However, indicators also enable analyses of human rights that add new dimensions of the reading of legal instruments, UN bodies’ reports, case law, and related sources. This analytical level is located midway between a general notion of the normative content of human rights and how such rights operate in specific cases. Compared to doctrinal analyses, such as how human rights are codified and interpreted, indicators open the door to analyses that consider human rights less formalistically, but look at how rights are realized at a level that is closer to the rights holders and authority responsible for implementing the rights. Compared to data documenting specific violations of human rights, indicators operationalize data to permit the assessment of human rights at a more holistic level than that of specific violations. Still, experts attempt to disaggregate data to identify discrimination across suspect categories, such as by gender, skin color, or age. Such discrimination, of course, runs contrary to the quality of universalism characterizing human rights.

15.4 HUMAN RIGHTS INDICATORS AND THE CESCR

Although indicators have been part of the human rights reporting discourse for thirty years, their conceptualization and use with reference to economic, social, and cultural (ESC) rights is recent and relatively unsettled. This is the result of history.¹⁷ The CESCR turned to indicators in the 1980s on realizing that ESC rights were not as developed as civil and political rights. The CESCR imagined that developing universally applicable, rights-specific indicators might bridge that gap and facilitate the development of the core content of ESC rights.¹⁸ Consequently, throughout the 1990s, the CESCR led efforts to develop universally applicable,

¹⁷ For a thorough account of this history, see, Rosga and Satterthwaite, “The Trust in Indicators: Measuring Human Rights”; AnnJanette Rosga and Margaret L. Satterthwaite, “Measuring Human Rights: U.N. Indicators in Critical Perspective,” in *Governance by Indicators: Global Power through Quantification and Rankings*, ed. Kevin E. Davis et al. (Oxford University Press, 2012), 297–316.

¹⁸ Rosga and Satterthwaite, “Measuring Human Rights: U.N. Indicators in Critical Perspective,” 299–301.

rights-specific indicators. At that time, the Committee envisioned its role as the producer of such indicators.

After a decade of unsuccessful attempts to develop indicators, the CESCR abandoned their goal of producing them and repositioned itself as the auditor of state-produced indicators.¹⁹ This change in position is documented in General Comment 14, in which the CESCR stated that, as part of their treaty obligations, State Parties were required to monitor the realization of ESC rights on their own. To do so, they were required to create and use their own indicators, with the CESCR acting as the reviewer and auditor of those indicators. At the same time, the CESCR engaged the OHCHR as the expert body responsible for developing compliance indicators. After extensive consultation with international experts, the OHCHR reached a more limited goal and, in 2012, published *Human Rights Indicators: A Guide to Measurement and Implementation* (hereinafter “OHCHR Guide”), laying out the conceptual framework and a set of illustrative indicators with the idea that States would use them in reporting to the CESCR.²⁰ Indicators for the right to science are not among the illustrative indicators produced by the OHCHR.

Engaging the OHCHR resulted in the transformation of indicators from political constructs to technical ones.²¹ Based on its expertise, the OHCHR clearly indicated that ESC rights indicators must be designed and used primarily to monitor compliance with treaty provisions. Further, it distilled technical standards to which producers of indicators, such as State Parties and civil society organizations, should adhere. However, the OHCHR did not settle all questions regarding human rights indicators. The OHCHR Guide navigates with some difficulty the unsettled questions of whether human rights indicators should be universally available or state-generated and context specific. In fact, it suggests that both are true. However, this conclusion generates confusion when it comes to applying the OHCHR principles and standards to developing new indicators, as we attempt to do in this chapter. Should indicators focus on compliance measurements along dimensions that apply to all State Parties? Or should they reflect the different level of progressive realization of the right? Science is a field particularly fraught with imbalances because differences among countries’ abilities to produce scientific knowledge, partly due to variation in availability of resources that can be allocated to research and development, are staggering. We will come back to this challenge later in the chapter.

15.5 DESIGNING INDICATORS OF THE RIGHT TO SCIENCE

According to the case study analysis conducted by Davis, Kingsbury, and Merry, indicators are developed following a three-step trajectory: conceptualization,

¹⁹ Rosga and Satterthwaite, 307–311.

²⁰ OHCHR Guide, 88–101.

²¹ Rosga and Satterthwaite, “Measuring Human Rights: U.N. Indicators in Critical Perspective,” 310–311.

production, and use.²² Conceptualization requires outlining a theory underpinning the indicator followed by developing categories for measurement and modes of analyzing the data.²³ At this stage, important choices are made that will define what is measured and how. Actors, institutions, expertise, temporality, and resources all influence these choices.²⁴ Production entails collecting data and promulgating indicators. According to Davis, Kingsbury and Merry, promulgation is comprised of presenting, packaging, and disseminating indicators.²⁵ Through promulgation, indicators accomplish one of their essential tasks: to represent the performance of what is measured. To perform this task, raw data must be organized and then operationalized to provide representations of the implications of that organization.²⁶ Operationalization is the process of connecting concepts to observations of a phenomenon, which includes a case's value on a variable.²⁷ Finally, use occurs when indicators are accessed, consumed, and deployed by the nonproducers of indicators.

Fortunately, the OHCHR Guide facilitates the design of human rights indicators as it addresses the three stages of development of indicators (conceptualization, production, and use). Our proposal of indicators of the right to science builds upon the conceptual framework and illustrative indicators presented in the Guide.

15.5.1 *Conceptualization*

The OHCHR Guide conceptualizes human rights indicators as compliance monitoring tools. They are therefore designed to measure the adherence by State Parties to a legal standard. For measurement to be possible, the particular human right's legal standard must be translated into a limited number (up to four or five) of tangible characteristics called "attributes," which must be at the same time comprehensive ("based on an exhaustive reading of the standard")²⁸ and selective ("[t]o the extent feasible, the attributes of the human right should collectively reflect the essence of its normative content.")²⁹ Compliance is then assessed through indicators that measure the State Party's commitment, effort, and achievements in relation to each attribute. Based on Hunt's work on the human right to health,³⁰ the OHCHR

²² Davis, Kingsbury, and Merry, "Introduction: The Local-Global Life of Indicators: Law, Power, and Resistance," 10–16.

²³ *Ibid.*, 10.

²⁴ *Ibid.*, 11.

²⁵ *Ibid.*, 12.

²⁶ *Ibid.*, 12–14. Aspects of promulgation include the presentation of data in buckets so that specific measurements become evident, presentation of a data in the form of time-series analysis, and aggregation by country to allow cross-country comparison.

²⁷ Russell K. Schutt, *Investigating the Social World: The Process and Practice of Research*, 5th ed. (Thousand Oaks, Calif.: SAGE Publications, Inc., 2006), 98.

²⁸ OHCHR Guide, 31.

²⁹ *Ibid.*

³⁰ Paul Hunt, The right of everyone to enjoy the highest attainable standard of physical and mental health. A/C.3/58/SR.41.

Guide identifies three types of indicators: structural, process, and outcome. Structural indicators “help in capturing the acceptance, intent and commitment of the State to undertake measures in keeping with its human rights obligations.”³¹ Process indicators “help in assessing a State’s efforts, through its implementation of policy measures and programmes of action, to transform its human rights commitments into the desired results.”³² Outcome indicators “help in assessing the results of State efforts in furthering the enjoyment of human rights.”³³

15.5.2 *Production*

Production involves data collection and promulgation. Data collection entails identifying sources for human rights indicators and, if needed, setting up data-generating mechanisms. The OHCHR identifies sources and methods to collect data, which include qualitative and quantitative information describing “acts of human rights violations and ident[if]ing victims and perpetrators,” socioeconomic and administrative statistics, perception and opinion surveys, and expert judgments. This list is typical of other governance indicators. Limitations on data availability and access to resources to collect new data may restrict the choice of indicators. As the OHCHR points out, this dilemma has implications for the choice of indicators because “[t]he use of indicators as a human rights assessment tool depends critically on the availability of relevant and reliable data.”³⁴

The OHCHR Guide lays out prescriptions that producers of indicators must follow in identifying sources of data or setting data-generating mechanisms. First, data collection must be reliable, transparent, and independent. Data sources and generating-mechanisms must be chosen to produce reliable indicators.³⁵ Indicators are reliable if the same mechanisms used over time produce consistent values, all things remaining equal. Second, transparent methods that a third party can verify lead to acceptable indicators that can be employed to study human rights. Third, when conducting data collection, individuals and organizations producing indicators should be independent of the subjects being monitored.

The OHCHR also prescribes that indicators be “global and universally meaningful but also amenable to contextualization and disaggregation by prohibited grounds of discrimination . . . and by vulnerable or marginalized population group at country level.”³⁶ Disaggregation is defined in terms of “sex, age, region (e.g., urban/rural) or administrative unit, economic wealth (e.g., quintile or decile of income or expenditure), socioeconomic status (e.g., employment status) or

³¹ OHCHR Guide, 34.

³² *Ibid.*, 36.

³³ *Ibid.*, 38.

³⁴ *Ibid.*, 21.

³⁵ *Ibid.*, 51. (“The reliability of an indicator refers to its consistency in the estimate or the value of an indicator if the data-generating mechanism employed for devising it is repeated.”)

³⁶ *Ibid.*, 51.

educational attainment.”³⁷ Disaggregation permits analyses of discrimination according to categories that typically are socially unacceptable.

Indicators must also be “human rights standards-centric; anchored in the normative framework of rights.” To ensure this requirement is met, three principles must be followed. First, when an indicator’s unit is the individual, and the individual is the source of the indicator’s data, that individual “should have the option of self-identifying when confronted with a question seeking sensitive personal information related to them” (the principle of self-identification). These include identification with a particular racial or ethnic group. Second, “all data-collection activities must respect robust guarantees to prevent abuse of sensitive data” and be regulated by law (the principle of data protection). Third, when feasible, data must be disaggregated at the desired level (the principle of disaggregation).

Finally, indicators must be developed employing a transparent and verifiable methodology, be timely, and be time-bound.³⁸ The “structural, process, and outcome indicators” framework helps achieve this objective.³⁹ In fact, structural indicators tend to be stable because legal reform and policy change occur relatively infrequently. Outcomes do not change momentarily but capture trends that develop over time. Conversely, process indicators are “more sensitive to changes . . . therefore more effective in capturing the progressive realization of the right or in reflecting the efforts of the state parties in protecting the rights.” To this list of prescriptions, we add validity and importance. Simply put, validity is actually measuring what we intend to measure.⁴⁰ An indicator may be reliable, but not valid. For instance, an indicator may measure a phenomenon repeatedly over time, but that measure may be incorrect, or invalid. Importance concerns whether the indicator is valuable and important for studying and assessing human rights.⁴¹ The properties of being valuable and important are related to being meaningful, centered around human rights, and transparent, but merit distinct attention because of their utility to establishing human rights indicators.

Regarding promulgation, that is the presentation, packaging, and dissemination of indicators, the OHCHR Guide instructs readers to organize and visualize indicators in the form of a matrix in which the attributes that capture the normative standard of a right are placed on the horizontal axis and the indicators on the vertical axis. A matrix approach offers a bird’s-eye view of the normative content of the right being monitored. “[T]he tabular format shows the range of indicators that are relevant to capturing the normative content and the corresponding obligations of human rights standards.” It offers a reader a clear overview of the normative content

³⁷ Ibid., 68.

³⁸ Ibid., 50.

³⁹ Siobhan McInerney-Lankford and Hans-Otto Sano, *Human Rights Indicators in Development: An Introduction*, World Bank Studies (World Bank Publications, 2010), 19–20.

⁴⁰ Schutt, *Investigating the Social World: The Process and Practice of Research*, 129.

⁴¹ UN Women, www.endvawnow.org/en/articles/336-indicators.html.

of a right just by looking at the one-page template laying out the indicators and the attributes of the right. Additionally, a matrix approach also offers readers the opportunity to focus solely on certain sections of the matrix. Focus may thus be restricted to indicators of a single attribute (a single column) or one a single indicator cutting across multiple attributes (a single row). This strategy may be useful to civil society organizations interesting in monitoring only certain indicators or certain attributes. This approach, the OHCHR argues, leads to “the selection of a few indicators, at any given point in time, to monitor the implementation of human rights is more informed and likely to be more meaningful than would otherwise be the case.”⁴²

15.5.3 Use

According to the OHCHR Guide, compliance monitoring is the most critical use of indicators. This use is at the core of the monitoring mechanism set up by the ICESCR, which focuses on State Parties’ compliance with their treaty obligations and progress towards securing the universal realization of human rights. Indicators facilitate monitoring by offering a “structured and transparent approach to applying standardized information . . . to national human rights assessments.”⁴³ This is not the only use that the OHCHR Guide envisions though. In fact, four additional uses are possible: performance monitoring; human rights advocacy and people empowerment; national human rights plans and development plans; and human rights budgeting.⁴⁴

Performance monitoring measures the extent to which development interventions achieve the intended results, relative to what was planned.⁴⁵ Indicators can be used in human rights advocacy to make “human rights more concrete and tangible in the eyes of policymakers,” to contextualize efforts to realized human rights thus “encouraging national ownership of the advocacy strategy,” and to capture the range of issues involved in the realization of specific rights.⁴⁶ Indicators can also be used in the design and implementation of national human rights plans and development plans. Introduced at the World Conference on Human Rights, national action plans are instruments in which a state identifies the steps necessary to improve the promotion and protection of human rights.⁴⁷ Commitment-effort-results indicators can be used to frame these plans and guide their implementation. Finally, indicators can be used by states to draft budgets that are aligned with their human rights

⁴² OHCHR Guide, 73.

⁴³ *Ibid.*, 104.

⁴⁴ *Ibid.*, 104–126.

⁴⁵ Organisation for Economic Co-operation and Development, *Glossary of Key Terms in Evaluation and Results Based Management* (Paris, 2002).

⁴⁶ OHCHR Guide, 112.

⁴⁷ Vienna Declaration and Programme of Action (Adopted by the World Conference on Human Rights in Vienna on June 25, 1993), para. 71.

obligations and prioritize spending resources likely to result in improved development and governance.⁴⁸

While adequate indicators can be used for any of these purposes, it is important to note that the intended use has an impact on the design of indicators. To reiterate, what indicators measure can become goals that guide nation states in their efforts to implement human rights. One significant concern is that if no indicator of a given component of a human right exists, a national government may fail to implement that particular component. This is particularly relevant to the work we present in the chapter as we are proposing newly designed indicators. If the goal is to monitor compliance, which is the case of the indicators we propose here, indicators must be anchored to human rights standards. If the goal is to measure the effectiveness of development programs or national human rights plans, indicators are better anchored to the objectives of those programs, which are to support the measurement of inputs, outputs, outcomes, and impact.⁴⁹

15.6 BUILDING THE RIGHT TO SCIENCE INDICATORS

Before getting to the proposed indicators, it is important to state certain key assumptions of our proposal.

First, we had to define the intended use of the indicators because different uses call for different designs of the indicators concerned. We chose to propose indicators to be used primarily for compliance monitoring rather than performance monitoring. The implication for indicator design is that we follow the “structural, process, outcome” model of indicators rather than the “input, output, outcomes, impact” model.⁵⁰ Our choice is in line with how the CESCR and the OHCHR have engaged with human rights indicators for more than two decades. We envision the proposed indicators being referenced by the CESCR when instructing states as to what they must address in their periodical reports, by States parties when reporting their progress, and by civil society organizations when drafting parallel reports. We focus on compliance monitoring because we believe this is an important function in achieving progress towards the realization of the right to science.

Envisioning indicators for compliance monitoring does not exclude their use, directly or indirectly, to achieve other objectives discussed in the OHCHR Guide. In addition to referencing them in parallel reports, human rights advocates can use indicators *directly* to advocate for the realization of the right at the state level and in shaping the science policy discourse.⁵¹ Monitoring indicators can also be used

⁴⁸ OHCHR Guide, 121–122.

⁴⁹ *Ibid.*, 110.

⁵⁰ *Ibid.*, 110. See the discussion of “uses” in above in Section 15.5.3.

⁵¹ Andrea Boggio and Cesare P. R. Romano, “Freedom of Research and the Right to Science,” in *The Freedom of Scientific Research* (Manchester, England: Manchester University Press, 2018), 170–172, www.manchesterhive.com/view/9781526127686/9781526127686.00023.xml.

directly in human rights budgeting as they identify areas (process indicators) that measure allocation of research funding. Monitoring indicators can also be used *indirectly* in performance evaluation to identify the inputs, outputs, outcomes, and impacts to be measured when a national human rights plan or a development program is assessed.

Second, we sought to clarify the human right standard expressed in Article 15 of the ICESCR because indicators must be grounded in, and drawn from, this standard. The challenge for us was that, as the essays in this volume amply demonstrate, the normative content of the right is underdeveloped compared to other rights – even other cultural rights.⁵² Consequently, identifying attributes under these conditions was inherently difficult as the human rights standards that underpin the right are unsettled.⁵³ Keeping in mind that this is, for the most part, uncharted territory, we have identified attributes and indicators based on various sources. The most important is General comment No. 25 on Science and economic, social and cultural rights.⁵⁴ Adopted in 2020, the General Comment, General Comment lays out the general, specific, and core obligations of State parties and articulate duties connected with international cooperation and national implementation.⁵⁵ Another important source is subsequent state practice in the application of the ICESCR. This practice is evidence of an agreement between the parties under Article 31(3)(b) of the 1969 Vienna Convention on the Law of Treaties and therefore are a source of interpretation of treaties.⁵⁶ State practice emerges from the reports filed by State Parties as part of the monitoring process of human rights treaties, which on occasion mention the right to science.⁵⁷ The most comprehensive source of analysis of state

⁵² It's important to note that, traditionally, cultural rights have received less attention than other kind of human rights, especially political rights. See, General Discussion on the Right to Take Part in Cultural Life as Recognized in Article 15 of the ICESCR, ESC, E/C.12/1992/2, at 59, para. 204.

⁵³ We are also mindful that the uncertainties surrounding the normative content of the right to science offer the opportunity to use indicators as tools to better define the human right standard. The matrix we drafted is itself a creative exercise that clarifies the normative content of the right. Further, if the indicators will be eventually used – by the CESCR, State Parties and civil society organizations as monitoring indicators – reporting based on these indicators will constitute state practice under the ICESCR and will be a formal source of interpretation of Article 15.

⁵⁴ See, General Comment No. 25. Besides “assisting the States parties in fulfilling their reporting obligations,” general comments are commonly considered to be the official interpretation of a right on the part of the United Nations. See, Committee on Economic, Social and Cultural Rights. Introduction, The purpose of general comments, U.N. Doc. E/1989/22, annex III at 87 (1989), reprinted in *Compilation of General Comments and General Recommendations Adopted by Human Rights Treaty Bodies*, U.N. Doc. HRRGEN/Rev.6. 2003; Helen Keller and Leena Grover, “General Comments of the Human Rights Committee and Their Legitimacy,” in *UN Human Rights Treaty Bodies: Law and Legitimacy*, ed. Geir Ulfstein and Helen Keller, Studies on Human Rights Conventions (Cambridge: Cambridge University Press, 2012), 116–198.

⁵⁵ See, General Comment No. 25, paras. 23–27, 41–52, 77–89.

⁵⁶ According to Article 31(3)(b) of the 1969 Vienna Convention on the Law of Treaties, state practice is “any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation.”

⁵⁷ Rumiana Yotova and Bartha M Knoppers, “The Right to Benefit from Science and its Implications for Genomic Data Sharing,” *The European Journal of International Law* 31, no. 2 (2020): 665–691. The

practice was recently completed by Yotova and Knoppers, who construct it upon reviewing all reports filed by State Parties to the ICESCR pursuant to Articles 16 and 17 of the ICESCR. A word of caution is needed in approaching state practice as a source of attributes and indicators. Since state practice emerges from periodical reports, what State Parties are asked to report is crucial. Reports are typically structured according to UN reporting guidelines, including the ones the CESCRC employs.⁵⁸ If State Parties are expected to present information on the human right to science to the CESCRC, but the reporting guidelines do not request information on a certain aspect of the right, State Parties are likely not to focus on, even think about, the aspect of the right that are not mentioned in said guidelines. The same may be true for civil society organizations who monitor UN monitoring efforts and State Parties' implementation efforts. What we are suggesting is that, if UN reporting guidelines do not instruct State Parties to present information about a particular aspect of the human right to science, that aspect may come to be viewed as unimportant to the right. Finally, we considered soft law instruments, such as the Venice Statement, which is the outcome of the gathering of experts in 2009 under the auspices by UNESCO,⁵⁹ the reports of Farida Shaheed in her capacity as Independent Expert and then Special Rapporteur on cultural rights,⁶⁰ and various UNESCO Declarations addressing the relationship between science and human rights.⁶¹

Third, we considered whether to include only indicators for which data are readily available. Data availability, of course, shapes which indicators are established, and which are not. The advantage of limiting the proposal to indicators based on existing data is that the CESCRC and State Parties could promptly deploy such indicators in compliance monitoring. However, when data are not readily available about a particular aspect of a right, indicators will probably not be developed.

authors show that 123 of the 168 States Parties have indicated taking specific measures to implement the right to benefit from science.

⁵⁸ Guidelines on Treaty-Specific Documents to be Submitted by States Parties under Articles 16 and 17 of the ICESCR, ESC, E/C.12/2008/2, at 15, paras. 70–73.

⁵⁹ UNESCO, *The Right to Enjoy the Benefits of Scientific Progress and Its Applications* (Venice Statement), 2009. The Venice Statement identifies three constitutive elements of the normative content of the right to science: the creation of an enabling environment for the conservation, development and diffusion of science, enjoyment of the benefits of scientific progress, and protection from the abuse and adverse effects of scientific progress.

⁶⁰ The work of Farida Shaheed is available at www.ohchr.org/EN/Issues/CulturalRights/Pages/FaridaShaheed.aspx. See, also, Lucky Belder and Helle Porsdam, *Negotiating Cultural Rights: Issues at Stake, Challenges and Recommendations* (Cheltenham: Edward Elgar, 2017).

⁶¹ UNESCO, *Universal Declaration on the Human Genome and Human Rights* (adopted at the 29th Session of the General Conference on November 11, 1997) BR/2001/PI/H/1; UNESCO, *International Bioethics Committee, Human Genetic Data: Preliminary Study by the IBC on its Collection, Processing, Storage and Use* (SHS-503/01/CIB-8/3 (Rev.2), May 15, 2002); UNESCO, *Universal Declaration on Bioethics and Human Rights* (adopted by the General Conference on 19 October 2005); UNESCO, *Recommendation on Science and Scientific Researchers* (adopted at the 39th Session of the General Conference on November 13, 2017) SHS/BIO/PI/2017/3.

Because this problem may lead to failure to measure, absence of a measure may come to be understood as indicating that aspect of the right is not important as lacking socio-legal value. Including indicators for which data are not readily available has the advantage of broadening progress monitoring to aspects of the right that are currently not captured empirically. Based on this reasoning, we decided to include indicators for which data are currently *not* available, knowing that the CESCR can request State Parties to gather and publicly share this information.⁶²

15.7 A MATRIX OF RIGHT TO SCIENCE INDICATORS

Based on these key elements of human rights indicators, we have generated a matrix that applies the OHCHR framework and follows the model of the indicative indicators published in the OHCHR Guide (see Appendix A). This matrix includes attributes on the horizontal axis and structural, process, and outcome indicators on the vertical axis.

Attributes are translations of legal standards into measurable dimensions. This means that each attribute is dependent upon, albeit may not coincide with, the legal obligations that the ICESCR creates. Our reading of Article 15 of the ICESCR led us to identify three main attributes and two secondary attributes. The three main attributes are scientific freedom, access to benefits, and opportunities to participate. The secondary attributes are the duty to create an enabling environment and to facilitate international cooperation. These secondary attributes complement the three main attributes rather than creating independent obligations. For instance, an enabling environment for science “implies *inter alia* academic and scientific freedom”⁶³ and international cooperation facilitates both the exercise of scientific freedom and access to benefits. These attributes must not be construed as exhaustive of the normative content of Article 15. Although the OHCHR Guide cautions readers to identify no more than four or five attributes, more attributes can be added. In fact, access to benefits could be conceptually split into two attributes: access to scientific knowledge and access to the applications of scientific knowledge. Furthermore, access to scientific knowledge can be expanded to measure the extent to which State parties protect and foster open science practices. In our minds, the indicators we propose are meant to trigger a conversation rather than close the door to further elaboration. This point is crucial given renewed attention to the right to science, as well as evolution in science, technology and human rights.

Indicators “unpack specific aspects of implementing the standard associated with that right.”⁶⁴ Structural indicators capture the acceptance, intent and commitment

⁶² General Comment No. 25, para. 88, direct States parties to “identify appropriate indicators and benchmarks, including disaggregated statistics and time frames, which allow them to monitor effectively the implementation of the RPEBSPA.”

⁶³ UNESCO, Venice Statement, para. 13(a).

⁶⁴ OHCHR Guide, 30.

of the State to undertake measures in keeping with its human rights obligations. In relation to the right to science, structural indicators include signing and ratifying the ICESCR and its Optional Protocol. Additionally, it captures the creation of the basic institutional mechanisms deemed necessary for the promotion and protection of the right's attributes. This includes adopting express legislative provisions to incorporate the obligations arising out of Article 15 of the ICESCR in domestic laws. Data for this indicator are partially available as they can be extracted from state reports⁶⁵ or derived from researching the laws of State Parties.⁶⁶

Structural indicators of different kinds correspond to the three main attributes. *Scientific freedom* indicators include legislation that ensures scientists' abilities to pursue any kind of research, to engage in self-governance (through scientific societies, respecting self-regulatory instruments, and other means), to be free of censorship and other threats to their independence, to engage in collaborations, to travel domestically and internationally, and to access funding. Structural indicators should also capture whether laws and regulations meet the requirements of "legality," that is, to convey in clear terms what is lawful and what is not. *Access to benefits* indicators include legislation that ensures adequate access to scientific knowledge, translational pathways to transforming knowledge into tangible benefits (pharmaceutical drugs, innovations in the agricultural, industrial, and other sectors), and policy development mechanisms that promote the use of scientific knowledge in decision making. *Opportunities to participate* indicators include laws and regulations addressing discrimination in recruitment of participants in research, ensuring equality by gender and minority status⁶⁷ in access to scientific education and professions, promoting citizen science, and including indigenous populations and minorities in the formulation of science policy.

Process indicators capture implementation efforts to transform human rights commitments into the desired results. Evidence of these efforts include resource allocation, developing and deploying plans and programs, setting up institutional mechanisms and incentives that redress violations, stimulate compliance, and promote the realization of the right. *Scientific freedom* indicators include the number (total number and number of publicly funded) and quality of universities, research institutions, and scientific societies, percentage of GDP allocated to research and development, and number of professionals employed as researchers (in total and by government). *Access to benefits* indicators include data on

⁶⁵ Yotova and Knoppers, "The Right to Benefit from Science and Its Implications for Genomic Data Sharing," 677-685.

⁶⁶ See, for instance, the indicators published at www.freedomofresearch.org/right-to-science-indicators/.

⁶⁷ The OHCHR Guide notes that, generally, disaggregation is encouraged on the "sex, age, economic and social situation, race, colour, language, religion, political or other opinion, national or social origin, property, birth, disability, health status, nationality, marital and family status, sexual orientation and gender identity, place of residence, and other status." However, the Guide does not mandate a particular kind of disaggregation and leaves it open to State Parties to proceed in a way that accounts for "national circumstances." See, OHCHR Guide, 69-70.

enrollment in tertiary education, on access to and use of university library or the internet, quality of math and science education, and internet use in schools for learning purposes. *Opportunities to participate* indicators include disaggregated data (by gender and minority status) on professional and educational opportunities in the sciences, participation in research and in the formulation of science policy, citizen science, the ability to attract talent from abroad, and scientists' participation in international conferences.

Outcome indicators measure the results of the commitments and efforts in furthering the enjoyment of human rights. *Scientific freedom* indicators include reported cases of persecution of, sanctions of, or political pressure on scientists (in the absence of evidence of misconduct), number and quality of articles published in scientific journals, and availability of scientists and engineers. *Access to benefits* indicators include aggregated data on scientific literacy, educational attainment and membership in professional and scientific societies, scientific literacy, attainment or completion of a doctoral degree or equivalent, suppression of or prohibition to divulge scientific data and/or knowledge (this could also be a scientific freedom indicator), and on innovation (collaboration between business and academia, development of drugs and other translational products). Finally, *opportunities to participate* indicators include disaggregated data (by gender and minority status) on scientific literacy, educational attainment, and membership in the profession and scientific societies.

15.8 CONCLUSIONS

The human right to science may be a game changer. It has the potential to reduce discrimination when it comes to learning about and doing science. This right could strengthen scientists' freedoms to collaborate, publish, and conduct their research. It could also make possible international collaborations, which may lead to scientific advances with universal benefits.

Yet we need to know more about the impacts of the human right to science as societies move toward its realization. As this volume demonstrates, the terrain of the human right to science is vast. This chapter responds to calls for indicators of this right. Such indicators have manifold uses. Indicators will enable scholars to properly articulate the normative content of the human right to science. Indicators can be employed to assess compliance with international frameworks of human rights, which can be used to determine how nation states are performing in comparison with each other. UN bodies, nation states, and civil society actors, including watch dogs, can employ indicators to monitor implementation of the human right to science. This chapter, however, encourages experts, researchers, and leaders to maintain wariness of indicators. Although indicators are certainly useful, we must recognize their limitations, including what they do not measure. As scholarship moves forward, indicators will play key roles in understanding how science can benefit everyone.

Appendix A Proposed Compliance Indicators of Article 15 ICESCR

	<i>Scientific freedom</i>	<i>Access to benefits</i>	<i>Opportunities to participate</i>
<i>Structural</i>	<ul style="list-style-type: none"> • ICESCR Ratification status • ICESCR Additional Protocol ratification status • Constitutional or other forms of superior law recognizing the right to science • Legislation protecting scientific freedom • Legislation ensuring the protection and safety of scientists • Significant limitations on scientific freedom (are limitations legal, necessary, and proportionate?) 	<ul style="list-style-type: none"> • Legislation on access to scientific data, information, and knowledge, including open access initiatives • Significant limitations on access to scientific data, information, and knowledge (are limitations legal, necessary, and proportionate?) 	<ul style="list-style-type: none"> • Legislation permitting the participation of human subjects in research • Legislation mandating nondiscrimination based on gender in hiring • Legislation establishing age differences in formal education by gender • Legal limits on conference travel
<i>Process</i>	<ul style="list-style-type: none"> • Number of universities/research institutions • Number of scientific societies • Quality of scientific research institutions • Percentage of GDP allocated to Research and Development • Rate of R&D collaboration between business and academia • Average university ranking score of countries based on their top 3 universities • Number of professionals employed as researchers (overall and by government) • Reported cases of suppression of scientific data and/or knowledge 	<ul style="list-style-type: none"> • Enrollment in tertiary education • Proportion of population with access to university library • Proportion of population with access to internet • Percentage of the population that uses the Internet • Quality of math and science education • Internet use in schools for learning purposes 	<ul style="list-style-type: none"> • Country's ability to attract talent from abroad • International conference participation • Enrollment in tertiary education by gender

(continued)

	<i>Scientific freedom</i>	<i>Access to benefits</i>	<i>Opportunities to participate</i>
<i>Outcome</i>	<ul style="list-style-type: none"> • Persecution of, sanctions of, or political pressure on scientists in the absence of evidence of misconduct • Number of 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 • Number of published articles having received at least H citations in the period 1996–2014 • Availability of scientists and engineers 	<ul style="list-style-type: none"> • Degree of scientific literacy of 15-year-old students as measured by the Programme for International Student Assessment (PISA) • Percentage of population ages 25 and over that attained or completed a doctoral degree or equivalent 	<ul style="list-style-type: none"> • Percentage of population ages 25 and over that attained or completed a doctoral degree or equivalent by gender • Percentage of females employed with advanced degrees out of total employed • Percentage of foreign-born professionals in tertiary education