

> CHAPTER 10

Diversity and plurality

Strategies to address complexities
in aligning STI and the SDGs

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OVERVIEW

- There is a need to focus on the plurality of worldwide interests, values and understandings and to aim for a diversity of possible STI responses to complex SDG challenges.
- A diverse research and innovation portfolio enables sensitivity to context.
- Deliberate diversification is more robust than the conventional policy aim of identifying a single 'optimal' STI pathway.
- STI portfolios should always be subject to rigorous technical analysis and vigorous democratic oversight.
- Effectively addressing sustainability challenges involves building capabilities to challenge the incumbent power that often concentrates around entrenched, unsustainable STI pathways.

Footnotes for this chapter are on page 118. A full list of references can be found on page 140.



→ Earlier sections of this report have explored various deep-seated dilemmas around aligning STI pathways with the social, economic and environmental imperatives embodied in the SDGs. A key issue is the importance of attending to the **plurality** of worldwide interests, values and understandings, which relate both to STI activities and to the prioritizing of issues encompassed in the SDGs.

In addressing this plurality of sustainability challenges, this report highlights some neglected real-world governance dilemmas in seeking to align STIs with the SDGs, as follows:

- SDG goals, targets and metrics encompass **multiple dimensions** of intersecting social, economic and ecological challenges
- Each dimension, and each relation between dimensions, displays **variabilities, uncertainties and ambiguities** that involve divergent understandings and perspectives
- Each potential STI pathway that may offer a response to these dilemmas may also be reasonably understood and evaluated in a **multiplicity of ways**

Diversity among STI responses

These dilemmas of plurality indicate the importance of a **diversity** of possible responses to SDG challenges. At first sight, this looks like it could compound the policy challenges. Real-world politics, with its entrenched structures and gradients of power and privilege, can put pressure on analysts and academic researchers to represent results in ways that artificially simplify the pluralities of the SDGs themselves and exclude diversity in the possible responses.

Yet on the other horn of this ‘real-world’ political dilemma, there are the ‘real real-world’ complexities of sustainability challenges and possible research and innovation responses themselves. The key questions are, therefore: What practical strategies are available for responding to the irreducible complexities around alignments of STI with the SDGs? What operational options exist for dealing robustly with challenges of plurality, uncertainty and ambiguity without simplifying or concealing these inconvenient truths?

Deliberate diversification of responses

Fortunately, there is a clear pragmatic option that can address these challenges in fundamental ways. Although it is neither a panacea nor without its downsides in particular contexts, this practical response is diversity itself.¹

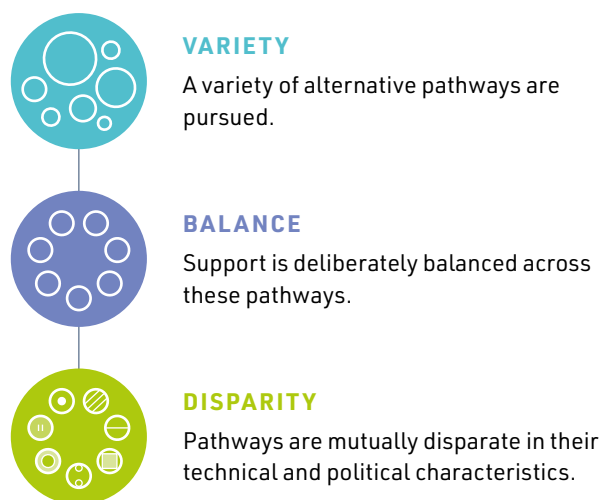
Through deliberately pursuing a diversity of responses to SDG challenges, governance of STI for the SDGs can:

- be sensitive to different contexts
- hedge against uncertainties
- accommodate ambiguities
- mitigate adverse forms of lock-in (that is, the rules and infrastructures that are set up for a particular way of doing things and keep it that way)
- foster creativity and accelerate deeper forms of learning in research and innovation themselves

By deliberate diversification, we mean placing explicit value on the quality of diversity in research portfolios and innovation programmes designed to address sustainability challenges. By ‘diversity’ in STI pathways, we refer specifically to the following three key qualities (see Figure 10.1):²

- A **variety** of alternative pathways are pursued. ‘Variety’ is an integer, simply counting the number of different pathways that might be categorized.
- Support is purposefully **balanced** across these pathways. ‘Balance’ is a set of fractions that add up to one, reflecting the relative prioritizations across these different pathways.
- Pathways are mutually **disparate** in their technical and political characteristics. ‘Disparity’ is the degree of salient difference between different pathways.

Figure 10.1 / Diversity in STI pathways: the three key qualities





The value of a diverse portfolio

By considering the properties of variety, balance and disparity, it becomes possible to derive a rigorous analytical tool to measure how much and what kinds of diversity might offer the best response to the challenges of aligning STI with the SDGs.⁵

Using this framework to systematically modulate variety, balance and disparity in a suite of STI pathways for a given SDG is more easily achieved than seeking to identify a single 'best' response.

Through these entangled qualities, a diverse research or innovation portfolio can begin to address the array of challenges described above, as follows.

- By embracing different social and technical attributes, a diverse portfolio can **address context-sensitivities** in ways that are not possible with any single pathway.⁴
- By incorporating features that address contrasting eventualities, diversity can help **build a response pool that is more resilient** in the face of deep uncertainties than the singular options often prioritized in mainstream policy

analysis.⁵ For instance, disparities between wind, solar and geothermal power mean that no single cause is likely to disrupt them all at the same time in the way that geopolitical or regulatory developments can affect coal, oil and gas simultaneously.

- By spanning characteristics that appeal to contending political, economic or sociocultural interests, diversity may be able to **accommodate seemingly irreconcilable ambiguities.**⁶ For instance, rural and urban conservatives and progressives may not be able to agree that any single energy strategy is 'best'. But a diverse portfolio of renewable options may collectively accommodate this plurality of perspectives and interests.
- By supporting disparate research and innovation 'niches', diversity can **mitigate adverse forms of path dependency and lock-in** around any particular dominant pathway.⁵ For instance, social and grassroots innovations for cultivating, preparing and distributing sustainable local produce can reduce dependency

on industrial monocultures driving highly processed, wasteful food consumption.

- By promoting connections and overlaps between communities, diversity can **foster greater creativity and accelerate deeper learning** between pathways.⁷
- Diversification among STI pathways can also help **address issues associated with spin-off and trickle-down** in the anticipated secondary effects of a project or development. These supposed benefits (for example, artificial intelligence for cities or civil nuclear power) are each shaped to some degree by some primary direction for innovation, such as military logistics or naval propulsion. Characteristics imposed by this original context (for example, hierarchical control in artificial intelligence or concentrated power in nuclear technologies) can constrain and imprint the associated trickle-down or spin-off effects. Promoting greater diversity can help avoid this issue.

A remarkable picture emerges when diversity of STI pathways is characterized in terms of these three properties. For instance, without considering disparity, we would not appreciate how the political-economic, technical, resource and supply-chain attributes of wind power make it arguably more different from both coal and nuclear power than either of these are from the other.³ So if we ignore disparity, the assumption might be that all pathways are equally different from each other.

The difficulties of diversity

Of course, it is important to be open-eyed about the less attractive attributes of diversity. Diversity in STI pathways is not a free lunch:⁸ it does not necessarily come without costs. By definition, deliberate diversification means affording relatively less support for pathways that are seen to perform best

and greater support for pathways whose overall performance might seem weaker, but which add to overall diversity.

What diversification means, then, is that the most favoured pathways become less dominant and more marginalized pathways become more supported. From the perspective of dominant pathways, this may appear to be a disadvantage. But from less powerful interests or less privileged perspectives, it may seem like a benefit. Under metrics associated with the dominant view, this will look like a diversity/performance trade-off.

Further practical challenges of deliberate diversification include elevated transaction costs caused by administrative inertia and the difficulty of communications across disparate programmes.⁹ For a particular STI pathway that might otherwise have been strongly supported in a portfolio, diversification in favour of other pathways can also involve a loss in economies of scale.¹¹ Some economies of scope may accrue,

but this may mean foregoing the benefits of standardization across the portfolio as a whole,¹¹ for example, due to increased costs of translating between different formats. In a wider governance context, it is also possible that diversification may obscure broader processes of accountability.¹⁰

There may also be dangers related to particular types of emphasis on diversity in policy discourse. If the approach to diversity is not systematic, then well-resourced interests associated with poorly-performing STI pathways may use diversity rhetoric to encourage support for failing options. Here, then, it is crucial to recognize that diversity (systematically defined and analysed) is a fundamental property of a portfolio of STI pathways as a whole. Advocacy of diversity that disproportionately promotes some specific individually-favoured innovation pathway is a sure sign of vested interests at work. Diversity does not mean ‘do everything’, but ‘choose openly and carefully’.¹⁰

Evaluating STI pathways

What all these considerations underscore is that deliberate diversification of STI pathways should be subject to rigorous and transparent technical analysis and vigorous democratic oversight. Fortunately, an approach based on variety, balance and disparity, as suggested here, yields a robust quantitative framework for systematic policy appraisal of the complex relations between diversity and performance in STI portfolios, without vulnerability to manipulation in favour of specific options.⁵

Depending on the nature of the sustainability challenge and the wider political dynamics, policymakers can pick the precise forms and degrees of diversity that are appropriate for specific challenges. The extent to which the advantages of

diversification are seen to be outweighed by costs and burdens can then be a matter for transdisciplinary analysis, inclusive participation and wider democratic oversight.¹¹

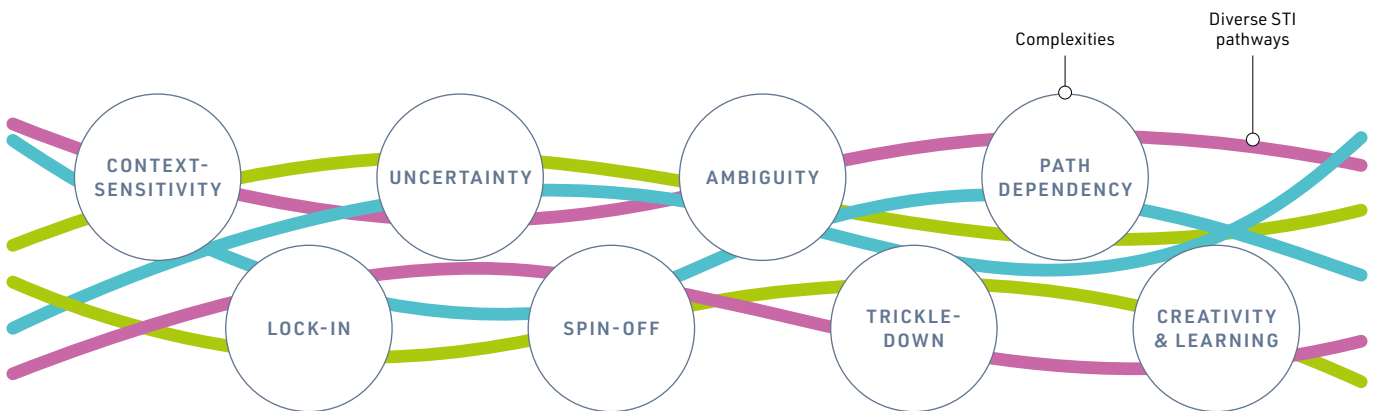
If the net benefits of diversity appear minimal, then governance may indeed prioritize a single STI pathway for the focal SDGs. Where the balance of pros and cons lie on the side of diversity, then more diverse STI portfolios will be justified. More diverse portfolios may be associated with a move from narrow elite policymaking to broader forms of governance involving more marginalized interests and civil society. Either way, what is crucial is that diversity in research and innovation for sustainability becomes the focus of transparent, systematic and accountable attention.

‘More diverse portfolios may be associated with a move from narrow elite policymaking to broader forms of governance involving more marginalized interests and civil society.’

Deliberate diversification of STI pathways is not about relinquishing rigorous analysis and does not imply that ‘anything goes’.¹² Through careful acknowledgement of the real-world complexities identified above, deliberate diversification offers a more robust approach than conventional policy appraisals that tend towards pursuing singular STI pathways.

Where careful empirical attention is given – from a range of perspectives and in both quantitative and qualitative terms – to the attributes of a range of STI pathways, a small number of

Figure 10.2 / Addressing complexities through deliberate diversification



A diverse research or innovation portfolio can help to address the many complexities described above

robust pathways will typically emerge as the strongest. Many other possibilities will be seen as manifestly less attractive, irrespective of the perspective. When this situation occurs, it is possible to attach far greater confidence to the more positive pathways than would be the case for analysis aimed simply at engineering closure. Decisions are still taken, but the understandings on which they are based are broader and more robust.

A focus on power and privilege

Ever since the Brundtland Commission in 1987,¹² sustainable development has been recognized as being just as much about participation and democracy in the processes of governance as it is about the various goals, targets and metrics bearing on the outcomes (such as improved water, air and food). The 2030 SDG framework itself reaffirms and further emphasizes that sustainability is as much about process as outcomes.

For the SDGs, this means a direct focus on how patterns of power and privilege operate in relation to challenges of social equality, economic well-being and ecological integrity. In some forms and settings, power of particular kinds offers an essential resource. In other modes and contexts, entrenched power and privilege are among the core problems.¹³

Whatever the context, effectively addressing sustainability challenges involves building capabilities to challenge the incumbent power that is often associated with entrenched, unsustainable STI pathways, such as toxic chemicals, fossil fuels, military approaches to international relations or related nuclear infrastructures.¹⁴

Whether through quantitative analysis, qualitative deliberation or other forms of mobilization, democracy is in this sense about access by the least powerful to the capacities for challenging power.¹⁵ When power remains unchallenged, it is most likely to be regressive (rather than progressive) in relation to sustainability challenges.¹⁶

There is a crucial responsibility for international governance of STI to give more systematic attention to the interlinked qualities of plurality and diversity.¹⁴ In this way it is possible to achieve the inclusive access, participatory agency and democratic governance that are intrinsic to achieving more democratic processes and more socially robust outcomes.^{17,18}

Tools to map STI pathways onto SDG challenges

In the end, there can be no unequivocal or definitive conclusions concerning the aligning of STI diversity with SDG plurality. Despite political pressures for policy justification, the complex dynamics and ambiguities in research and innovation and in social and ecological challenges will typically preclude simple single prescriptions.¹⁹

It is impossible to determine exact, final answers to the dilemmas of aligning STI with the SDGs as one might determine precise geometric relations in mathematics, for example.^{20,21} But this does not mean that governance processes cannot derive, in robustly qualitative ways, the broad patterns of possible alignments. The resulting practical pictures are 'heuristic' because they explore different reasonable responses, rather than mechanisms to assert particular solutions. Rather than pretending at a single final analytical view, heuristics may offer a more collectively firm basis for further investigation and learning.^{22,23} By using an explorative, heuristic approach to align STI with the SDGs, policymakers and funders may obtain a useful sense of the relations between different challenges and pathways, even if the precise details are hazy.^{24,25}

As has been mandated in sustainable development frameworks from their very beginning, these plural and conditional analytical mappings need to be complemented by transparent communication, inclusive access, participatory involvement, open accountability and wider democratic governance.^{26,27} It is through such ongoing, iterative and interactive processes – firmly grounded in disparate geographical settings around the world – that global research and innovation activities can become better aligned with sustainability imperatives. ●

Building on the above ideas, the following chapters present:

- the various ways that global governance can better align STI with the SDGs (Chapter 11)
 - the use of a tool to enable stakeholders to make their own choices on the relevance of STI for SDGs (Chapter 12)
 - our recommended policy interventions to address misalignments between STI and the SDGs (Chapter 13)
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