efforts (goal 2) can counteract local livelihoods and increase inequalities (working against goal 10).

Timescale matters: intensifying food production to end hunger in places where resources are scarce may be feasible in the short term, but over time can deplete fisheries and forests. And spatial scale matters, too: for instance, industrial development may cause pollution and adversely affect the local environment and people's health, but may also generate wealth that can support national health infrastructure. Politicians might mandate that health plans directly benefit the local community.

This conceptual framework is a starting point for building an evidence base to characterize the goal interactions in specific local, national or regional contexts. There is no formal platform for sharing such knowledge yet, but the International Council for Science (ICSU) is beginning to use the framework and populate it with empirical evidence[3]. The ICSU is bringing together research teams of leading experts from universities and institutes around the world to develop thematic case studies, starting with the SDGs for health, energy and food. Each team will define the expertise needed to characterize and quantify the domain's interactions with all other SDGs, organize existing knowledge about these interactions, and identify key gaps and priorities.

Many knowledge gaps will surface. For example, the relationship between urban developments and human health and well-being is only beginning to be studied. Filling the gaps will be costly and will require contributions from research councils and funders such as the European Union's Horizon 2020 framework, as well as governments and universities. The UN should consider how best to track interactions in its SDG monitoring systems, which is now being designed. Tracking interactions will be more complicated than monitoring single sectors, but it could be done in detail in a few key places, such as for the nine SDG pilot countries, which include Uganda and Vietnam.

This interactions framework is intuitive, relatively easy to use and broadly replicable. It will facilitate the accumulation of knowledge and policy learning across countries. To further ensure that the research meets governments' needs, the ICSU and other knowledge brokers such as the Organisation for Economic Co-operation and Development and the UN should convene a series of dialogues and workshops around interactions and how to apply them to policy-making. A first opportunity to put SDG interactions on the agenda is at next month's high-level political forum, where 22 countries, including Germany and Colombia, will report back on their early action plans. ■

ABBIE TRAYLER-SMITH/PANOS

A hydropowered irrigation pump in use at the Kabwadu Women's Banana Farm in Zambia.

WORKED EXAMPLE

The wins and losses en route to zero hunger

In sub-Saharan Africa, ending hunger (goal 2) interacts positively with several other goals — including poverty eradication (goal 1), health promotion (goal 3) and achieving quality education for all (goal 4). Addressing chronic malnourishment is 'indivisible' from addressing poverty — which gains the interaction a score of +3. Tackling malnourishment reinforces (+2) educational efforts because children can concentrate and perform better in school. Not addressing food security would counteract (–2) education, when the poorest children have to help provide food for the day.

Food production interacts with climate-change mitigation (goal 13) in several ways, because agriculture represents 20–35% of total anthropogenic greenhouse-gas emissions[4]. Climate mitigation constrains (–1) some types of food production, in particular those related to meat (methane release from livestock constitutes nearly 40% of the global agricultural sector's total emissions)[5]. Yet food production is reinforced (+2) by a stable climate. Securing food from fisheries is also reinforced by protecting the climate, because that limits ocean warming and acidification.

Finally, in some parts of sub-Saharan Africa, promoting food production can also constrain (–1) renewable-energy production (goal 7) and terrestrial ecosystem protection (goal 15) by competing for water and land. Conversely, limited land availability constrains (–1) agricultural production.

Måns Nilsson *is research director at the Stockholm Environment Institute, Stockholm, Sweden, and professor of the practice of policy analysis at the KTH Royal Institute of Technology, Stockholm, Sweden.* **Dave Griggs** *is professor in sustainable development at the Monash Sustainability Institute, Monash University, Melbourne, Australia, and Warwick University, Coventry, UK.* **Martin Visbeck** *is professor in physical oceanography at GEOMAR Helmholtz Centre for Ocean Research Kiel and Kiel University, Kiel, Germany.*
e-mail: mans.nilsson@sei-international.org

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CORRECTION

Reference 1 in the Comment 'Create a global microbiome effort' (N. Dubilier *et al. Nature* **526,** 631–634; 2015) gave incorrect page numbers. It should have read: Alivisatos, A. P. *et al. Science* **350,** 507–508 (2015).