

EVALSDGs Insight # 18: Evaluating Quality of Science towards achievement of Sustainable Development Goals

PURPOSE:

[Science is crucial to help meet the challenges for sustainable development](#) as it lays the foundation for new approaches, technologies, and solutions to identify, clarify, and tackle future global challenges. When announcing the creation of an independent Scientific Advisory Board to advise UN leaders on breakthroughs in science and technology and how to harness the benefits of these advances and mitigate potential risks, the UN Secretary-General [stated in 2023](#), "scientific and technological progress can support efforts to achieve the Sustainable Development Goals (SDGs)." There is an urgent need for mainstream science and/or research (used interchangeably due to diverse contexts) to be delivered in a credible manner and to meet the needs of communities. To align with and contribute to meeting the SDGs, science needs to be inclusive and mission-driven, with funding and capacity building supported by multi-stakeholder engagement. This EVALSDGs Insight 18 highlights the role of science and research in contributing to the SDGs and presents evaluative framing and methods best suited to address the complexity of Research for Development (R4D) using CGIAR's approach to evaluate Quality of Science (QoS), and specifically bibliometrics, as part of a case study.

THE ISSUE:

The international community has recognized Science, Technology, and Innovation (STI) as drivers for effective change in society that clearly [contributes to most, if not all, SDGs](#). This is the case for CGIAR R4D interventions as well. For example, the CGIAR [Genebank Platform](#) contributed to SDG 2.5, the conservation of genetic diversity in soundly managed genebanks; and the CGIAR Research Program on [Climate Change, Agriculture and Food Security](#) to SDG 13, Climate Action.

However, evaluating quality, alignment, and contributions of R4D interventions with SDGs is not straightforward for evaluators, researchers, scientists, or funders. This Insight proposes a structured and comprehensive approach to evaluating the above by introducing the QoS evaluation criterion, and a menu of mixed methods.

Evaluating Quality of Science: A designated evaluation criterion of QoS is proposed as a clear and structured approach for evaluating the intersection of R4D and comparators in CGIAR, to better align with the SDGs. Its two core elements constitute: (1) *Scientific credibility* - the robust nature of research findings and the soundness and dependability of knowledge sources; and (2) *Legitimacy* - the fairness and ethical nature of the research process. Four interlinked dimensions of the QoS evaluation criterion: *research design, inputs, management processes, and outputs* are the core of any research project or program. (see Figure 2 for dimension definitions). They help to operationalize the QoS criterion and, depending on the context, can be mapped to standard OECD/DAC evaluation criteria as illustrated in Figure 1.

The CGIAR [Evaluation Guidelines: Applying the CGIAR QoR4D Framework to Process & Performance Evaluations](#) suggest mixed methods and the evaluation questions to be deployed against standard and designated evaluation criteria and four dimensions for assessing related R4D interventions with [FAQs](#) (see more on framing of the CGIAR approach on AEA [blog](#) and EES [EvalEdge podcast](#)).

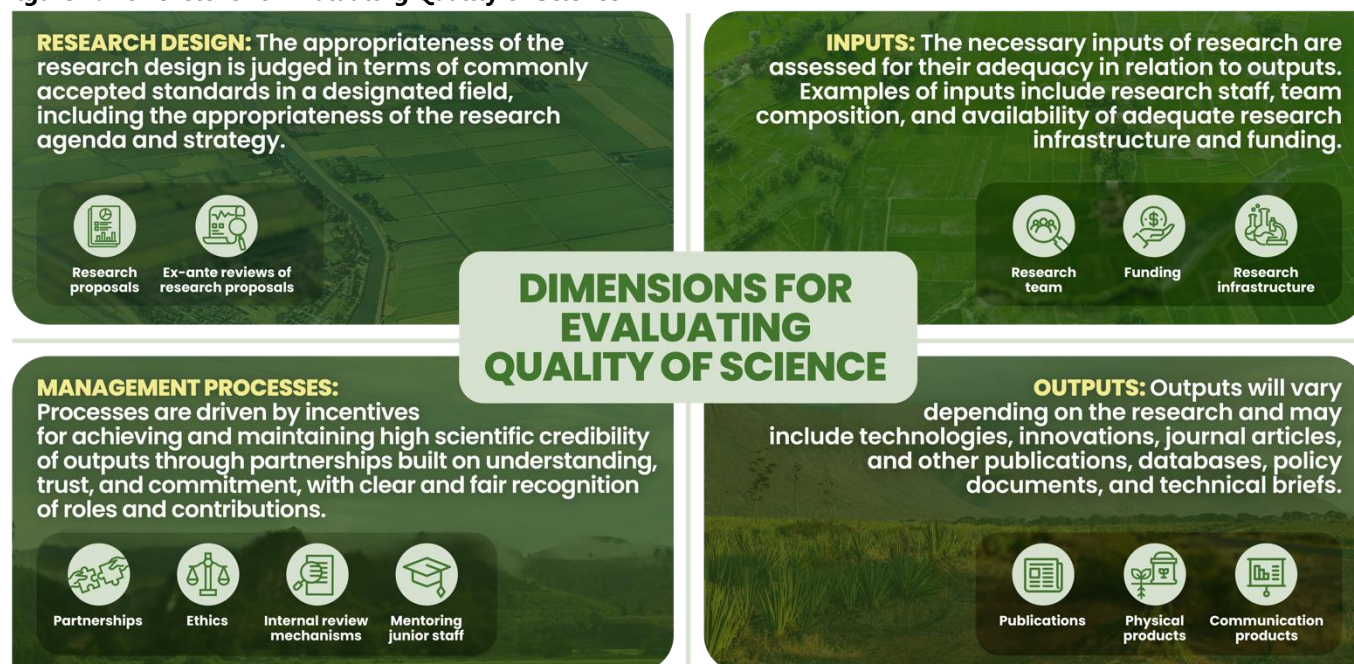
Evaluators familiar with qualitative methods (e.g., interviews, document reviews) in a development context, may be less familiar with quantitative indicators particularly useful for R4D organizations (e.g., bibliometrics, altmetrics), given that qualitative methods have historically been heavily foregrounded when assessing societal research outcomes ([Spaapen and Drooge 2011](#)).

Figure 1. Seven Evaluation Criteria Mapped to QoS Dimensions

EVALUATION CRITERIA								
QUALITY OF SCIENCE			RELEVANCE	COHERENCE	EFFICIENCY	EFFECTIVENESS	SUSTAINABILITY	IMPACT
DIMENSIONS	Design	X	X	X				X
	Input	X	X	X	X			
	Process	X			X	X	X	X
	Outputs	X	X				X	X

Figure 1 demonstrates how the four QoS dimensions map to seven evaluation criteria (six of OECD Development Assistance Committee and QoS as a standalone criterion), which frame how evaluative judgments are made in process and performance evaluations. If R4D interventions are to have a sustained contribution to the SDGs, related interventions must not only be relevant and effective, but also credible and legitimate. Credibility is more important for design and input dimensions, while legitimacy is especially important for processes and building strong, sustainable partnerships.

Figure 2. Dimensions for Evaluating Quality of Science



SDGs and evaluating QoS: design, inputs, and processes: CGIAR R4D projects are aligned with the SDGs. Depending on the context, targets, and priorities of partners, the research design and inputs can be shown to directly align with SDG 2, Food production and security; SDG 5, Gender inclusion; SDG 13, Adaptation and mitigation of climate change; and SDG 17, Effective, productive partnerships.

Furthermore, processes including stakeholder engagement, gender inclusiveness, mentorship, capacity building, institutional transparency, and incentive systems can be shown to directly align with SDGs 2, 5, and 17. **SDGs and analyzing QoS design, inputs, processes, and outputs - bibliometrics:** A nuanced approach to the evaluation of QoS allows for better role alignment of STI in contributing to the SDGs. Bibliometric methods constitute a powerful set of tools to contribute to the assessment of the scientific performance of STI by characterizing various dimensions of their scientific outputs—mostly peer-reviewed publications—such as the size of their production or their scientific (academic citation) impact. For example, the UN Population Fund analyzed nearly 2,000 publications on human reproduction over a 20-year period using such established bibliometric approaches to better understand the quality and impact of HRP's work ([Gurney et al. WHO/RHR/HRP/13.07](#)). Bibliometric data can also help manage scientific policies and measure progress toward the achievement of various social and economic objectives, notably through the capture of citations from policy-related documents ([CGIAR](#)

[Research Program on Policies, Institutes and Markets: Pinheiro et al., 2021; Zdawczyk et al., 2022](#)).

Emerging innovative bibliometrics increasingly allow assessments not just of outputs, but also elements of *research design, inputs, and/or process* dimensions. Bibliometric indicators can be used in monitoring the SDG-readiness of research projects, or the extent to which a research team's composition and environment exhibits characteristics that are associated with a greater likelihood of leading to subsequent SDG-aligned outcomes.

Table 1 presents a non-exhaustive selection of bibliometric indicators for use in monitoring and evaluation of SDG-readiness - where the quantitative indicator acts as an evaluation proxy. The *SDG readiness bibliometrics* capture components such as author collaboration (for instance, between authors from lower-middle-income and high-income countries), which show multi-stakeholder involvement and direct links to contribution to international partnerships (SDG 17). Academic-private collaborations on research toward sustainability (i.e., on research topics addressing SDG-related goals) additionally address transfer toward industry (SDGs 9 and 17). Bibliometrics can capture various forms of collaboration patterns such as these, as well as the extent to which research efforts combine different fields of knowledge (multidisciplinarity), speaking to the necessary approaches to tackling these complex goals from all sides ([Crow, 2023](#)).

Additionally, measuring the propensity to share articles' underlying datasets or the articles themselves through depositions in open repositories captures contributions to SDG 16 targets on accountable, inclusive, transparent societies. Measurement of gender equality in publication authorship contributes to tracking progress towards SDG 5.

Table 1. Bibliometric Indicators and Monitoring Research Projects - SDG-Readiness

Bibliometric indicator(s)	QoS evaluation dimension	SDG
Share of highly multidisciplinary publications	Design, inputs, and/or processes	All
Average share of women authorship, publication-level	Design, inputs, and/or processes	5
Share of publications with whose data has been deposited in open repositories	Design, inputs, and/or processes	16
Share of co-publications between a LMIC and a HIC; share of LMIC-LMIC co-publications	Design, inputs, and/or processes	17
Average share of LMIC women authorship, publication-level	Design, inputs, and/or processes	5, 17
Share of academic-private co-publications, in research areas contributing to sustainability; share of publications cited in patents, in research areas contributing to sustainability	Design, inputs, and/or processes	9, 17
Share of publications cited in policy-related documents, in research areas contributing to sustainability	Outputs	17
Citation impact, publication productivity (depending on content SDG-alignment)	Outputs	None or indirectly

Researchers, evaluators, and monitoring professionals have also attempted to directly measure thematic alignment of grant proposals and journal publications with SDG targets. Such methods are based on semantic analysis of text to search for key concepts aligned with the SDGs (Rivest et al., 2021). The above indicators can be used by experts in bibliometrics who analyze results while understanding limitations. One limitation is that the indicators simply show if a research publication is thematically relevant to an SDG, without deeper context on realized outcomes.

Mixed methods: integrating qualitative indicators with bibliometrics

In alignment with commitments such as The Leiden Manifesto for Research Metrics (Hicks et al., 2015) and the new Agreement on Reforming Research Assessment (European University Association, 2022), the bibliometric indicators have been designed for use within program evaluations to track aggregate outcomes from multiple projects.

Comprehensive evaluation of QoS requires balancing qualitative criteria and indicators related to inputs, processes, and likelihood of use with quantitative indicators. Despite new uses for process-oriented bibliometrics, many dimensions require qualitative methods for full assessment. Criteria such as capacity building and communication can be subject to both quantitative (e.g., numbers of trainees and methods/tools) and qualitative (e.g., useful to planned activities, relevance to the target audience) assessment.

Limitations of bibliometrics include data quality, design complexity, imperfect proxies, lack of normalization, and adequate capture of diversity and legitimacy. Author-level use of the indicators presented here is not recommended and has not been validated. To mitigate limitations and increase the credibility and validity of evaluations, bibliometrics should always be used

together with additional qualitative and quantitative methods, and through triangulation.

The [2020 evaluative reviews of CGIAR Research Programs](#) combined mixed methods and qualitative and quantitative indicators to evaluate QoS, resulting in credible, balanced, and useful evaluation results.

Potential conflicts and trade-offs: In evaluating the contribution of STI to the SDGs, some concerns remain about whether progress towards one SDG conflicts with another. It was learned from [Insight #14](#), which focused on environmental sustainability in evaluation, that some evaluations may focus too narrowly on planned results and relevant key performance indicators while excluding damaging downstream costs. It is important to recognize the potential for trade-offs between development and environmental sustainability. An understanding of the causal bases of trade-offs and careful attention to design and processes (risk assessment) in evaluating QoS is needed to manage and mitigate preventable conflicts.

KEY CONSIDERATIONS:

- A designated evaluation criterion on QoS is useful in R4D contexts.
- The four QoS dimensions allow evaluators to design and conduct nuanced and comprehensive evaluations to build evidence on how science contributes to progress toward the SDGs.
- Bibliometrics can help monitor research projects for SDG-readiness.
- Bibliometric indicators aid monitoring of contributions to SDGs. I.e., women's participation in research (SDG 5); international cooperation (SDG 17), academic-private transfer and innovation towards sustainable industrialization (SDG 9), and promotion of accountable, inclusive, transparent societies (SDG 16).

References

CAS Secretariat (CGIAR Advisory Services Shared Secretariat). (2020). CGIAR Research Program 2020 Reviews: Policies, Institutions, and Markets. Rome: CAS Secretariat Evaluation Function. <https://cas.cgiar.org/>

Crow, J. M. (2023, October 11). *Achieving UN climate goals needs purposeful, persistent action from science*. Nature News. <https://www.nature.com/articles/d41586-023-03090-7>

Gurney, K., Sheridan-Jones, B., & Thomson, S. (2013). Bibliometric Analysis. In *External Evaluation 2008-2012: Advancing Sexual and Reproductive Health* (pp. 245–288). Book, World Health Organization.

Hicks, D., Wouters, P., Waltman, L., De Rijcke, S., & Rafols, I. (2015). Bibliometrics: The Leiden Manifesto for research metrics. *Nature*, 520(7548), 429–431. doi:10.1038/520429a

Pinheiro, H., Vignola-Gagné, E., & Campbell, D. (2021). A large-scale validation of the relationship between cross-disciplinary research and its uptake

in policy-related documents, using the novel Overton altmetrics database. *Quantitative Science Studies*, 2(2), 616–642. https://doi.org/10.1162/qss_a_00137

Rivest, M., et al. (2021). Improving the Scopus and Aurora queries to identify research that supports the United Nations Sustainable Development Goals (SDGs) 2021. Mendeley Data. Elsevier BV. doi:10.17632/9SXDYKM8S4.4

Spaapen, J., & van Drooge, L. (2011). Introducing 'productive interactions' in social impact assessment. *Research Evaluation*, 20(3), 211–218. <https://doi.org/10.3152/095820211X12941371876742>

Zdawczyk, C., Vignola-Gagné, E., & Lenne, J. (2022). Expertise fused with context: Strengthening bibliometric recommendations through co-design. Retrieved from <https://iaes.cgiar.org/evaluation/news/expertise-fused-context-strengthening-bibliometric-recommendations-through-co>

Additional Reading

- [Preliminary Reflection and Comments of SAB on SDGs Final \(leopoldina.org\)](#)
- [Science – our best bet to achieve the SDGs? | United Nations](#)
- [Science, Technology and Innovation for Sustainable Development | United Nations](#)
- EvalForward: [Brief](#) on two discussions on evaluating QoS and STI in R4D context
- Technical Note. [Bibliometric Analysis to Evaluate Quality of Science in the Context of One CGIAR | CAS | CGIAR Advisory Services](#)
- Blog: [Independent advising in one CGIAR: Cross Pollination of Science Advice with Evaluative Evidence](#) (CGIAR's Independent Advisory and Evaluation Service)
- BLOG: [Expertise Fused with Context: Strengthening Bibliometric Recommendations Through Co-Design](#) (Science-Metrix/Elsevier with CGIAR)

Did you know?

EVALSDGs is a global network formed to add value and learning to SDGs, made up of people with a shared interest in evaluation and sustainable development. EVALSDGs Guidance Group (GG) is an EVALSDGs sub-group focusing on strengthening capacity development for evaluation and the SDGs. The EVALSDGs 'Insights' are short, light and easy to digest notes presenting ideas and new information, and stimulate thinking to strengthen evaluation capacity.

Authors of this Insight: Svetlana Negroustoueva and Jill Lenné (CGIAR's Independent Advisory and Evaluation Service), Etienne Vignola-Gagné and Christina Zdawczyk (Science-Metrix/Elsevier).

Editorial team: Dr. Dana Linnel and Ravi Ram.

To provide your feedback or get more information, please contact:

Lenyora Sihwa: sihwakabelo@gmail.com

Roxana Gómez Valle: roxana.gomezvalle@unitar.org

