Expansion of sustainability science needed for the SDGs

Dominant research modes are not enough to guide the societal transformations necessary to achieve the 2030 Agenda. Researchers, practitioners, decision makers, funders and civil society should work together to achieve universally accessible and mutually beneficial sustainability science.

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This is a decisive year for the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs). Convening this week, the United Nations High-level Political Forum on Sustainable Development (HLPF) includes a quadrennial SDG summit under the auspices of the General Assembly. Here, the Global Sustainable Development Report (GSDR)[1], prepared by an independent group of scientists, will be officially presented. It reviews progress and strives to chart ways ahead.

Adopted in 2015, a remarkable year for multilateralism, the 2030 Agenda has successfully raised awareness of the kinds of transformations needed — in policy, civil society, business, science and technology — to put countries on a sustainable development path.

But recent scientific assessments[1–3] paint a sobering picture of progress towards the SDGs. There is a growing gap between what needs to happen and what is actually being done. Just a handful of the 169 sub-targets are on track to fulfil the 17 higher-level SDGs. Many are off track and some display even negative trends including those related to tackling climate change, inequalities and biodiversity loss[1]. Massively expanded concerted actions are urgently needed to enable sustainable development in the next decade. In particular, we must quickly make available the best policy-relevant knowledge to guide these actions.

GSDR framework

The GSDR 2019 proposes a framework for knowledge-based transformations to sustainable development that reconciles evidence and socio-political deliberations for accelerated action. It emphasizes the following three key complementary areas of knowledge production[4,5].

Understanding systemic interactions. Guided by the 2030 Agenda, we must improve understanding of how complex human–environment system dynamics can produce trade-offs that hinder individual targets, on the one hand, or produce synergies, on the other. For example, scaling up dominant food systems to meet growing demand can harm targets related to ending poverty, halting climate change and preserving life on land. Conversely, sustainable intensification of food production (for example, agroecology) and adapting people's diets can have positive spillover effects for many social and environmental targets.

Understanding competing development agendas. Governance, business and finance, individual and collective action, as well as science, technology and innovation all provide crucial levers for transforming vicious systemic circles into virtuous circles[1]. However, we must clearly identify how the values and interests of powerful actors help or hinder the 2030 Agenda, and how rules and incentives can be changed to enable collaboration towards common goals. For instance, there is a pressing need for evidence-based guidance on how to regulate the financial sector, markets, trade, taxation, and so on, to support — not harm — ecological sustainability and social cohesion[6].

Understanding transformations in concrete contexts. Individual countries and regions face unique challenges and have different development priorities. The specific design of transformation pathways depends on each context — few solutions will work the same way everywhere. Instead, we must strive to combine different sets of transformation levers based on the needs and conditions of each setting. At the same time, harmonized high-level efforts are needed to steer the interactions between pathways and their aggregate outcomes to deliver universal progress towards the 2030 Agenda. For example, poor nutrition is a global challenge demanding international cooperation, but it also requires customized local pathways based on cultural preferences, educational attainment, prevalent food systems, available technologies and other local factors.

Achieving the 2030 Agenda

Science has played a central role in building the still fragile international consensus on the SDGs. Researchers have made major advancements in understanding coupled human–environment systems, especially thanks to increasing use of interdisciplinary approaches[7]. Various international scientific assessments have successfully synthesized fragmented evidence, enabling policy breakthroughs such as the 2015 Paris Climate Agreement.

Nevertheless, there are fundamental limits to our ability to design sustainable transformation pathways based on evidence[8]. Human–environment systems remain highly complex and difficult — or impossible — to map fully. Causes and effects are often hard to distinguish and context dependent. Stakeholders frequently disagree about problems and solutions[9]. In such cases, decision makers must navigate ways forward based on careful consideration of risks, uncertainty and issues of social justice. Precautionary measures or interventions may be advisable even if cause-and-effect relationships are not fully established.

In response to such challenges, the growing field of sustainability science has adopted a variety of useful approaches —

Box 1 | Systemic entry points for global transformations to sustainable development

The GSDR 2019 identifies six entry points that must be addressed to rebalance the relationship between people and nature:

1. Strengthening human well-being and capabilities.
2. Shifting towards sustainable and just economies.
3. Building sustainable food systems and healthy nutrition patterns.
4. Achieving energy decarbonization and universal access to energy.
5. Promoting sustainable urban and peri-urban development.
6. Sustaining the global environmental commons.

To manage trade-offs and harness synergies, several transformation levers should be deployed in context-specific combinations: governance, economy and finance, individual and collective action, and technology and science.

such as co-production of knowledge and hands-on testing of interventions with local stakeholders — capable of aiding needed transformations[10]. New journals, networks, platforms and funding mechanisms have gradually emerged around these innovative research modes. Despite these promising developments, however, the following two major factors hamper the effective contribution of such research to knowledge-based transformations.

Sustainability science still a niche field. The 2030 Agenda raises crucial, universally valuable research and development (R&D) questions regarding the design, implementation and monitoring of innovative transformation pathways. Yet more than 60% of global R&D spending is accounted for by the private sector, based primarily on the pursuit of narrow sectoral goals and business interests[11]. In the remaining smaller share of public R&D funding, sustainable development is treated as merely one priority among many. This and other institutional factors, such as hyper-specialization and counterproductive forms of academic competition, impede the urgently needed shift from individual — and individualistic — research modes to cooperative transformation-oriented approaches[12]. Failure to rebalance funding and institutional priorities towards sustainable development prevents sustainability science from revealing its full potential.

Global science inequality. Access to data, research and scientific capacity remains highly uneven globally, with major divides apparent between high-, low- and middle-income countries. Organisation for Economic Co-operation and Development (OECD) countries accounted for 66% of R&D spending in 2014 while least-developed countries accounted for just 0.3%. There are more than 3,500 researchers per million inhabitants in OECD countries versus only 70 per million in low-income countries[11]. This greatly restricts scientific output in poor countries. African countries, for example, only contributed 2.6% of total scientific publications globally in 2014[11]. These alarming inequalities handicap both overall scientific progress and the ability of low-income countries to realize sustainable development[1]. It prevents them from developing the necessary context-specific and knowledge-based transformation pathways. And it prevents high- and middle-income countries from understanding the (often harmful) spillover effects or dependencies caused by their own development pathways — based on flows of goods, capital, people and information across administrative and geographic boundaries.

Overall, insufficient mobilization and reorientation of science more broadly — including its approaches, organization and funding structures — threatens to derail the 2030 Agenda. Rather than standing by and allowing ourselves to come up short, the global community must enable scientific research to fulfil its transformational potential.

A global mission

We believe it is time to commit to a global mission for universally accessible, mutually beneficial sustainability science. Uniting the global North and South, this joint mission will unlock the transformational capacity of research and share its gains equitably. It requires contributions from the natural sciences and engineering, life sciences and medicine, social sciences and humanities, law, and more. Without it, the SDGs are unlikely to be achieved.

The mission should emphasize knowledge production based on six global systemic entry points (Box 1). With supervision from the International Science Council (ISC), these six research areas should be collaboratively fleshed out by the science community and relevant stakeholders within one year, building on several key existing proposals that largely overlap (for example, refs. [1,3,13]).

A recent meeting (8–9 July 2019) convened by the ISC at the US National Academy of Sciences revealed wide agreement between academic institutions and funders of R&D about the need to maximize the impact of SDG-related research investments through 'strategic partnerships'. This united stance contrasts sharply with current geopolitical splits over climate and development policies, and highlights the potential for science diplomacy to bridge divides while producing knowledge for appropriate action locally and globally.

To generate the knowledge we need, experts must combine: (1) synthesis of disciplinary and interdisciplinary evidence on key trade-offs and co-benefits across contexts and scales; (2) analysis of key actors in the public sector, private sector and civil society who hold the power to leverage change; (3) application of transdisciplinary approaches to co-design and co-implement pathways to transformations. Given our small window of time to realize the 2030 Agenda, researchers should especially focus on rapidly collecting, aggregating and scientifically assessing existing information on successful or failed interventions — including lay, practical and indigenous knowledge.

The institutions and structures needed to implement these approaches must oversee various forms of knowledge brokering and diplomacy. In collaboration with research institutions, governments should establish sustainable development open-access knowledge platforms — especially in low- and middle-income countries — based on the six systemic entry points recommended above. These platforms can help to manage cooperative efforts by researchers to synthesize fragmented knowledge about SDG interactions[14]; conduct assessments on existing transformation knowledge; and serve as knowledge brokers to non-scientific actors when designing country-specific transformation pathways.

Use of novel tools and approaches will be crucial. Evidence shows the promise of experimental labs that bring together diverse actors — whether public servants, entrepreneurs, policy makers or children — to innovate and test new practices in cooperation with researchers[15]. Partnership-based experimentation is also needed between science and business to test new practices against scientific understanding. These approaches can enable innovative

collaborations and catalyse sustainable business ideas, as exemplified by the global science–business initiative for ocean stewardship[16]. Numerous examples of direct collaboration between researchers and farmers in the global South — facilitating improved management of land as a common pool resource and promotion of sustainable agroecological practices — show the promise of such transdisciplinary approaches[17].

At the same time, robust global networks must be established between the recommended national and regional knowledge platforms to understand the interplay of the six systemic entry points across places and scales. Connecting to scientific networks such as Future Earth would enable exploration of transboundary interactions, analysis of spillover effects, and the design of adequate responses by governments, businesses and civil society. Global coordination and coherence should be ensured by the ISC and its subsidiary organizations.

This mission will require swift mobilization of unprecedented levels of funding — at least a tenfold increase — as well as novel funding structures. Worldwide research funding should be quickly realigned according to a joint overarching mission for sustainability science and realization of the SDGs, guided by the entry points and supporting organizational elements outlined above. National and international funding agencies can pool their valuable expertise on how to implement corresponding calls for proposals, project selection and evaluation.

These tasks clearly go beyond the purview of traditional science funders. They will also require support from international development agencies, multi-lateral development banks, national governments, the private sector and philanthropic donors. In developing countries — especially in Africa — R&D funding should be combined on behalf of long-term research and practice partnerships, enabling scientists and implementers to realize joint SDG-related projects with sufficient autonomy and adequate support infrastructure.

Sustainable development is not a 'nice to have'. It is a 'must have' for a thriving planet and continued human well-being. Sustainability science is a precondition for its achievement. Boosting sustainability science and expanding access to scientific data and research in the global South will benefit us all. ❐

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