



RESEARCH ARTICLE

Operationalising sustainability? Why sustainability fails as an investment criterion for safeguarding the future

Simon Friederich¹ | Jonathan Symons²

¹University College Groningen, University of Groningen, Groningen, the Netherlands

²Macquarie School of Social Sciences, Macquarie University, Macquarie Park, New South Wales, Australia

Correspondence

Jonathan Symons, Macquarie School of Social Sciences, Macquarie University, Level 2, 25B Wally's, Macquarie Park, New South Wales 2109, Australia.
Email: jonathan.symons@mq.edu.au

Abstract

Policy instruments promoting sustainability, such as investment taxonomies, are playing an increasing role in guiding the allocation of financial resources internationally. But can policy instruments define sustainability in ways that are both operational (i.e. assessable via replicable procedures) and which specify practices that can reliably be expected to enhance future generations' welfare? This paper analyses candidate definitions of sustainability and identifies a dilemma: while various definitions identify a 'capital' variable whose value can indeed be determined empirically; we have no reason to assume that preservation of any specific capital variable will maximise expected future welfare. By contrast, sustainability can be defined 'dynamically' in terms of activities that will, on expectation, lead to future developmental trajectories with high welfare. But, as we show through discussion of concrete examples, 'dynamic sustainability' cannot readily be operationalised. We conclude that what qualifies as 'sustainable' will remain a subject of political dispute and that authoritative comprehensive assessments of 'sustainability' will remain chimeric. We suggest that selecting a narrow class of specific measures, such as of life-cycle greenhouse gas emissions, might lead to more effective and less contentious approaches to resource allocation.

1 | INTRODUCTION

There is widespread agreement that it is desirable for communities to develop 'sustainably' by shifting from 'unsustainable' to 'sustainable' practices. This consensus was first consolidated in 1992 when the United Nations' 'Agenda 21' action plan for implementation of sustainable development by national and local governments won almost universal state support (Evans & Theobald, 2003). Subsequently, growing recognition that global economic activity might push ecological systems beyond planetary boundaries – in areas such as atmospheric carbon concentrations, nitrogen use and biodiversity – consolidated the political commitment to sustainability (Edenhofer et al., 2014; Kaya & Stoetzer, 2021; Steffen et al., 2015). Early efforts to quantify 'sustainability' generally took the national

economy as their subject, and combined an array of social, economic and environmental indicators (see for example, Eurostat, 1997). More recently, governance initiatives have sought to promote financing of 'sustainable' projects: the UN General Assembly's Sustainable Development (SD) Goals (2015, see also Long, n.d.; McGowan et al., 2019; Hillerbrand, 2018) and the European Union Taxonomy for Sustainable Activities (the Taxonomy) are prominent multilateral efforts (European Parliament, n.d.). Mirroring the European Taxonomy, a wide variety of national jurisdictions, including China, Russia, Indonesia and Japan are developing similar investment taxonomies. These efforts to define sustainability focus on assessing the contribution that individual projects make to social and environmental priorities, among which avoiding dangerous climate change is particularly prominent.

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial](https://creativecommons.org/licenses/by-nc/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

© 2022 The Authors. *Global Policy* published by Durham University and John Wiley & Sons Ltd.

These governance initiatives have a significant influence on resource allocation. Consider the case of the Taxonomy. It will directly regulate the European Environmental and Social Governance Investment sector (approximately \$2 trillion of a \$3.6 trillion global sector in 2020; IMF, 2021); will guide the allocation of public resources within the EU (e.g. €265 billion of projects funded under the European Union's Covid Recovery Fund, and all of the €1 trillion earmarked for the European Green Deal Investment Plan must be invested in Taxonomy-compliant activities; Taylor, 2020) and will indirectly influence investment decisions in all jurisdictions that have significant ties to the EU. Through the Taxonomy, EU policy makers are seeking to develop an agreed measure of sustainability which they hope will counter corporate greenwashing and other attempts to advance sectional interests behind the cover of sustainability discourse. The International Monetary Fund's 2021 Global Financial Stability Report endorsed the idea that agreed investment taxonomies are a necessary part of the global climate response. It declared that 'globally agreed-upon principles for sustainable finance classifications' are needed 'urgently' in order to effectively finance climate change mitigation internationally (IMF, 2021).

Attempts to develop suitable taxonomies face two challenges. The first challenge concerns greenwashing: the concept of sustainability is easily used as a rhetorical 'fudge' whose positive connotations are used to legitimate business as usual (Shue, 1995). While sustainability taxonomies might be useful if they eliminate such greenwashing by establishing rigorous tests, the risk is that powerful economic and political actors will take advantage of 'sustainability's' vagueness and shape taxonomies in their interests, potentially to the detriment of the public good. The second challenge is that conflicting values and beliefs can make it difficult to agree on what is to be classified as sustainable. During development of the Taxonomy, for example, controversies arose over how nuclear power should be categorised. The European Commission Joint Research Centre (JRC) was commissioned to write a report which concluded that, to the extent that technologies already accepted into the taxonomy fulfil the criteria for inclusion, nuclear energy does so and should also be accepted. However, after an additional, narrow, vote in the European Parliament nuclear energy was only listed as a 'transition' technology, alongside emissions-intensive fossil gas, and subject to further politically negotiated constraints on its deployment. Clearly, in the resolution of this dispute, political negotiation has played as large a role as technical assessment against environmental standards.

One possible diagnosis of the source of these problems is that the characterisation of sustainability underlying the Taxonomy¹ is not 'operational', that is, not specified through criteria that are capable of

Policy Implications

- Investment taxonomies can play a significant role in aligning resource allocation with public interests, such as that of avoiding dangerous climate change.
- In developing policy-relevant definitions of sustainability it is useful to distinguish between capital-focused definitions linked to the belief that activities can continue 'indefinitely' if they preserve specific capital variables, and 'dynamic' definitions that seek to steer future development towards trajectories with high welfare and/or low catastrophic risks.
- Capital-focused definitions of sustainability can be made operational in the sense of making it possible to assess sustainability via quantifiable and empirically replicable procedures. However, we show there is no reason to believe that such definitions will identify practices that maximise the expected welfare of future generations.
- Dynamic definitions of sustainability that identify sustainable practices with those that maximise expected future welfare and/or minimise catastrophic risks cannot be operationalised. Sustainable investment taxonomies are thus destined to remain politically contested.
- Compared with bundling multiple measures into seemingly authoritative comprehensive assessments of 'sustainability', a potentially more useful aid to policy making is to utilise a narrow class of quantifiable measures of environmental impact, for example, 'life-cycle greenhouse gas emissions'.

being assessed empirically via replicable procedures. This differentiates 'sustainability' in the sense of the Taxonomy from other policy-guiding concepts such as 'full employment' or 'wage parity'. Applying an operational definition of sustainability has in fact long been recommended by Daly (1990), pioneer of sustainability studies, who argued that the concept of sustainability should be given clear 'logically consistent and operational content'.

If an operational definition of sustainability captured factors that demonstrably enhance the welfare of future generations it might solve both challenges: there would be no possibility of greenwashing if sustainability were an empirically ascertainable matter of fact. And it could make assessment of sustainability a matter of apolitical scientific inquiry, thereby eliminating the need to resort

to unsatisfying procedures that involve political negotiation and power struggles.

In this paper we seek to assess if an operational definition of sustainability is realisable and desirable. Our method is what Schliesser (2019) calls *synthetic philosophy*: ‘a style of philosophy that brings together insights, knowledge, and arguments from the special sciences with the aim to offer a coherent account of complex systems and connect these to a wider culture or other philosophical projects’. Our sobering conclusion is that a concept of sustainability cannot, on the one hand, be determined via a quantifiable empirical assessment (operationalisable) and, on the other hand, also provide a reliable guide to optimising future prospects (effective). Instead, given uncertainty about socially desirable outcomes and how to achieve them, ‘experimental’, ‘adaptive’ approaches to governance that incorporate periodic review and political reflection on specific measures of environmental impact will be more appropriate to governance of ‘sustainability’ (De Búrca et al., 2014; Rijke et al., 2012). We conclude that the EU’s failure to develop an operational umbrella definition of sustainability was to be expected, because, plausibly, no such determinative measure is possible.

The structure of our argument is as follows: Section 2 reviews what we take to be the standard textbook account of sustainability, the ‘indefiniteness account’, which holds that a practice is sustainable if and only if it can be performed indefinitely. We consider attempts to operationalise the indefiniteness account with reference to the preservation of particular stocks of capital and the historical debates between advocates of ‘strong’ and ‘weak’ sustainability over what kind of capital variable (natural or otherwise) would maximise the welfare of future generations.

However, as we argue in Section 3, assessing how current practices will affect the future and deciding which futures are desirable means making highly uncertain predictions concerning coupled social-ecological systems and inherently political judgements of value. Neither of these can be operationalised.

In Section 4, we argue that the dilemma of operationalisability runs even deeper than has previously been recognised. If decision-making is organised around minimising future risk and maximising the prospects for meeting the needs of future generations, there is no reason to only consider practices that are ‘sustainable’ in the sense of any capital preservation account. Here we consider a newer account of sustainability drawn from a seminal paper of Bostrom’s, first published in *Global Policy* in 2013. Bostrom argues that sustainability should be assessed with reference to developmental trajectories, and that behaviour which depletes some finite natural capital stock may actually improve overall future prospects. We substantiate his suggestion by discussing a concrete example of the possibility envisaged by him, namely, mining for renewable energy

installations. We argue that ‘dynamic sustainability’ in Bostrom’s sense cannot be operationalised. In particular, especially as human impacts move key ecological systems beyond ‘planetary boundaries’, preservation of natural capital cannot always be presumed to be socially or environmentally beneficial.

We conclude that taxonomies of sustainable activities can either be based on operational criteria – but then policy outcomes will be uncertain; or they can be more loosely based on visions and expectations of desirable futures – and then there is no reason to expect that they will conserve natural capital or be capable of indefinite repetition.

2 | THE ‘INDEFINITENESS’ ACCOUNT OF SUSTAINABILITY AND NATURAL CAPITAL

The literature on sustainability is vast, and there are different views on what constitutes the notion’s conceptual core. Whereas much academic research has addressed measures of national or global sustainability (see, for instance, Pearce & Atkinson, 1993; Cabeza-Gutés, 1996), our focus is on policy instruments that assess the sustainability of specific practices. A textbook characterisation such as that given by Atfield (2018, p. 61), who classifies a ‘practice’ as sustainable if and only if it has the ‘capacity to be practised or maintained indefinitely’ is a reasonable starting point, as it captures what has historically been the dominant theoretical account of sustainability. We refer to definitions of sustainability that emphasise capacity for replication through time as versions of the ‘indefiniteness account’ of sustainability.

Already in the first half of the 18th century, Carl von Carlowitz used a term that is closely related to the modern German term for sustainability (‘Nachhaltigkeit’) to denote forestry practices that can be maintained indefinitely. According to von Carlowitz and von Rohr (1732, p. 105, authors’ translation), ‘the highest art/science/industriousness [*sic*] ... will consist in such a conservation and replanting of timber that there be a continuous, ongoing and sustainable (‘nachhaltende’) use’.

The indefiniteness account is not itself an operational definition of sustainability. It is clear that some practices are radically unsustainable according to any reasonable way of interpreting the indefiniteness account, for instance, cutting down an entire forest, thereby creating an ecological desert, and using the profits from wood sales for short-term consumption. But it is far from self-evident that the capacity to be performed indefinitely is a sufficient test to provide an intuitively satisfying definition of sustainability. For instance, must a forester preserve the biodiversity of the forest she is responsible for in order for her practice to qualify as sustainable? Many people would

think so. However, a forester who replaces native vegetation with a faster-growing monocultural forest that is harvested no faster than its rate of reproduction could also be argued to satisfy the indefiniteness account. It is also unclear how the indefinite repetition of specific 'practices' connects to the sustainability of the social orders in which they are embedded. For instance, if a forester preserves a biodiverse forest and makes a living selling its wood harvest within an economic system that causes climate change, and if the forest is ultimately destroyed by fires or pestilence that were made more likely by climate change, should the practice be considered sustainable?

One traditional way of operationalising sustainability, which is very much in the spirit of the indefiniteness account, uses the notion of 'capital' that must be preserved by some practice in order for it to qualify as sustainable. Timber is one form of 'capital'; von Carlowitz's imperative that no more timber should be harvested than grows back can be seen as a special case of the more general statement that the overall stock of natural capital should not shrink. This statement, in turn, can be seen as based on the indefiniteness account: practices that cause the stock of natural capital to shrink by some fixed amount cannot be performed indefinitely and, hence, do not satisfy the indefiniteness account.

Clearly, if the indefiniteness account is to be made operational by specifying a particular kind of capital preservation, a specific type of relevant 'capital' must be unambiguously identified. But identifying a suitable 'capital' variable raises new complexities, which are reflected in the long-standing debate between proponents of 'weak' and 'strong' sustainability. Strong sustainability requires that a specific type of capital, 'natural' capital, must be preserved, whereas weak sustainability insists on the preservation of capital only in a more general sense. Under weak sustainability, natural capital can be substituted for by 'man-made capital' at least to some extent (Cabeza-Gutés, 1996; Pearce & Atkinson, 1993). Proponents of strong sustainability such as Daly (1990) object to weak sustainability on the basis that, plausibly, man-made capital can only complement natural capital, not substitute for it.

The debate between proponents of weak and strong sustainability centres around the question of what kind of variable should be used as the 'capital' variable. Weak sustainability might be expressed as conservation of a scalar numerical quantity that has different additive contributions from both natural and other types of capital. Strong sustainability, in contrast, might be expressed as conservation of a multidimensional capital variable with different complementary 'entries' that must all be preserved at their current levels. Elkington's (1997) concept of a 'triple bottom line' – sharpened by Rambaud and Richard (2015) to that of a 'triple depreciation line' – requires preservation of

three different types of capital: natural, financial, and human, and can be seen as a moderate version of strong sustainability.

In any case, the question of whether some types of capital can substitute for other types also arises at the level of natural capital itself and, thus, also within strong sustainability. Besides the amount of timber in any specific forest, there are many other types of natural capital that a society may want to preserve. For example, geological deposits of different types of minerals can be seen as forms of natural capital. So too can the absence of pollution in different types of ecosystems or even in the atmosphere as a whole. From that perspective, increasing concentrations of nitrogen oxides, sulphur oxides, carbon dioxide, radioactive caesium-137 or particulate matter differentially contribute to decreases in these capital stocks. A multidimensional approach also suggests that assessments of sustainability must be made at the level of entire economic systems, rather than local practices. As we have seen, the forester lacks control of externally generated pollution that might diminish the capital stored in her forest.

Advocates of strong sustainability must specify whether and, if so, to what extent substitution between these different types of natural capital is permissible. The most radical account of strong sustainability would be one in which no substitution at all is possible and, for example, even partly substituting one type of timber for another violates sustainability. Even Daly (1995, p. 49), ardent advocate of strong sustainability, rejects the idea that 'no species should ever go extinct, nor any non-renewable resources should ever be taken from the ground' and derides it as 'absurdly strong sustainability'. Daly's (1995) own preferred version of strong sustainability, inspired by El Serafy (1989), even allows for the depletion of non-renewable resources, though only as long as the rate of depletion is no more than 'equal to the rate at which renewable substitutes can be developed' (Daly, 1990, p. 50).

Daly claims that this version of strong sustainability is 'operational'. However, we disagree because Daly does not provide a detailed account of how exactly the variable 'natural capital' should be computed. Daly's account of strong sustainability clearly is meant to allow that one type of natural capital can sometimes substitute for another, at least in some specific cases, but it is not clear which empirical procedure could be used to determine which cases exactly. For Daly's strong sustainability to be operational, one would need a detailed account of what type of mathematical variable should be used as natural capital and how to compute its value under different circumstances using directly measurable quantities as inputs. Daly provides no such account, nor to our knowledge does any other proponent of (weak or strong) capital-based, sustainability. Operationalising Daly's account at the level of individual practices or technologies would raise additional

challenges of calculating local contributions to societal ledgers.

In the actual practice of policy making, sustainability regulations tend to be aligned with more abstract and less demanding goals than preserving any specific capital variable. For example, the European Taxonomy requires that projects make a 'substantial contribution' to one of six objectives: (1) climate change mitigation; (2) climate change adaptation; (3) sustainable [sic] use and protection of water and marine resources; (4) transition to a circular economy; (5) pollution prevention and control; and (6) protection and restoration of biodiversity and ecosystems; while doing 'no significant harm' to others. It seems doubtful whether all these criteria can be motivated in terms of capital preservation or, for that matter, practices that can be performed indefinitely. These same dilemmas have prompted some scholars to argue that as long as we are lacking a systematically privileged operationalisable measure of sustainability, this can be approximated by using 'dashboards' of multiple capital stocks (Fleurbaey & Blanchet, 2013). In what follows, we argue that efforts to codify sustainability in terms that will safeguard the welfare of future generations will inevitably resit operationalisation.

3 | DEFINING SUSTAINABILITY WHILE REFERRING TO THE FUTURE

What is the ultimate rationale for pursuing sustainability? Perhaps that rationale can guide us to identify the right variable 'capital' whose preservation we should require (or the candidate 'practices' that will potentially be performed indefinitely). Plausibly, that rationale – the 'raison d'être' for sustainability – is a concern for future generations or intergenerational equity (see Heath, 2013). If we rely on practices that cannot be performed indefinitely, we risk undermining the welfare of future people; indirectly and ultimately, we may risk the collapse of communities and, in the worst case, of human-instigated society itself.² The famous definition of 'sustainable development' – which, to a first approximation, might be construed as development from unsustainable to sustainable practices – used in the report 'Our Common Future' by the Brundtland Commission makes this concern for the future central: 'Sustainable development meets the needs of the present generation without compromising the ability of future generations to meet their needs' (Brundtland, 1987).

Considerations about what the future will be like if certain practices are adopted, maintained, or abandoned can indeed be helpful to determine what to treat as the capital variable which 'sustainability' seeks to preserve. For example, modelling the Earth's future climate as a function of present and future greenhouse gas emissions can help us determine what the

consequences are if the type of capital 'unpolluted atmosphere' decreases further. Such modelling can also enhance our understanding of what other types of capital might possibly substitute for an 'unpolluted atmosphere' and so allow 'adaptation'. For example, the forester may use predictions of the future climate to decide to what extent substituting one type of timber for another can be conducive to maintaining the forest as a biodiverse ecosystem and/or how to preserve its economic value by growing climate change-resilient types of timber.

But could working backwards from anticipated future outcomes help us to operationalise sustainability by identifying some specific capital variable that should be preserved? We do not think so, for two reasons: uncertainty about the future and value-ladenness.

The first reason why considering likely future outcomes does not provide us with an operational definition of sustainability is that all assessments of what the future will be like, conditional on the different currently available courses of action, inevitably involve some degree of uncertainty. For instance, predictions about future warming depend on predictions concerning future social and technological developments and on estimates of the sensitivity of the climate to elevated atmospheric concentrations of greenhouse gas emissions. These predictions and estimates require delicate weighing of projected interactions within coupled social-ecological systems, and can at best produce probabilistic outcomes. Consider the case of so-called 'fat tail' events that have a low probability of occurring, but which would be enormously consequential (e.g. an abrupt shift in the Atlantic Meridional Overturning Circulation that would have dramatic consequences for European weather systems). Uncertainty over the probability of occurrence means that an assessment of sustainability geared to managing this risk involves a decision concerning the appropriate risk tolerance (e.g. IPCC AR6 WG1 reports 'medium confidence' that no abrupt shift in Atlantic Meridional Overturning Circulation will occur before 2100; IPCC, 2021). Risk tolerance is an inherently political collective choice (see below for further considerations on the political dimension of sustainability verdicts) that cannot be resolved by any replicable empirical procedure and, hence, cannot be operationalised.

Zero tolerance of anthropogenic risk might seem to offer one way to cut through this uncertainty. For example, since greenhouse gas emissions increase risks, sustainability might be operationalised with reference to zero atmospheric pollution. However, since zero anthropogenic risk is no longer possible it is not clear that a simple 'zero pollution' rule minimises risks. Consider the case of aerosol pollutants that reflect sunlight into space and so produce short-term cooling. The IPCC estimates this effect currently masks approximately 0.5°C of warming (IPCC, 2021). An immediate cessation of

all atmospheric pollution (including cooling aerosols) would thus likely lead to a period of accelerated warming that could take the planet beyond 1.5°C of warming.

Consequently, if eliminating climate risk is the goal, a managed period of climate restoration during which cooling pollutants were phased out and carbon was drawn down from the atmosphere would be preferable to an immediate cessation of pollution. Since prior impacts have taken the planet outside the 'safe operating space for humanity' the challenge of sustainability is not simply one of avoiding adverse impacts, but of navigating a path back toward 'safety' (Biermann & Kim, 2020). This applies to other environmental challenges too. For example, given the delay between habitat loss and extinction, avoiding continued loss of biodiversity requires not simply an end to practices of converting land to agricultural uses, but deliberate additions to natural capital through, for example, habitat restoration practices that are often referred to as 'rewilding' (Jørgensen, 2015). The case of ecosystem restoration already illustrates a point that we will develop in the next section: if we want to minimise risks for future generations, there may well be options that are superior to practices that can be performed indefinitely.

The second reason why choosing a specific capital variable in the light of likely future outcomes is a step that plausibly cannot be operationalised has to do with value-ladenness: identifying courses of action that have a high likelihood of allowing one to meet the needs of present and future generations, perhaps even maximising their welfare, strongly depends on social preferences and what one takes to be the needs and welfare of future generations. There can be trade-offs, for instance, associated with the quantum of future greenhouse gas emissions that may be deemed acceptable to soften the transition to an emission-free global energy system. This translates into the question of to what extent further decreases in the value of the variable 'unpolluted atmosphere' are considered compatible with sustainability if these decreases alleviate poverty and help present and near-future generations meet their needs. Several reasonable answers to this question seem possible, and our aim here is not to determine the most convincing one. Indeed, it is likely that different future communities will reach different conclusions about the relative value of, for example, avoiding climate change versus more developed infrastructure. Rather than to resolve such controversies our goal is simply to highlight that the choice of any specific (potentially mathematically rather complicated) 'capital' variable that must be preserved for sustainability, relies on substantive value judgements. As Fleurbaey and Blanchet (2013) put it, operationalising sustainability in the light of what we expect to be beneficial for future generations requires 'prior consensus about what we want to sustain' and tacitly assumes this consensus will approximately hold constant through time. Plausibly,

this requirement, like the predictions and estimates concerning the consequences of present courses of action, cannot usefully be operationalised, on account of the problem of value-pluralism.

The role of value judgements in efforts to operationalise sustainability is reflected in the significant change in ideas of 'sustainability' that have occurred in just the last few decades. Consider again the six objectives of the European Taxonomy: those related to pollution, water use and biodiversity were central to the 'limits to growth' debates of the 1970s and 1980s that first brought 'sustainability' to global prominence. However, the objectives linked to climate change and creation of a circular economy were much less prominent. Indeed, while climate adaptation is now a key objective of sustainability regulation, US Vice President Al Gore's denunciation of adaptation as a 'lazy cop-out' reflected mainstream environmental opinion in the 1980s and 1990s (as cited in McDonald, 2022). Objectives associated with dominant social conceptions of sustainability shift rapidly.

We have arrived at a dilemma for the project of operationalising sustainability: without considering likely future outcomes of current actions we cannot specify the (natural) capital variable that should be preserved by our practices in order for these to qualify as sustainable. But the process of evaluating possible future outcomes and considering their respective likelihoods, essential as it is for minimising the risk of future societal collapse, cannot be operationalised.

In the next section, we will argue that, once likely future outcomes of current actions are identified and evaluated, the very rationale for restricting deliberation to practices that can be repeated indefinitely is undermined.

4 | WHEN 'UNSUSTAINABLE' PRACTICES MAXIMISE FUTURE PROSPECTS

In the previous section we have seen that introducing an appeal to the prospects of future generations in the definition of sustainability makes that definition non-operational. No clear-cut procedure can objectively determine what will enhance the prospects of future generations. A choice is unavoidable: either one stipulates a precise capital variable that makes the imperative of capital preservation operational – but then there is no guarantee and perhaps not even a strong reason for believing that sustainable practices will, on expectation, lead to particularly good future outcomes – or one accepts the irresolvable complexity of obtaining and weighing the evidence as to which current practices are more likely to lead to desirable future outcomes.

However, as soon as one opts for the second option and resolves to obtain and weigh that evidence,

there is no longer a good reason for restricting one's attention to practices that conform to any version of the indefiniteness account. The main motivation for operationalising sustainability, recall, was to coordinate resource allocation toward actions that bring demonstrable long-term societal benefits, while minimising the influence of deceptive and self-serving advocacy. But if value-based debate over uncertain future outcomes is unavoidable, we should also consider the possibility that future prospects are optimised by temporarily adopting practices that simply cannot be performed indefinitely and do not preserve (natural) capital, or only do so under rather contorted interpretations and/or operationalisations of 'practice' and 'capital'.

This possibility is highlighted by Bostrom (2013), who proposes a dynamic account of sustainability.

We should perhaps therefore not seek directly to approximate some state that is 'sustainable' in the sense that we could remain in it for some time. Rather, we should focus on getting onto a developmental trajectory that offers a high probability of avoiding existential catastrophe. In other words, our focus should be on maximising the chances that we will someday attain technological maturity in a way that is not dismally and irremediably flawed. Conditional on that attainment, we have a good chance of realising our astronomical axiological potential

(Bostrom, 2013, p. 25).

Bostrom illustrates his point in terms of a rocket. While a rocket on a launchpad, and a rocket travelling through space, are both capable of remaining in a stable state for a near-indefinite period, a rocket in mid-air is not. Once launched, if the rocket reduces its fuel consumption it might remain at a constant altitude for longer, and then crash to earth. However, if it instead pursues a sustainable trajectory – by increasing its fuel burn and escaping the earth's gravitational pull – it can achieve a longer period of 'sustainability' (Bostrom, 2013, p. 25; see also Karlsson, 2016).

Bostrom's idea that applying practices that are clearly unsustainable when judged against the indefiniteness account can in some circumstances be part of the best option to improve human-instigated society's long-term prospects may initially sound like sophistry. Indeed, while Bostrom's work has inspired a significant body of scholarship on catastrophic risks (notable Ord, 2020), and there has been a general move toward recognising the value of conceptualising sustainability in terms of 'open', 'dynamic', 'pathways' (Arias, 2013; Dryzek & Pickering, 2018; Leach

et al., 2010), very few sustainability scholars have accepted his specific account of *dynamic sustainability* (Karlsson, 2016). Nevertheless, the design of the European Taxonomy, which includes 'transitional' and 'enabling activities' alongside those that are considered inherently sustainable, reflects a move away from a narrow focus on indefiniteness and capital preservation. Efforts to develop dynamic models of the global economy with references to the planet's biophysical limits, rather than to assess the environmental impacts of individual projects, reflect an analogous effort to analyse sustainability as a property of entire development *trajectories* (Dafermos et al., 2017).

Consider, for example, the challenge of switching to emission-free energy sources. There is robust expert agreement that an important part of any practically viable solution to the climate challenge will involve a dramatic upscaling of solar and wind power for energy generation and of batteries for energy storage, especially in electromobility applications. For instance, in the recently released 'Net Zero by 2050 Scenario' of the International Energy Agency (IEA, 2021a), the combined share of solar and wind power in global energy generation grows to a staggering 70% and the global road vehicle fleet is largely battery-powered by 2050.

However, building and constructing these installations to set up an emission-free global energy system will require an enormous amount of mining to obtain the required materials. As the IEA itself puts it in a recent report:

[T]he mineral requirements of an energy system powered by clean energy technologies differ profoundly from one that runs on fossil fuels. A typical electric car requires six times the mineral inputs of a conventional car, and an onshore wind plant requires nine times more mineral resources than a similarly sized gas-fired power plant. (IEA, 2021b)

The IEA regards the required expansion of mining as a major international challenge and warns that the transition to emission-free energy sources may be slowed significantly unless obstacles to this expansion are minimised. An obvious suggestion in response to the call for such a drastic upscaling of mining is that communities globally, notably in developed countries, should simply drastically reduce energy consumption and avail themselves of recycled materials wherever possible. And indeed, this suggestion seems in line with the spirit of the indefiniteness account of sustainability – whether it is, strictly speaking, mandated by it, again, will depend on how that account is operationalised.

There is a strong objection against the standard of ‘strong sustainability’ that would plausibly require minimising mining when expanding renewable energy, namely, following it would involve making emission-free energy relatively scarce and would in practice lead to a competitive advantage of fossil-fuel based sources, which have not been held to such standards. Climate change is often characterised as arising from a collective action problem, which reflects the fact that agents individually benefit – at least in the short term – from using relatively cheap and versatile fossil fuels, whereas it is ultimately in humanity’s collective interest to rapidly phase these out (Gardiner, 2011). The dramatic declines in the costs of solar and wind power in the first decades of the 21st century are widely regarded as indicators of progress in escaping this collective action problem, at least with regard to emissions from electricity generation. Making solar and wind power scarce and more expensive again by severely restricting the mining of the materials needed for their construction may be dramatically counterproductive for climate change mitigation and thereby increase overall catastrophic, perhaps even existential, risks. In the European Taxonomy’s terms, these activities are classified as ‘enabling technologies’ for their role in supporting the trajectory of expanding renewable energy.

To the extent that this reasoning is adequate, the materials needed to scale up solar and wind power are a real-world example of the ‘rocket fuel’ in Bostrom’s example. An expansion of mining at the scale outlined by the IEA can plausibly not be maintained indefinitely. It might be possible to somehow construe expanded mining as conforming to the indefiniteness account of sustainability, but, in our view, such a conclusion would be quite artificial. At some point, stocks that are accessible at ecological and economic costs deemed acceptable will be exhausted. A switch to practices centred on recycling and/or a switch to other types of installations, for example, future, less material-intensive solar panels and wind turbines, will be needed in a few decades or centuries. However, it is not clear at present which of these practices will most realistically be taken up in the future, or indeed, if entirely different practices may be more practical. For example, some may suggest that nuclear fission and, in a longer time-frame, nuclear fusion reactors have long-term environmental advantages (e.g. lower material and land requirements) over renewable energy.

In the present situation, the materials that need to be mined in order to scale up solar and wind power provide a concrete illustration of Bostrom’s idea that practices which most increase our chances at avoiding societal collapse and improving the welfare of future generations may not be sustainable in any straightforward implementation of the indefiniteness account of

sustainability. Moreover, the fact that the prospects of covering our energy needs with renewable energy are generally seen much more favourably today than only a few decades previously, indicate the contribution of ongoing review and reflection concerning what actions might benefit future generations.

5 | CONCLUSION

In the previous sections, we have encountered two different types of account of sustainability, the indefiniteness account on the one hand and the dynamic account on the other. They may initially appear to be two sides of the same coin – with one focusing on the inputs (natural capital) that generate the outcome (future welfare) that dynamic sustainability pursues – but we think that this impression is misleading. Attfield (2018, p. 61–62), who understands sustainability along the lines of the indefiniteness account and considers it ‘a key virtue’ of environmental ethics, nevertheless concedes that ‘we should not assume that whatever is sustainable is good’. He thus seems to suggest that sustainability is necessary for ‘goodness’ in the sense of being in the interest of future generations, but denies that sustainability is sufficient. Our argument goes further, establishing that sustainability in Attfield’s sense is also not necessary for ‘goodness’.

The statement that, in the interest of future generations, we should uniformly switch to sustainable practices as soon as possible is plausible only if sustainability is interpreted ‘dynamically’, as advocated by Bostrom, and then trivially so, because what is dynamically sustainable is, by definition, what most increases long-term prospects for human-instigated society. At the same time, developing the capacity to determine whether specific practices are sustainable through clear-cut replicable empirical means is plausible only for some versions of the first type of account, and for those it is not always clear that adopting such practices will necessarily enhance the prospects of future generations. In fact, the example of mining for the expansion of renewable energy suggests that some of the practices that minimise future risks are plausibly not in line with the indefiniteness account.

Both the ‘indefiniteness’ and ‘dynamic’ accounts of sustainability encode important and useful ideas. However, to avoid misunderstandings and intellectual shortcuts it is important to keep them apart. Indeed, if we are right, and there cannot be any concept of sustainability that is simultaneously operationalisable and also a reliable guide to optimising future prospects, then we suggest it is preferable for governance instruments to avoid creating a false impression of scientific rigour. In part this is to avoid rendering sustainability discourse muddled and incoherent. We conclude the paper by providing three additional reasons why

non-operational, value-laden assessments of sustainability should be flagged as such.

The first reason is that some individual measures of environmental impact can be readily operationalised; life-cycle carbon intensity is a prominent example. Keeping public focus on quantifiable measures of environmental impact, rather than bundling them into seemingly authoritative comprehensive assessments, is a useful aid to public deliberation. This is precisely because operationalisable measures have the capacity to cut through greenwashing and sophistry. For example, at the time of writing, Greta Thunberg and a variety of environmental NGOs are utilising carbon intensity data to campaign against the subsidisation of the Drax 'sustainable biomass' power station in North Yorkshire (Vaughan, 2021); while there is some disagreement over the lifecycle carbon intensity of biomass, this question can be resolved through empirical analysis. Verdicts about the generalised sustainability of specific activities, unless they are made on the basis of some specifically chosen operational account, do not have that capacity. Presenting comprehensive assessments of sustainability as though they are authoritative, apolitical, empirical measures risks stunting public debate.

The second reason to be cautious of comprehensive assessments of sustainability, is that they risk undermining the reflexive, experimental forms of governance that may be a necessary response to environmental crises. If global environmental conditions have only recently moved outside what might be understood as the 'safe operating conditions' for humanity, it is not surprising that knowledge of and cultural attitudes toward environmental questions are also in a state of flux. Consider, for example, how much more emphasis is placed on climate change mitigation and adaptation in contemporary taxonomies than was the case in Agenda 21 or in the various measures of sustainable development that were developed in the 1990s, even though the challenge of climate change was very well understood at the time (Eurostat, 1997). A process of social learning has shifted public conceptions of 'sustainability' in the intervening decades. Many scholars now advocate for forms of self-consciously 'experimentalist' governance that frames environmental problems in open-ended ways, that are subject to periodic review and revision, and which draw on advances in both locally generated and collective societal knowledge (De Búrca et al., 2014; Rijke et al., 2012). If efforts to operationalise sustainability claim to have a comprehensive and conclusive definition, then they risk slowing down these processes of social learning.

A third reason relates to the problem of respecting pluralism in the context of international power inequality. Given the European Union's economic and normative power, the Taxonomy has begun to shape investment decisions the world over, even before it has

been finalised. Is this extra-territorial influence a boon for the earth, or a neo-colonial threat to the democratic autonomy of non-European communities? If we were confident that the Taxonomy encoded an operational definition of 'sustainability' and that the activities this definition identified would reliably lead to beneficial outcomes for future generations globally, then the Taxonomy's extra-territorial influence might be widely welcomed. But we have seen here that expecting this much from any account of sustainability means expecting too much. Any recommendation that a practice should be adopted because it is 'sustainable' invariably reflects the values and preferences of the specific communities which make that recommendation. Given the complexity of energy and climate challenges, their interlinkage with a wide variety of political sensitive issues, and the varied needs of differently situated communities, there can be no single universally applicable technical or institutional formula (see Cherp et al., 2011; Hillerbrand, 2018). We thus have both normative and practical reasons to be cautious about the global imposition of any single measure of 'sustainability'.

ACKNOWLEDGEMENTS

We are indebted to two anonymous referees and the editors for helpful comments on an earlier version of this paper, and to Emilie Aebischer, Daniel Lara De La Fuente and Rasmus Karlsson for conversations that informed the content.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

ORCID

Simon Friederich  <https://orcid.org/0000-0003-4372-5995>

Jonathan Symons  <https://orcid.org/0000-0003-0078-9614>

ENDNOTES

¹ The European Union Taxonomy defines sustainability as 'i.e. making a substantial contribution to EU environmental objectives such as climate change mitigation, while doing no significant harm to other environmental objectives'. European Commission (2021b, p. 1). Commission Delegated Regulation (EU) .../... of 4.6.2021 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives (C(2021) 2800 final). (European Commission. Brussels, 4 June 2021), <https://ec.europa.eu/finance/docs/level-2-measures/taxonomy-regulation-delegated-act-2021-2800en.pdf>.

² We use this term to recognise that AI or post-human organisms may be central to the societies that descend from current human societies.

REFERENCES

- Arias Maldonado, M. (2013) Rethinking sustainability in the Anthropocene. *Environmental Politics*, 22(3), 428–446.
- Attfeld, R. (2018) *Environmental ethics: a very short introduction*. Oxford: Oxford University Press.
- Biermann, F. & Kim, R.E. (2020) The boundaries of the planetary boundary framework: a critical appraisal of approaches to define a 'safe operating space' for humanity. *Annual Review of Environment and Resources*, 45, 497–521.
- Bostrom, N. (2013) Existential risk prevention as global priority. *Global Policy*, 4(1), 15–31.
- Brundtland, G.H. (1987) Report of the world commission on environment and development: our common future. United Nations General Assembly document A/42/427mn.
- Cabeza-Gutés, M. (1996) The concept of weak sustainability. *Ecological Economics*, 17(3), 147–156.
- Cherp, A., Jewell, J. & Goldthau, A. (2011) Governing global energy: systems, transitions, complexity. *Global Policy*, 2(1), 75–88.
- Dafermos, Y., Nikolaidi, M. & Galanis, G. (2017) A stock-flow-fund ecological macroeconomic model. *Ecological Economics*, 131, 191–207 <https://doi.org/10.1016/j.ecolecon.2016.08.013>
- Daly, H. (1990) Toward some operational principles of sustainable development. *Ecological Economics*, 2(1), 1–6.
- Daly, H. (1995) On Wilfred Beckerman's critique of sustainable development. *Environmental Values*, 4(1), 49–55.
- De Búrca, G., Keohane, R.O. & Sabel, C. (2014) Global experimentalist governance. *British Journal of Political Science*, 44(3), 477–486.
- Dryzek, J.S. & Pickering, J. (2018) *The politics of the Anthropocene*. Oxford: Oxford University Press.
- Edenhofer, O., Steckel, J.C. & Jakob, M. (2014) Does environmental sustainability contradict prosperity. *Global Policy*, 5, 15–20.
- El Serafy, S. (1989) The proper calculation of income from depletable natural resources. In: Ahmad, Y., El Serafy, S. & Lutz, E. (Eds.) *Environmental accounting for sustainable development*. Washington, D.C.: The World Bank, pp. 141–162.
- Elkington, J. (1997) *Cannibals with forks: the triple bottom line of 21st century business*. Oxford: Capstone Publishing.
- European Parliament. (n.d.) Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 (18 June 2020). Available from: <https://eurlex.europa.eu/legal-content/EN/TXT/?uri=celex:32020R0852>
- Eurostat. (1997) *Indicators of sustainable development: a pilot study following the methodology of the United Nations Commission on sustainable development*. Luxembourg: Office for Official Publications of the European Communities.
- Evans, B. & Theobald, K. (2003) LASALA: evaluating local agenda 21 in Europe. *Journal of Environmental Planning and Management*, 46(5), 781–794.
- Fleurbaey, M. & Blanchet, D. (2013) *Beyond GDP: measuring welfare and assessing sustainability*. Oxford: Oxford University Press.
- Gardiner, S. (2011) *A perfect moral storm: the ethical tragedy of climate change*. Oxford: Oxford University Press.
- Heath, J. (2013) The structure of intergenerational cooperation. *Philosophy & Public Affairs*, 41(1), 31–66.
- Hillerbrand, R. (2018) Why affordable clean energy is not enough. A capability perspective on the sustainable development goals. *Sustainability*, 10(7), 2485.
- IEA. (2021a) *Net zero by 2050*. Paris: IEA. Available from: <https://www.iea.org/reports/net-zero-by-2050> [Accessed 8th November 2022].
- IEA. (2021b) *The role of critical minerals in clean energy transitions*. Paris: IEA. Available from: <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions> [Accessed 8th November 2022].
- IMF. (2021) *Global financial stability report October 2021*. Washington DC: IMF. Available from: <https://www.imf.org/en/Publications/GFSR/Issues/2021/10/12/global-financial-stability-report-october-2021>
- IPCC. (2021) Summary for policymakers. In: Masson-Delmotte, V., Zhai, P., Pirani, A., Connors, S.L., Péan, C., Berger, S. et al. (Eds.) *Climate change 2021: the physical science basis. Contribution of working group I to the sixth assessment report of the intergovernmental panel on climate change*. Cambridge: Cambridge University Press.
- Jørgensen, D. (2015) Rethinking rewilding. *Geoforum*, 65, 482–488.
- Karlsson, R. (2016) Three metaphors for sustainability in the Anthropocene. *The Anthropocene Review*, 3(1), 23–32.
- Kaya, A. & Stoetzer, O. (2021) *The 100 billion dollar question: COP26 glasgow and climate finance*. Available from: <https://www.globalpolicyjournal.com/blog/16/11/2021/100-billion-dollar-question-cop26-glasgow-and-climate-finance> [Accessed 8th November 2022].
- Leach, M., Stirling, A.C. & Scoones, I. (2010) *Dynamic sustainabilities: technology, environment, social justice*. London: Routledge.
- Long, G. (n.d.) *Sustainable development goal indicators are technical, but also political*. Available from: <http://www.globalpolicyjournal.com/blog/14/05/2015/sustainable-development-goal-indicators-are-technical-also-political>
- McDonald, M. (2022) Geoengineering, climate change and ecological security. *Environmental Politics*, 1–21. Available from: <https://doi.org/10.1080/09644016.2022.2113606> (in press).
- McGowan, P.J.K., Stewart, G.B., Long, G. & Grainger, M.J. (2019) An imperfect vision of indivisibility in the sustainable development goals. *Nature Sustainability*, 2(1), 43–45.
- Ord, T. (2020) *The precipice: Existential risk and the future of humanity*. London: Bloomsbury.
- Pearce, D. & Atkinson, G. (1993) Capital theory and the measurement of sustainable development: an indicator of 'weak' sustainability. *Ecological Economics*, 8(2), 103–108.
- Rambaud, A. & Richard, J. (2015) The 'triple depreciation line' instead of the 'triple bottom line': towards a genuine integrated reporting. *Critical Perspectives on Accounting*, 33, 92–116.
- Rijke, J., Brown, R., Zevenbergen, C., Ashley, R., Farrelly, M., Morison, P. et al. (2012) Fit-for-purpose governance: A framework to make adaptive governance operational. *Environmental Science & Policy*, 22, 73–84.
- Schliesser, E. (2019) Synthetic philosophy. *Biology and Philosophy*, 34, 19. Available from: <https://doi.org/10.1007/s10539-019-9673-3>
- Shue, H. (1995) Ethics, the environment and the changing international order. *International Affairs*, 71(3), 453–461.
- Steffen, W., Broadgate, W., Deutsch, L., Gaffney, O. & Ludwig, C. (2015) The trajectory of the Anthropocene: the great acceleration. *The Anthropocene Review*, 2(1), 81–98.
- Taylor, K. (2020) EU agrees to set aside 37% of recovery fund for green transition. *Euractiv.com*. 18 December 2020. Available from: <https://www.euractiv.com/section/energy-environment/news/eu-agrees-to-set-aside-37-of-recovery-fund-for-green-transition/> [Accessed 8th November 2022].
- United Nations General Assembly. (2015) *RES/70/1. Transforming our world: the 2030 agenda for sustainable development*. Seventieth United Nations General Assembly, New York, (25 September 2015).
- Vaughan, A. (2021) First carbon-negative power plant. *New Scientist*, 250(3337), 13.
- Von Carlowitz, H.C. & Rohr, V. (1732) *Sylvicultura Oeconomica, oder Haußwirthliche Nachricht und Naturmäßige Anweisung zur Wilden Baum Zucht*, Leipzig.

AUTHOR BIOGRAPHIES

Simon Friederich is an Associate Professor of Philosophy of Science at the University of Groningen, the Netherlands. His research focuses on the philosophy of physics, epistemology, and more recently global catastrophic risks.

Jonathan Symons is a Senior Lecturer in Politics and International Relations at Macquarie University, Australia. His current research focuses on global climate politics and his most recent book is *Ecomodernism: Politics, technology and the climate crisis*, Polity Press, 2019.

How to cite this article: Friederich, S. & Symons, J. (2022) Operationalising sustainability? Why sustainability fails as an investment criterion for safeguarding the future. *Global Policy*, 00, 1–11. Available from: <https://doi.org/10.1111/1758-5899.13160>