

> CHAPTER 2

A review of existing literature

Academic and policy discussions on STI-SDG relations

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OVERVIEW

- This chapter examines current academic and policy literature about the relationship between STI and the SDGs. After developing a search methodology, we identified recent publications and summarised their discussions into four broad, related themes:
 - Synergies and trade-offs between SDGs
 - Misalignment between STI and the SDGs
 - Approaches to shaping STI towards the SDGs
 - Monitoring of the success of STI for the SDGs
- We found that many publications proposed approaches to shaping STI investments and policies towards the SDGs. Yet less effort has been made in trying to understand what works and how to evaluate the efficacy of different approaches.
- By studying what has already been achieved, and identifying potential gaps and limitations in the literature, this chapter informs our own approaches and methods.



→ Introduction

Science, technology and innovation (STI) policies have a crucial role to play not only as a way to boost R&D, productivity and the competitiveness of nations, but also to solve some of the major issues highlighted in the SDG targets, such as reducing poverty and inequalities, and improving life on land or water. In order to better understand this role, we set out to analyse the main findings from recent academic and policy publications (both scientific papers and grey literature) that examine the relationships between STI investments/policies and the SDGs.

After developing a search methodology (see Appendix 1 for more details), we identified 58 recent publications. The findings and discussions in these publications were then grouped in four different themes:

1. Synergies and trade-offs between SDGs
2. Misalignment between STI and the SDGs
3. Approaches to steering STI towards the SDGs
4. Monitoring the success of STI for the SDGs

We created these themes based on our interpretation of the major topics addressed by all the identified publications. The aim of this chapter is not to produce a comprehensive literature review, but to provide some context about current bodies of research that can then inform how we can steer STI towards achieving the SDGs.

Synergies and trade-offs between SDGs

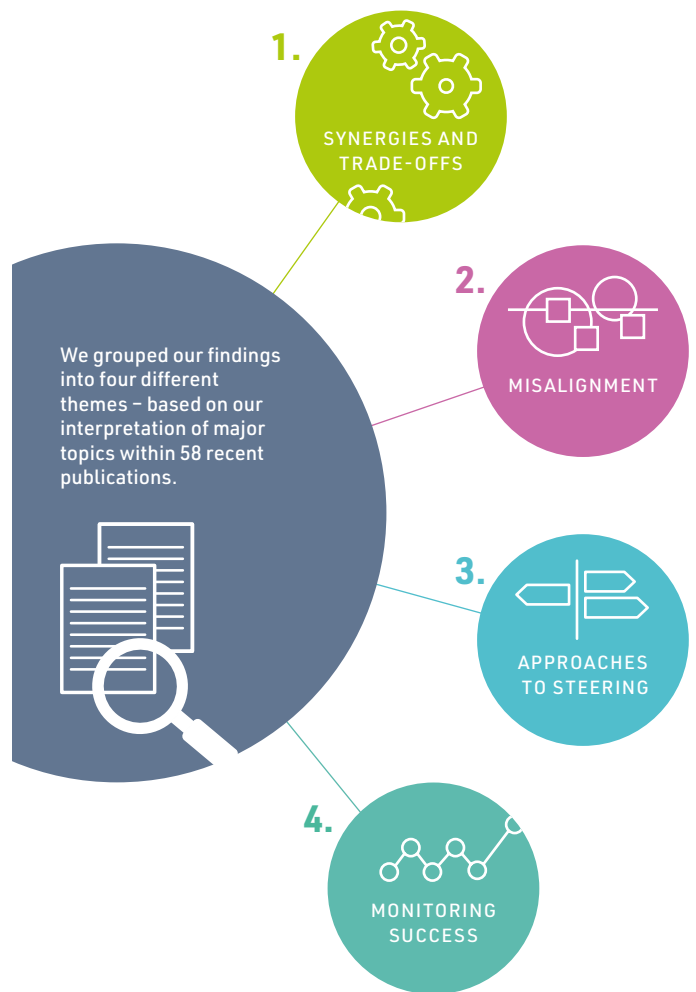
The first theme relates to the synergies and trade-offs between SDGs – that is, whether improvements in some SDG areas are linked to improvements (or negative consequences) in other areas. It is crucial to understand these complex relations between the SDGs before exploring the other themes.

Several publications argue that studying the interaction between SDGs is essential for the efficient design of public

policies (including STI), since an integrated approach can save resources and reduce costs by exploiting the positive links, or **synergies**, between SDG targets and minimizing the negative ones, or **trade-offs**.¹

The literature in this category has applied various methodologies to study the links between SDGs, although most analysis assesses these interactions at the level of individual SDG targets. On the empirical side, many authors have used a time series of SDG indicators to correlate co-evolution between them.² Other approaches have relied on expert opinion, theoretical models, or a review of the literature to identify essential interlinkages between SDG targets.³ Additionally, text mining approaches have been used successfully to assess synergies and trade-offs.⁴ For instance, Le Blanc (2015) finds that, of 107 SDG targets, 60 explicitly refer to at least one goal other than the one to which they belong. This aspect of the SDGs is frequently mentioned as an improvement on the Millennium Development Goals, which formed a less integrated system.⁵

Figure 2.1 / Key themes in the literature



Overall, the literature agrees that positive interactions between SDG targets outweigh the negative ones.⁶ There is also consensus that the relationships between different SDG targets are greatly context-dependent, varying according to geographical location, governance context, number and types of people affected, and the time frame.⁷ For example, increasing fishing activity in a certain region can lead to a reduction of hunger (↑ SDG target 2.1 and 2.3) and improved livelihoods in the short-term (↑ SDG target 8.5). With time, however, fish stocks may become overused, with the same effort leading to less and less yield, unless sustainable management practices are put in place (↓ SDG target 14.4). The context-dependencies make it difficult to draw generalizable conclusions about interactions that may ultimately depend on locally specific factors.⁸

Misalignment between STI priorities and the SDGs

Publications in the second group consider the reasons for the potential misalignments between STI priorities and the SDGs, that is, why STI investments do not always help to meet the SDGs. One issue highlighted is the **uneven distribution of STI activities across countries**. Most STI activities take place in high-income countries, which means they tend to focus on themes and problems that are less relevant to the problems of the worldwide majority.⁹ For example, it is argued that the concentration of technology in the hands of a few companies in high-income countries has often oriented economic growth in consumption-led directions, which are not typically in the interests of the SDGs.¹⁰

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Another factor mentioned in the literature is that, within most countries, **societal priorities differ substantially according to economic status**. For example, a survey sent to 34 African countries¹¹ found that hunger (SDG 2), health (SDG 3), water and sanitation (SDG 6), access to energy (SDG 7), and infrastructure (SDG 9) were the issues that mattered most to the poor. In contrast, the wealthiest respondents were more likely to cite jobs and economic growth (SDG 8) and peace, justice and strong institutions (SDG 16) as priorities. Since decisions about STI priorities emerge from complex interactions between policymakers, funders, researchers and innovators, each with their own incentives and institutionalized practices, it is possible that in many cases STI prioritization is not well aligned with the needs of the poorest residents.

Another important finding is that **some forms of STI contribute to environmental degradation, disrupt livelihoods and exacerbate inequalities**.¹² It has been argued, for example,¹³ that at least nine SDGs could be negatively impacted by advances in automation and artificial intelligence, primarily through the direct and indirect consequence of increased unemployment but also through threats in emergent sectors like the ‘gig’ and ‘on-demand’ economies.

Approaches to steering STI towards the SDGs

Literature associated with the third theme identifies various approaches that can be taken to shaping STI to meet the SDGs. These include:

- i) A focus on **directionality** of STI policies towards the SDGs – in other words, ensuring that national development and STI efforts are aligned with the country’s commitment towards the 2030 Sustainable Development Agenda. Such efforts can take the form of challenge- or mission-oriented approaches, or other incentives for directing STI activities towards the SDGs. In most cases, these approaches include the demand side and involve stakeholders in policy design and implementation.¹⁴
- ii) **Plans, roadmaps or integrated assessments** of STI investments and policy, which are developed and agreed jointly by public, private and civil society actors.¹⁵ These plans might involve, for example, identifying technology gaps or creating research and development roadmaps.
- iii) **Promoting inclusive and grass-roots innovation policies** that consider the specific situations and needs of poor people, women and vulnerable groups to achieve more equitable, sustainable and inclusive development.¹⁶
- iv) **Strengthening national systems of innovation in developing countries** (for example, improving infrastructure, lowering barriers to technology use and diffusion, building STI literacy and capabilities) and **fostering well-functioning institutions** (for example, strengthening political stability, educating workforces, and strengthening the science-policy interface) **in order to boost economic, environmental, social and cultural resilience** that will contribute to the achievement of the SDGs.¹⁷
- v) **Using the SDGs as an opportunity for developing countries to ‘leapfrog’ to sustainable frontier technologies**.¹⁸ For example, some people in developing countries who have previously had no access to electricity are bypassing fossil fuels by adopting solar electricity, thus leaping directly to the stage of renewables. By doing so, they are not only contributing to SDG 7 (Affordable and clean energy), but also developing capabilities and skills in a set of technologies that will be critical in the future.
- vi) Considering the broad **transformations/transitions**¹⁹ that are required in the wider economy to achieve the SDGs by 2030. One study,²⁰ for example, focuses on six

key transformations required to achieve the SDGs by 2030: (1) education, gender and inequality; (2) health, well-being and demography; (3) energy decarbonization and sustainable industry; (4) sustainable food, land, water and oceans; (5) sustainable cities and communities; and (6) digital revolution for sustainable development. Central to these transformations are technology-intensive transitions and the need for open and effective governance at all levels.

Monitoring the success of STI for the SDGs

While the literature contains several theoretical approaches, less has been published about understanding what works and how to evaluate the success of STI in achieving the SDGs. The inherent complexity of all 17 SDGs and the variety of pathways by which different areas of STI can contribute to specific targets make it difficult to rigorously evaluate impact and specific relations.²¹ Yet, the existence of indicators associated with the SDG targets and the requirement for the collection of standardized data provide an important opportunity to monitor the relationships between STI and the SDGs.²²

An important issue relating to SDG indicators is that many national statistical systems have faced severe challenges in tracking progress, which requires an unprecedented amount of data and statistics at all levels.²³ The Global SDG Indicators Database²⁴ reveals that, for four of the 17 goals, less than half of the 194 countries or areas have produced internationally comparable data. Even some countries with available data have recorded only a small number of observations over time, making it difficult for policymakers to monitor progress and identify trends.

Therefore, most literature related to this theme recommends increased investments in national data and statistical systems and the mobilization of additional international and domestic resources to guarantee the internal consistency, comparability and overall quality of data produced to advance

the 2030 Agenda. This is especially relevant in lower-income contexts, where, arguably, these actions and investments should be complemented by an operational/technical assistance budget dedicated to monitoring and evaluating policy.²⁵ In such countries, the literature argues, it is essential to enhance capacities related to monitoring and accountability in order to establish policies that help to achieve the SDGs.

On a positive note, some of the literature argues that advances in technology and the proliferation of data are providing new opportunities for monitoring and tracking the progress of the SDGs. A promising avenue is the data produced through **citizen science**, which can complement and ultimately improve the SDG reporting process.²⁶ Fritz et al. (2019) provide concrete examples of how citizen data are currently being adopted as well as highlighting potential areas for future contributions. For example, volunteers in the Philippines are collecting household census data on poverty, nutrition, health, education, housing and disaster risk reduction, which are then used by the Philippine Statistics Authority to enhance their statistics on 32 SDG indicators.

Conclusion

Overall, our review found several proposed approaches to help steer STI investments towards the SDGs. Partially due to the complexity of the issues at hand, less effort has been made in trying to understand what policies and investments work, and how to evaluate their efficacy. Understanding the mechanisms that foster STI to help achieve the 2030 Agenda in specific contexts, and how to measure performance and progress, are significant research gaps. The STRINGS project aims to address these gaps – both by developing methodologies that track misalignments between STI and the SDGs at the global level and by analysing how well different STI pathways are aligned to specific SDG challenges in our case studies in East Africa, India and Argentina. ●

Notes

- Alcama et al., 2018; Allen et al., 2018; Barbier and Burgess, 2017; Donoghue and Khan, 2019; Elder et al., 2016; ICG, 2017; Kumar et al., 2018; Scharlemann et al., 2016.
- Fonseca et al., 2020; Pradhan et al., 2017; Sebestyén et al., 2019.
- Fuso Nerini et al., 2018; McCollum et al., 2018; Moyer and Bohl, 2019; Nilsson et al., 2018, 2016.
- Le Blanc, 2015; Dörgó et al., 2018.
- Fukuda-Parr, 2016.
- Barbier and Burgess, 2019; McCollum et al., 2018; Nilsson et al., 2018; Pradhan et al., 2017.
- Breuer et al., 2019; Nilsson et al., 2018; Scharlemann et al., 2016.
- McCollum et al., 2018.
- United Nations, 2019, 2014; Walsh et al., 2020.
- Walsh et al., 2020.
- Coulibaly et al., 2018.
- UNCTAD, 2017.
- UNDP, 2018.
- Giovannini et al., 2015; Mazzucato, 2018; UNCTAD, 2018, 2017.
- Allen et al., 2019; IAP Workgroup, 2019; IATT, 2018, 2020; Miedzinski et al., 2019; United Nations, 2016a; United Nations Economic and Social Council, 2015.
- UNCTAD, 2017; United Nations, 2016b.
- IAP, 2019; Leal Filho et al., 2018; United Nations, 2016b, 2016c, 2014.
- United Nations, 2018.
- Sachs et al., 2019a; Schot and Steinmueller, 2018; The World in 2050, 2018.
- Sachs et al., 2019.
- Adenle et al., 2020; Cervantes and Hong, 2018; United Nations, 2016a.
- Gusmão Caiado et al., 2018; Reyers et al., 2017; Salvia et al., 2019.
- ISSC, 2015.
- United Nations, 2020.
- IAP Workgroup, 2019; Namubiru-Mwaura and Marincola, 2018; Schmalzbauer et al., 2016.
- Fritz et al., 2019; Quinlivan et al., 2019.