Capacity to Measure Sustainable Development

William C. Clark[1], Alicia G. Harley[2]

[1]Harvey Brooks Professor of International Science, Public Policy and Human Development; Director, Sustainability Science Program, Harvard Kennedy School,

[2]Post-doctoral Fellow, Sustainability Science Program, Harvard Kennedy School; Lecturer in Environmental Science and Public Policy, Harvard College 0000-0002-3532-7754

Published on: Sep 10, 2020

DOI: 10.21428/f8d85a02.ffa1dd36

Cite as: Clark, William C., and Alicia G. Harley. 2020. "Capacity to Measure Sustainable Development." In *Sustainability Science: A Guide for Researchers*, edited by Alicia G. Harley and William C. Clark, 1st ed. Retrieved from https://www.sustainabilityscience.org/pub/2v26r7gd

---

One of the greatest and longest standing challenges facing sustainability science has been to design and implement methods for measuring sustainable development. As characterized by Partha Dasgupta in his seminal work on the subject (2004), the measurement challenge takes two forms: valuing recent pathways of development and evaluating the likely impact of policies or other interventions on future pathways of development.

A vast array of metrics has been used to value and evaluate development pathways. These range from GNP to carbon emissions to the Human Development Index to the UN's SDG metrics. Most capture something relevant to sustainability, none capture everything (Laurent 2018). Fortunately, one of the strongest contributions of science to sustainable development over the last two decades has been the beginnings of an integrative, theory-grounded, and useful capacity to measure one central feature of sustainability: the adequacy of the resource base to support human well-being now and in the future. Systematic efforts to assess the resources base, grounded in both theory and empirical work, are now being advanced on a number of fronts under the general banner of "Beyond GDP" (Stiglitz, Fitoussi, and Durand 2019). The variant of these approaches to measurement that has resonated most deeply with the sustainability science community is that on "inclusive wealth," recently summarized in a series of comprehensive reviews (Dasgupta 2014; Polasky et al. 2015; (Irwin, Gopalakrishnan, and Randall 2016)). We sketch the current state of play on inclusive wealth metrics in the remainder of this chapter, highlighting relevant assumptions, applications, and remaining challenges.

1 Findings: Well-being, resources, capital assets, and inclusive wealth

Measuring sustainable development in terms of its ends is formally equivalent to measuring it in terms of the means for achieving those ends. In particular, measuring sustainability in terms of its goals of inclusive well-being goals is formally equivalent to measuring it in terms of the inclusive wealth that constitutes the productive capacity on which people draw to achieve those goals. Both theory and experience suggest, however, that for measuring sustainable development over long periods it is generally easier to measure the stocks of resources that function as its determinants (means) than it is to measure the flows of goods and services that are consumed as constituents of its ultimate end, i.e., inclusive well-being (P. S. Dasgupta 2018).

The particular stocks that must be conserved can usefully be seen as the resources highlighted in many of the analytic frameworks discussed in the Chapter on a Framework for Research. The theory behind

this view builds on a long tradition of work in welfare economics and the economic theory of capital. It portrays resources as the **capital assets**[1] that constitute the **productive base**[2] on which people in the Anthropocene System draw to produce the goods and services that they then consume to advance their well-being. As noted in the Framework chapter, some of these resources (assets) are "natural" in that they are directly derived from nature, whereas others are "anthropogenic" or constructed by people. Subdivisions of these major resource categories that have been particularly useful in sustainability science research are listed and illustrated with an example in Table 2. The key insight for sustainability science is that both natural and anthropogenic resources (assets) are necessary to produce well-being, just as the fishing community of Table 2 requires both fish and boats to prosper.

Table 2: Resource stocks that constitute the productive base for human well-being

a) Resource group	b) Specific example of an ocean fishery	c) General list of representative resource stocks	d) Recent reviews
Natural capital			(Barbier 2019)
• Ecosystems	Fish and their food	Biota, biomass, communities	(IPBES et al. 2019)
• Environment	Ocean temperature, pH	Climate, quality and quantity of land, air, water	(Ekins, Gupta, and Boileau 2019)
• Minerals	Fossil fuel for the boats	Fossil fuels, iron, sand, etc.	(OECD 2018)
Anthropogenic capital			(Díaz et al. 2015)
• Manufactured capital	Boats of the fleet	Roads, buildings, infrastructure	(Weisz, Suh, and Graedel 2015)
• Human capital	Skilled fishers	Population; its health, education, distribution	(Lundborg, Nordin, and Rooth 2018)
• Social capital	Regulations on catch	Institutions (including rules, norms, rights, culture, networks, etc.)	(Hamilton, Helliwell, and Woolcock 2016; National Research Council 2014)
• Knowledge capital	Maps of the seabed	Indigenous, practical, scientific	(Hess and Ostrom 2007; Hess 2012)

The resources that are most important in a given case will always depend on context, as suggested by Column B of Table 2 and the more general examples of Column C. But research suggests that the resources shown in the Table can usefully be thought of as the fundamental determinants or state variables underlying the generation of peoples' well-being in the Anthropocene System. A significant body of research has now accumulated exploring the character of each of the general resource categories listed in Table 2: what enhances them, what depletes them, how do they benefit society (see Column D, "Reviews"). Sustainability science should build on this progress, moving beyond a preoccupation with single resources and aiming to assess the potential contributions to sustainability from each of the basic resource categories summarized in Table 2, as well as the interactions among them.

Inclusive wealth in theory: Inclusive wealth theory has built upon the foundational research findings noted above to create a rationale for the following proposition:

For a development trajectory to be sustainable, a necessary condition is that it conserve inclusive wealth, defined as the per capita social value, adjusted for distribution, of the full array of resource stocks that constitute the productive base of the Anthropocene System.

The full elaboration of the argument behind this proposition is subtle and merits more attention than we can provide here. The reviews cited at the beginning of this chapter provide the details.

Important features of inclusive wealth that are addressed in those reviews include the following:

- "Well-being" of people is a central goal or end objective of sustainable development. It has multiple constituents, the importance of which will vary across people and generations. Measuring well-being directly is highly problematical. But under a plausible range of conditions, per capita well-being is tracked by per capita wealth.
- "Wealth" is a means to the end of creating social well-being. It consists of resources, both natural and anthropogenic, that together constitute determinants of well-being. Wealth is not the total amount of resource. Nor is it their monetary value. Rather it is the estimated social value of those resources, i.e., what they can contribute as means for the creation of well-being.
- The social value of resource stocks to particular social actors depends on context, in particular where and when they live, their goals for sustainability, and how they define what well-being means for them;

- "Inclusive" means everyone's: not just aggregate quantities of resources, but actual access by relevant actors to those resources (or the goods and services they produce); not just resource endowments here and now, but also across relevant places and generations. Aggregation weights for

individual actor's wealth can be designed to reflect society's commitment to equity in sustainable development (see Chapter on Capacity for Equity);

- "Conserving" inclusive wealth means that it not decline with time, i.e., that each generation passes on to the future (at least) as much inclusive wealth as it received from the past. Note that in general many alternative bundles of resources will meet the "conservation" criterion for sustainability;

- "Inclusive wealth" is always about forecasts: What value could society expect to produce from a specified endowment of resources given a particular understanding of how (relevant parts of) the Anthropocene System work? Which actors have the power to make it work for them? Good measures of inclusive wealth therefore require deep scientific understanding of the dynamics of the Anthropocene System.

- Estimates of inclusive wealth are only about the potential of the relevant system to produce well-being. This potential may not be realized in practice if the assumptions of the forecasting model turn out to be wrong or if people lack the other capacities addressed later in this Research Guide.

Inclusive wealth in practice: Practical applications of inclusive wealth concepts have begun to accumulate. These include a growing array of science-grounded assessments of the sustainability of recent development patterns (Tzvetkova and Hepburn 2019). They have been carried out by individual scholars (Arrow et al. 2012; Lintsen et al. 2018), by non-governmental organizations (Managi and Kumar 2018), and by the World Bank (Lange, Wodon, and Carey 2018). The initial focus on national-level measures is now being complemented with an increasing number of local and regional valuations (e.g., Yoshida et al. 2018; Agarwal and Sawhney 2020). Moreover, the theory is beginning to be employed in prospective evaluations of alternative policies for promoting sustainability in cases ranging from alternative scenarios of national development (Ikeda and Managi 2019); to massive desalinization for the production of drinking water (R. D. Collins et al. 2017); to substituting anthropogenic for natural capital (Cohen, Hepburn, and Teytelboym 2019); to mitigating the risk of collapse of the Greenland ice sheet (Nordhaus 2019). Much remains to be done. But the current state of research and application on inclusive wealth represents a significant advance over a past in which sustainability was whatever those claiming to pursue it wanted it to be.

2 Building Capacity: Resources, capacities, connections, and equity

The challenges of fully developing and operationalizing research-informed but practically useful measures of sustainable development remain substantial. Three merit particular attention.

Valuing resources: A combination of methods and models are now being employed to provide useful estimates of the social value or inclusive wealth represent by resource stocks. Some are anchored in the social deliberation (Dryzek and Stevenson 2014), others in systems simulation (R. D. Collins et al.

2017), and still others in market prices supplemented by science-informed calculation of the true value to society (also called "shadow" or "accounting" prices) of resource-based goods and services that are not traded in markets (Yamaguchi and Managi 2019). Current value estimates are relatively solid for resources traded in markets (e.g., minerals and houses), improving rapidly for ecosystems, and almost nonexistent for less tangible resources such as social capital (but see Jumbri and Managi 2020). Building a capacity for integrated valuation of all relevant resources in particular contexts should be a central task of future research in sustainability science.

Valuing operational capacities: This guide argues that in addition to the conservation of inclusive wealth, a variety of operational capacities are necessary for the pursuit of sustainability. We discuss these capacities at some length in subsequent chapters of the Research Guide. As is the case for resources, social actions can either deplete or strengthen each of these capacities. For none of them, however, are good measures of their social value yet available. Informed choices regarding the relative merits of investments in the respective capacities are thus impossible. Research to rectify this situation by creating good measures of the operational capacities discussed in the following chapters is urgently needed (Irwin, Gopalakrishnan, and Randall 2016).

Accounting for connections: Connections among heterogeneous units of the Anthropocene System are now generally accepted to be important determinants of system behavior and sustainability (see the Chapter on a Framework for Research, Figure 1). This importance clearly ought to extend to inclusive wealth accounts. To date, however, virtually all of the theory and empirical work on inclusive wealth ignores connections that move wealth within and across levels of system organization. This shortfall seems more one of neglect than of inherent conceptual difficulty. It should thus be a ripe area for future research in efforts to develop a mature capacity to measure sustainable development.

We further explore the governance challenges of measuring sustainable development to nurture shared resources in Section 2 of the Chapter on Capacity for Governance.

Footnotes

1. **Capital assets**: resource stocks—both natural and anthropogenic—on which society draws for its well-being (see Table 2) ↩

2. **Productive base**: the total set of resource stocks or capital assets on which society draws for its well-being ↩

Citations

1. Dasgupta, Partha. 2004. *Human Well-Being and the Natural Environment*. 1st paperback, with Revised Appendix. Oxford: Oxford University Press. ↩

2. Laurent, Éloi. 2018. *Measuring Tomorrow: Accounting for Well-Being, Resilience, and Sustainability in the Twenty-First Century*. Princeton, NJ: Princeton University Press. ↩
3. Stiglitz, Joseph E., Jean-Paul Fitoussi, and Martine Durand. 2019. *Measuring What Counts: The Global Movement for Well-Being*. New York: The New Press. ↩
4. Dasgupta, Partha. 2014. "Measuring the Wealth of Nations." *Annual Review of Resource Economics* 6 (1): 17–31. https://doi.org/10.1146/annurev-resource-100913-012358. ↩
5. Polasky, Stephen, Benjamin Bryant, Peter Hawthorne, Justin Johnson, Bonnie Keeler, and Derric Pennington. 2015. "Inclusive Wealth as a Metric of Sustainable Development." *Annual Review of Environment and Resources* 40 (1): 445–66. https://doi.org/10.1146/annurev-environ-101813-013253. ↩
6. Error ↩
7. Dasgupta, Partha S. 2018. "Foreword to the Inclusive Wealth Report 2018." In *Inclusive Wealth Report 2018 | Measuring Progress Towards Sustainability*, edited by Shunsuke Managi and Pushpam Kumar, 1st ed., xxi–xxviii. London: Routledge. http://www.taylorfrancis.com/books/e/9781351002073. ↩
8. Error ↩
9. IPBES, Sandra Díaz, J Settele, Eduardo Brondízio, H Ngo, M Guèze, J Agard, et al. 2019. "Summary for Policymakers of the Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services." Bonn, Germany: IPBES secretariat. https://www.ipbes.net/global-assessment-report-biodiversity-ecosystem-services. ↩
10. Ekins, Paul, Joyeeta Gupta, and Pierre Boileau, eds. 2019. *Global Environment Outlook 6*. New York: Cambridge University Press. ↩
11. OECD. 2018. "Global Material Resources Outlook to 2060 - Economic Drivers and Environmental Consequences - En - OECD." 2018. http://www.oecd.org/environment/global-material-resources-outlook-to-2060-9789264307452-en.htm. ↩
12. Díaz, Sandra, Sebsebe Demissew, Julia Carabias, Carlos Joly, Mark Lonsdale, Neville Ash, Anne Larigauderie, et al. 2015. "The IPBES Conceptual Framework — Connecting Nature and People." *Current Opinion in Environmental Sustainability* 14 (June): 1–16. https://doi.org/10.1016/j.cosust.2014.11.002. ↩

13. Weisz, Helga, Sangwon Suh, and T. E. Graedel. 2015. “Industrial Ecology: The Role of Manufactured Capital in Sustainability.” *Proceedings of the National Academy of Sciences* 112 (20): 6260–64. https://doi.org/10.1073/pnas.1506532112. ↩
14. Error ↩
15. Hamilton, Kirk E., John F. Helliwell, and Michael Woolcock. 2016. “Social Capital, Trust, and Well-Being in the Evaluation of Wealth.” WPS7707. The World Bank. http://documents.worldbank.org/curated/en/249031468195550873/Social-capital-trust-and-well-being-in-the-evaluation-of-wealth. ↩
16. National Research Council. 2014. Civic Engagement and Social Cohesion: Measuring Dimensions of Social Capital to Inform Policy. Washington, DC: The National Academies Press. https://doi.org/10.17226/18831. ↩
17. Hess, Charlotte, and Elinor Ostrom, eds. 2007. *Understanding Knowledge as a Commons: From Theory to Practice*. Cambridge, MA: MIT Press. ↩
18. Hess, Charlotte. 2012. “The Unfolding of the Knowledge Commons.” Text. May 2012. https://www.ingentaconnect.com/content/stair/stair/2012/00000008/00000001/art00003. ↩
19. Tzvetkova, Sandra, and Cameron Hepburn. 2018. “The Missing Economic Measure: Wealth.” *Our World in Data*. https://ourworldindata.org/the-missing-economic-measure-wealth. ↩
20. Arrow, Kenneth J., Partha Dasgupta, Lawrence H. Goulder, Kevin J. Mumford, and Kirsten Oleson. 2012. “Sustainability and the Measurement of Wealth.” *Environment and Development Economics* 17 (3): 317–53. https://doi.org/10.1017/s1355770x12000137. ↩
21. Error ↩
22. Managi, Shunsuke, and Pushpam Kumar, eds. 2018. *Inclusive Wealth Report 2018 | Measuring Progress Towards Sustainability*. 1st ed. London: Routledge. http://www.taylorfrancis.com/books/e/9781351002073. ↩
23. Lange, Glenn-Marie, Quentin Wodon, and Kevin Carey. 2017. *The Changing Wealth of Nations 2018: Building a Sustainable Future*. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-1046-6. ↩
24. Error ↩
25. Agarwal, Priti, and Aparna Sawhney. 2020. “Sustainability and Comprehensive Wealth Accounting: The Case of India.” *Environment, Development and Sustainability*, April.

https://doi.org/10.1007/s10668-020-00743-9.↩

26. Ikeda, Shinya, and Shunsuke Managi. 2019. "Future Inclusive Wealth and Human Well-Being in Regional Japan: Projections of Sustainability Indices Based on Shared Socioeconomic Pathways." *Sustainability Science; Dordrecht* 14 (1): 147–58. http://dx.doi.org.ezp-prod1.hul.harvard.edu/10.1007/s11625-018-0589-7. ↩

27. Collins, Ross D., Noelle E. Selin, Olivier L. de Weck, and William C. Clark. 2017. "Using Inclusive Wealth for Policy Evaluation: Application to Electricity Infrastructure Planning in Oil-Exporting Countries." *Ecological Economics* 133: 23–34. https://doi.org///dx.doi.org/10.1016/j.ecolecon.2016.11.013. ↩

28. Error ↩

29. Error ↩

30. Dryzek, John S., and Hayley Stevenson. 2014. *Democratizing Global Climate Governance*. Cambridge; New York: Cambridge University Press. ↩

31. Error ↩

32. Error ↩