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Building Capacity to Measure Sustainability: Lessons from scholarship and practice

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Abstract: One of the longest standing challenges facing both research and practice in sustainable development is the design and implementation of methods for measuring progress towards sustainability. While the overarching goals of sustainable development have been clearly articulated since the 1980s (WCED 1987), conceptually coherent measurement systems for tracking progress towards those goals have lagged significantly behind. But goals without measures mean that the idea of sustainability is often used as buzzword and dismissed as meaning whatever anyone wants it to mean, or worse co-opted to greenwash activities that are decidedly unsustainable. If sustainability is to be anything more than a slogan, society must build and maintain a stronger capacity to measure it. Such a capacity is needed to support at least four tasks: i) to assess whether current development pathways are consistent with the normative goals of sustainability; ii) to evaluate whether proposed interventions are likely to foster sustainable development pathways in the future; iii) to signal where improved well-being in one context (e.g. place or time) comes at the expense of damaging the well-being of others elsewhere or for future generations; and iv) to serve as a basis for collaboration and negotiation of transboundary and intertemporal sustainability challenges. This working paper provides a high-level overview of the state of research on measuring sustainable development as well as insights from the past half century of practice in the field. The paper is designed as a jumping off point for a seminar series on Capacity for Sustainable Development (C4SD) organized by the Mossavar-Rahmani Center for Business and Government, the Sustainability Science Program, Salata Institute for Climate and Sustainability, Center for International Development, and the Belfer Center for Science and International Affairs at Harvard Kennedy School. For more information about the seminar series see this link: https://www.hks.harvard.edu/centers/mrcbg/programs/sustainability-science-program/c4sd-seminar-series

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1. Introduction:

What capacities are most needed for the effective pursuit of sustainability in the face of the multiple crises currently facing the Anthropocene system? Taken together these intertwined crises – climate, pandemics, extinction, inequity, and others arising from the increasingly intense interactions between nature and society – are threatening the implicit promise of sustainability which has emerged over the last decades as one of the most widely shared goals in human history: **that each generation should hand on to its successors whatever it takes to allow them to achieve a standard of living at least as good as its own, while simultaneously seeking to alleviate poverty and inequity within its own time** (Solow 1993; WCED 1987). Keeping this promise will ultimately require decisive action on multiple fronts. But in this complex world, what will it take to foster our collective ability to pursue sustainability in the face of deep uncertainty and the inevitability of unexpected change?

In the Capacity Building for Sustainable Development (C4SD) research project,[1] we argue that advocates for sustainable development should pay greater attention to building a set of strategic capacities that empower and enable actors (individuals, communities, organizations etc.) to make strategic decisions, and to take deliberate and collective action in the pursuit of sustainability. By capacity we mean both the intention and the ability to accomplish a task or achieve an outcome or, more bluntly, "the ability to get stuff done". Why? Because failure to build, exercise, and improve capacity for the pursuit of sustainability has too often resulted in a "missing middle"—an inability to connect widespread agreement on the goals of sustainable development with the scientific understanding of the dynamics of intertwined nature-society systems that set the stage on which those goals must be pursued.

Three features of today's world make the need to build such strategic capacities particularly urgent:

1) Crises challenging the goals of sustainable development are multiplying and intensifying (Folke et al. 2021), threatening the remarkable progress in many dimensions of well-being that has been achieved over the last two centuries or more (Deaton 2013; McNeill 2016). More effective action to address the multiple threats to sustainability is increasingly urgent.

[1] The Capacity Building project is an activity of the Sustainability Science Program, hosted by the Mossavar-Rahmani Center at Harvard's Kennedy School of Government.

2) The threats to sustainability are interconnected, as is the underlying nature-society system from which they emerge (Preiser et al. 2018). Efforts to address them one-by-one at best become a Sisyphean nightmare of whack-a-mole and often end up competing with or undermining one another. All too visible examples are provided by unsatisfactory results of siloed efforts taken in pursuit of one or another of the UN's 17 SDGs. Strategic approaches are needed to support actions likely to be effective across multiple interconnected challenges and where efforts to foster sustainable development require attention to the whole intertwined system rather than just the parts.
3) Better assessments, forecasts, and the scientific models to support them are necessary components of such strategic approaches. But they are not sufficient. The reason is that nature-society interactions constitute complex adaptive systems in which novelty (innovation, evolution), uncertainty and surprise are the norm rather than the exception (Preiser et al. 2018). This complexity virtually guarantees that even the most scientifically informed plans will eventually turn out to be at best incomplete if not altogether wrong. Effective strategies must complement "thinking through" with "acting out" approaches, i.e. with capacities to approach problems and solutions from a systems perspective, to treat interventions as experiments, to learn from those experiments, and to course correct when forecasts eventually, and inevitably, go wrong.

This working paper focuses specifically on the capacity to measure sustainable development as one of a broader set of six capacities that we argue connect the goals of sustainable development with the scientific understanding of the multiple, interacting, and complex sustainability challenges currently facing the Anthropocene. These six capacities emerged from decades of research across multiple interdisciplinary—but often disparate—research programs focused on what is needed to foster sustainability (Clark and Harley 2020). Taken together the six capacities enable collaborative action for sustainability in the face of uncertainty. They are:

1. **Capacity to measure** progress toward sustainable development
2. **Capacity to adapt** development pathways to protect human well-being in the face of shocks
3. **Capacity to transform** unsustainable development pathways into sustainable ones

4. **Capacity to advance equity** both within and among generations
5. **Capacity to govern,** i.e., to build and maintain collaborative relationships in pursuit of sustainable development
6. **Capacity to link knowledge with action** for sustainability

This remainder of this working paper is organized in three sections: the first section reviews the state of knowledge and scholarship on measuring sustainable development; the second section highlights what actors are already doing at the cutting edge of sustainability measurement; and the third section synthesizes emerging insights from practitioners and scholars collected as part of the Capacity Building for Sustainable Development (C4SD) research project about what is needed to build and maintain and strategic capacity to measure sustainable development. We hope that the seminar series for which this background paper has been prepared will further contribute to the C4SD research project, deepening the insights found in this working paper.

2. Measuring Sustainability: A brief overview of the scholarship

Research over the past two decades has made considerable advances toward a theory grounded approach for measuring sustainability (Conference of European Statisticians 2014; Dasgupta 2001, 2014; Laurent 2018). These advances begin by taking seriously the international consensus that the goal of sustainable development is fair or equitable advancement of human well-being within and across generations (J. E. Stiglitz, Fitoussi, and Durand 2018; J. Stiglitz, Sen, and Fitoussi 2009).

Measuring progress toward sustainability therefore must ultimately be about tracking both intra- and inter-generational human well-being. Two approaches to the measurement of well-being have emerged – one focused on the constituents of human well-being, the other on its determinants (Hanley, Dupuy, and McLaughlin 2015). Both approaches to measurement are pluralistic, in that they acknowledge that different people will emphasize different components of well-being, depending on their preferences, abilities, and circumstances. Both acknowledge that a mature capacity to measure sustainable development must be able to handle trade-offs among those different views and components. But the two approaches also differ in important ways:

Constituents: The first approach focuses on tracking indicators of well-being per se, including life expectancy, health, education, happiness or subjective well-being, access to nature, social connections and physical security among others (Greco et al. 2020; Lutz et al. 2021).This approach provides valuable information about trends in the well-being of people alive today but presents considerable practical and theoretical drawbacks for measuring progress towards sustainable development across space and time. This is because measuring the well-being of people in one city, region or country says little about how the flows of goods and services that generate that well-being impacts the ability of others elsewhere to pursue their own well-being. Nor does it indicate how the well-being enjoyed by people alive today might impact the ability of future generations to define and pursue their own well-being.

Determinants: The second approach attempts to overcome some of the drawbacks of the first through the insight that measuring sustainable development in terms of its ends or goals (i.e. human well-being) is under plausible conditions formally equivalent to measuring it in terms of the means for achieving those ends (Dasgupta 2001). The "means" are the resources to which people have access for use in producing the goods and services that they consume to create well-being. Research has established that "wealth" is the most useful index for measuring the social value of those resources. In this view, development paths are not sustainable if they deplete the potential of the resource base for generating future well-being, i.e., if suitably defined indices of "inclusive wealth" decline. Resources tracked by inclusive wealth indices include both natural capital (including minerals, land and water, biodiversity, and the climate system) and anthropogenic capital (including manufactured infrastructure, institutions and culture, knowledge, and above all people who are healthy, educated and committed to one another). Measuring trends in inclusive wealth involves estimating the social value of the resource base for producing well-being and forecasting how the depletion of one resource (e.g., forests) or investments in another resource (e.g., roads) will change the social value of the resource base as a whole (Polasky et al. 2015). While inclusive wealth has the theoretical ability to address spatial displacements (i.e., where improvements to inclusive wealth in one context (e.g., country) comes at the expense of damaging well-being elsewhere), this potential is barely realized in existing scholarly research. Current research frontiers in the measurement of inclusive wealth explore how to better handle issues of differential access and equity and cross-border flows of resources

and waste (Ikeda and Managi 2019; Polasky and Dampha 2021; Yamaguchi, Islam, and Managi 2023; Zhang, Nozawa, and Managi 2020).

3. Measuring Sustainability: A brief review of practice

Early efforts to measure sustainable development in practice mobilized countless indicators of the economic, social and environmental dimensions of sustainability on scales ranging from the local to the global (e.g. (National Research Council 1999)). Many of these efforts proved valuable in documenting particular features of the Anthropocene that specific groups felt strongly about. But they too often lost sight of the broader forest while measuring individual trees—providing at best a dis-integrated picture of progress (or lack thereof) toward sustainability. Today, an increasing number of public, private, and civil society actors are grappling with their own efforts to measure and track the sustainability impacts of their activities, products and operations (Boiral, Heras-Saizarbitoria, and Brotherton 2019). Evidence is mixed, however, as to whether these efforts are contributing to a broader capacity to measure sustainability, with various measurement systems complementing, substituting, or competing against one another (Lambin and Thorlakson 2018; Mura et al. 2018). And if the current hodgepodge of hundreds of indicators designed to measure progress toward the United Nations' Sustainable Development Goals (UN SDG) is any guide, the global community still has a long way to go to deploy a useful sustainability measurement system (Biermann et al. 2022; Brand, Furness, and Keijzer 2021; Fukuda-Parr and McNeill 2019).

This is hardly surprising. The history of human efforts to measure social progress shows that robust capacity to do so cannot be built overnight. Gross domestic product (GDP)—arguably a far simpler indicator than many of those proposed for sustainability—was first developed in the late 1800s to assess national production. It was not until the mid-20th century that countries around the world began coordinating to regularly report GDP using standardized data and assumptions (Lepenies 2016). Refinements to the methods for measuring GDP as well as the capacity to generate internationally comparable GDP estimates continue today and have required substantial investments in people, organizations and monitoring (Jorgenson 2018). If a measurement system for sustainable development is to complement or even replace GDP as the metric by which society assesses progress, a comparable capacity must be built and maintained. Several promising beginnings are underway:

- Some of the earliest work was done by the Bhutanese government, which in 2011 invited the nations of the world to prioritize happiness and well-being in efforts to measure social progress (G.A. Res. 309 U.N.GAOR, 65th Sess. 2011). Following Bhutan's leadership, a growing list of countries have begun to build new measurement systems that prioritize the goals of sustainable development. Governments at the forefront of these efforts include Bhutan, Britain, Canada, Iceland, the Netherlands, New Zealand, Scotland and Wales.[2] While most country-level sustainability measurement systems have thus far prioritized a constituent-based approach to measuring progress towards sustainability, Canada, the Netherlands, and New Zealand have made substantial progress in developing measurement systems that address both the constituents (current well-being) as well as the determinates (potential for future well- being) of sustainability. New Zealand has probably gone further than any other country, building on the existing capacity of the budgeting process to ensure that government ministries align their spending with the country's sustainability priorities (Government of New Zealand 2021).
- Regional and global efforts to build the capacity for measuring sustainable development are also moving forward. In 2011, the OECD created a multi-dimensional approach to measuring the constituents of well-being called the Better Life Index, which is available online in an interactive format for anyone to explore (OECD n.d.). And in 2012, the United Nations published the first in a series of Inclusive Wealth Reports focusing on trends in the determinates of well-being—human, natural and manufactured capitals—across a wide range of countries (UNU-IHDP and UNEP 2012). Today, inclusive wealth reports are regularly compiled and published by the United Nations as well as the World Bank (Managi and Kumar 2018; UNESCO MGIEP 2024; World Bank 2021, 2024). Unfortunately, regional, and global efforts to measure sustainable development including both the OECD's work on the constituents of well-being as well as the UN and the World Bank's work on determinates have yet to sufficiently grapple with the displacements (both spatial and intertemporal) that are so central to the challenges of sustainable development. Various regularly published "footprints" are one step in the right direction towards a better understanding of how resources consumed to support activities in the

[2] Links to country-level efforts to MEASURE progress toward sustainability: Bhutan; Britain; Canada; Iceland; the Netherlands; New Zealand; Scotland and Wales.

here and now affect others elsewhere or in the future. But these metrics remain underdeveloped in their ability to measure and track intra- and inter-generational human well-being more broadly (Global Footprint Network 2023; Matuštík and Kočí 2021).

4. Emerging Lessons from Practice and Scholarship

Despite the progress detailed above, efforts in building capacity to measure sustainable development remain in their early stages and are just beginning to exert significant influence on decision-making, policy formulation or issue framing. As part of the C4SD research project, we have conducted extensive interviews with practitioners and scholars to begin to distill and synthesize the lessons coming out of their work to date. What we have learned is that building a better capacity to measure progress toward sustainability will require substantial investments in the specification, monitoring, analysis, reporting and auditing of data that are locally meaningful and globally comparable across multiple geographic levels and consumption-production systems. Below we highlight four specific lessons from this research that we believe are important for building capacity to measure sustainability moving forward.

1) **Prioritize saliency:** For sustainability measurement systems to gain widespread use they must provide information that decision-makers perceive to be useful – indeed indispensable –in solving their most pressing problems. Measurement systems that fail this decision saliency test – however credible or beloved they are to their advocates – will be displaced by others that pass it (Clark et al. 2016). Building the capacity to produce measures that are salient to, and used in, the pursuit of sustainability is most readily accomplished when governments and other authorities simply mandate the use of meaningful sustainability measures in decision-making. This saliency-by-mandate strategy is indeed being pursued in multiple contexts. For example, the Chinese government is now requiring the use of Gross Ecosystem Product (GEP), an indicator that captures the value of a wide array of ecosystems services, in planning and policy formulation and to evaluate the performance of government officials at provincial, county and city levels (Ouyang et al. 2020). But in contexts where saliency-by-mandate is not feasible, collaborative approaches to building useful sustainability measurement systems can also work. A strong example is provided by the Natural Capital Project (NatCap), a university-based NGO that partners with decision-makers in governments, multilateral

investment banks, NGOs and local communities around the world to create tailored assessments of natural capital that are relevant to local needs (Natural Capital Project 2023). For NatCap, the first step of any project is to work closely with local decision-makers to understand their needs, constraints, and policy windows to identify a set of priories at the nexus of nature and human development that would benefit from a more robust capacity to measure. Only after this collaborative process does NatCap work to mobilize data into indicators that reflect the value of ecosystem services and natural resources in their stakeholders' decision contexts. Their strategy prioritizes saliency by honing a capacity to produce measures that are not only useful to but also usable by decision-makers.

2) **Ensure legitimacy:** For measurement systems to gain widespread use, they must not only be credible and salient but also be, and be seen to be, legitimate – that is protected from manipulation by powerful interests. This is particularly important for measurement systems guiding the pursuit of sustainability given the central commitment of that pursuit to the highly political task of achieving equitable (re)distribution of access to well-being. Contemporary concerns for "greenwashing" highlight the challenges involved (Heras-Saizarbitoria, Urbieta, and Boiral 2022; Lashitew 2021). Efforts to ensure the legitimacy of sustainability measurement systems often rely on independent third-party audits and certification systems. However, certification systems can also have unintended consequences including leakage, lack of transparency and traceability, and exclusion of marginalized and vulnerable communities (Boiral, Heras-Saizarbitoria, and Brotherton 2019; Lambin et al. 2018). Experience in the cocoa sector shows that the capacity to do well-informed audits is often constrained by the complexity and number of actors involved (Thorlakson 2018). At the level of national governments striving for adequate distance between the politics of the moment and the legitimacy of measurement systems, there is a long tradition of creating independent measurement offices to give legitimacy to the reports they produce. In New Zealand, the Public Service Act mandates that an independent treasury provide 'politically neutral, free and frank advice' to decision-makers across political parties. This tradition of nonpartisanship also supports the legitimacy of their sustainability measurement system, where leaders at the New Zealand

Treasury are careful to distinguish their Living Standards Framework (LSF) from the sustainability policies and goals of the current government. The ultimate risk to legitimacy, however, may be the exclusion from the design and implementation of measurement systems by dominant actors of whole groups of less powerful actors (Fukuda-Parr, Yamin, and Greenstein 2014; Malay 2019). New Zealand grappled with this challenge when the first iteration of their Living Standards Framework (LSF) was criticized for the exclusion of indigenous perspectives on well-being. Working with indigenous communities, the New Zealand Treasury updated the LSF to better reflect Māori culture and values including a greater emphasis on community well-being and the intrinsic value of nature. By prioritizing legitimacy, the New Zealand Treasury strengthened their overall capacity to measure sustainability (The Treasury, Government of New Zealand 2021).

3) **Balance parsimony and complexity:** Good sustainability indicators must capture the multi-dimensional character of sustainability goals and be streamlined enough that they can be used for everyday deliberation and decision-making. The complexity of nature-society systems poses substantial challenges for building the capacity needed to produce such indicators. Neither the quest a single integrated indictor aspiring to the role of GDP (e.g., " carbon footprints"), nor the disintegrated invitation to cherry-picking offered by the many UN SDG indicators resolve the balance challenge (Heras-Saizarbitoria, Urbieta, and Boiral 2022; Matuštík and Kočí 2021). More promising have been efforts to construct meaningful "dashboards" comprising multiple indicators relevant to sustainability (J. E. Stiglitz, Fitoussi, and Durand 2018). A good example of what's possible is provided by the OECD, which has devised a two-pronged strategy for measuring progress towards sustainability that tracks both indicators of current well-being as well as the stocks of resources necessary to produce well-being in the future (aka inclusive wealth) (OECD n.d.). The OECD's measurement framework emphasizes the importance of moving beyond averages, ensuring that data on equity and access is foregrounded in measurement and reporting. This approach facilitates understanding of trends in both intra- and inter-generational well-being but leaves the tradeoffs—both between different elements of current well-being and between current and future

generations open for users of the measurement system to make themselves. Leaders responsible for the OECD's measurement approach found that this level of granularity is important to decision-makers who prefer to leave decisions about tradeoffs in the political arena. At the same time, OECD leaders recognize that without a single indicator to measure progress toward sustainability, emerging sustainability measurement systems may struggle to replace GDP as the compass by which society tracks progress.

4) **Harmonize across contexts:** Sustainability measurement systems are better to the extent that they are comparable across contexts. One reason is common to many other measurement systems: comparable indicators motivate people to "move up" on implicit rankings, and to learn from higher ranked performers (Kelley and Simmons 2015). A second reason, however, is especially important for sustainable development: comparable indicators are needed to navigate political tensions and to serve as a basis for negotiation when actions that improve well-being in the here and now come at the expense of others elsewhere or of future generations. For this reason, harmonization is necessary to create sustainability measurement systems that are salient, credible, and legitimate: no matter how usable local actors find a measurement system to be, if the measurement system is not deemed credible, legitimate, or salient by a broader community of stakeholders, it will not be useful for negotiating transboundary and intertemporal sustainability challenges. The quest for harmonization places extraordinary demands on capacity building for measuring sustainable development, requiring that actors in different contexts collaborate with one another in designing measurement systems and selecting indicators that are acceptable to all. The rewards of such efforts, however, can be substantial, as has been demonstrated in the role of equivalent effective stratospheric chlorine (EESC) – a relatively straightforward indicator that reflects the effective quantity of halogens in the stratosphere based on emissions data of ozone-depleting substances. The development of the EESC indicator created a shared understanding of the problem of stratospheric ozone depletion which decision-makers used as a basis for collaboration in crafting the Montreal Protocol (Selin 2018). Progress is also being made in efforts to harmonize broader sustainability measurement systems. The Wellbeing Economy Alliance (WEAll), a collaboration of leaders working to transform economic

systems toward human well-being, created a platform (WEGo) for collaboration and knowledge exchange between governments (WEAll 2023). The WeGo platform offers important opportunities for harmonizing approaches to the measurement of sustainable development, but with participation in the platform currently limited to Canada, Finland, Iceland, New Zealand, Scotland, and Wales, substantially more needs to be done to foster widespread adoption of an interoperable sustainability measurement system. A more inclusive, if still incremental, effort to harmonize measurement systems focuses on the contributions of natural capital to human well-being (Dasgupta 2021). Led by the United Nations Statistical Commission, the System of Environmental-Economic Accounting (SEEA) is a comprehensive statistical framework for assessing the value of natural capital stocks and integrating this information into national accounting systems (United Nations 2023). The SEEA has already been adopted (at least in part) by more than 90 countries around the world. In 2023, United States' Office of Science Technology and Policy, the Office of Management and Budget and the Department of Commerce jointly proposed a national strategy for natural capital accounting in alignment with the standards set forth in the SEEA (Fenichel 2024; OSTP 2023).

Our intention is that the seminar series for which this working paper provides a foundation will provide further opportunity to refine (or refute) these lessons as well as to add new lessons we have not yet included.

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