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Need for Translational Research in Science, Technology, Engineering, Mathematics and Medicine for Sustainable Development

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Translational research in Science, Technology, Engineering, Mathematics (STEM) and Medicine can connect the gap between discoveries of laboratories and real world solutions. Translational research outputs are also useful for speeding up of green technology adoption and addressing urgent global challenges as well for sustainable development.

Seventeen sustainable development goals, adopted by 193 countries, and not one of them achievable by scientific discovery alone (United Nations, 2015). Sachs and colleagues, mapping the 2030 Agenda onto six practical transformations, six years ago, made a point that is easy to state and hard to act on: almost none of these transformations is blocked by a shortage of science (Sachs et al., 2019). What blocks them is the distance between a finding and its use. A Lancet Global Health Commission put a number on what that distance costs, concluding that poor-quality, under-implemented care now prevents more deaths from being avoided worldwide than lack of access to care itself (Kruk et al., 2018). If that is true in medicine, arguably the STEM field with the most developed pipeline from laboratory to practice, it is worth asking how much further behind other fields sit.

The vocabulary for this problem came from medicine first. Steven Woolf described translational research, in a widely cited 2008 essay, as the deliberate work of carrying knowledge from bench to bedside and then into everyday clinical routine (Woolf, 2008). World Health Organization had already given the resulting shortfall a name four years earlier, the know-do gap, the space between what is known and what is actually done (World Health Organization, 2004). Neither term was coined with engineers, climate scientists, or computer scientists in mind, but the gap they describe is not medicine's alone. It shows up wherever a discipline produces knowledge faster than the institutions around it can absorb it.

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Earth-system science offers one of the clearer examples of what closing that gap can look like, and also of how long it can take. When Rockström and colleagues proposed nine planetary boundaries in 2009, defining the biophysical limits within which human development could safely continue, the paper was received as an important but largely academic exercise (Rockström et al., 2009). It has since become one of the more consequential pieces of translated science of the past two decades, feeding directly into the SDG framework itself and into national environmental policy far beyond the scientific community that produced it. The lag between publication and adoption was not measured in months.

Artificial intelligence sits at the opposite end of that timeline, and illustrates a different translational challenge. A 2020 expert-elicitation study found that AI could plausibly advance 134 of the SDGs' 169 targets, but might just plausibly inhibit 59 of them, depending on how, and how carefully, the technology is deployed (Vinuesa et al., 2020). For a field this young, translation is not simply a matter of moving a finished result into practice. It requires building the regulatory and ethical scaffolding around a technology at the same pace the technology itself is developing, a much harder coordination problem than anything Woolf or the WHO had in mind when they first described the know-do gap.

None of this plays out identically across countries, and Sri Lanka's own trajectory is a useful, if sobering, illustration. The most recent Sustainable Development Report placed the country 93rd of 167 nations, an improvement on its 2020 position but a retreat from the 76th place it held in 2022 (Sachs et al., 2024). That regression did not happen because Sri Lankan science stopped producing results. It is far more consistent with a translation problem than a discovery problem, findings failing to reach the regulators, engineers, and practitioners positioned to act on them, at the pace the goals require.

What ties these examples together is not their subject matter but their structure. Researchers studying how the SDGs interact with one another have argued that treating each goal as a separate optimization problem is itself part of what slows translation down, since an intervention aimed at one target routinely helps or harms several others, and recognizing those interactions has to be built into the research design from the start rather than added afterward as a policy afterthought (Stafford-Smith et al., 2017). A STEM paper aimed at sustainable development, on this view, is judged not only by the strength of its result but by how explicitly it names the institution, regulation, or practice that would need to change for the result to matter.

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