# Interrogating Technology-led Experiments in Sustainability Governance

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## Abstract

Solutions to global sustainability challenges are increasingly technology-intensive. Yet, technologies are neither developed nor applied to governance problems in a socio-political vacuum. Despite aspirations to provide novel solutions to current sustainability governance challenges, many technology-centred projects, pilots and plans remain implicated in longer-standing global governance trends shaping the possibilities for success in often under-recognized ways. This article identifies three overlapping contexts within which technology-led efforts to address sustainability challenges are evolving, highlighting the growing roles of: (1) private actors; (2) experimentalism; and (3) informality. The confluence of these interconnected trends illuminates an important yet often under-recognized paradox: that the use of technology in multi-stakeholder initiatives tends to reduce rather than expand the set of actors, enhancing instead of reducing challenges to participation and transparency, and reinforcing rather than transforming existing forms of power relations. Without recognizing and attempting to address these limits, technology-led multi-stakeholder initiatives will remain less effective in addressing the complexity and uncertainty surrounding global sustainability governance. We provide pathways for interrogating the ways that novel technologies are being harnessed to address long-standing global sustainability issues in manners that foreground key ethical, social and political considerations and the contexts in which they are evolving.

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## Digital technologies in sustainability governance: possibilities, politics, power

Efforts to harness emerging technologies to address a host of new and longer-standing sustainability challenges have recently proliferated. Artificial intelligence (AI), blockchain, big data and other new technologies are central to a growing number of on-going experiments, ranging from the tracking of greenhouse emissions to monitoring wildlife poaching and global supply chains, to transnational efforts to combat human trafficking, and manage the COVID-19 pandemic. These unfolding experiments seek to mobilize digital technologies to meet a growing range of governance challenges that are typically grouped together under the banner of sustainability and sustainable development.[1]

These developments have not, however, been much interrogated in international relations and global governance scholarship (though see Boersma and Nolan, 2019; Duberry, 2019; Gale, Ascui, and Lovell, 2017). Existing policy and practitioner debates, meanwhile, tend to emphasize the affordances and pathologies of specific digital technologies (Beaumier et al., 2020). A number of important questions have thus remained unaddressed: How do unfolding initiatives centred on AI, blockchains, big data and other emerging technologies seek to overcome, or extend and reinforce, the limits of existing global governance? What debates and conflicts of interest are elided by appeals to technological applications as solutions to governance challenges? How does the development and deployment of new technologies intersect with existing disparities of power, resources, and access?

This article begins to address these questions, synthesizing discussions an interdisciplinary workshop on these themes held at the University of Warwick in December 2019. We situate on-going technology-led experiments in sustainability governance within three longer-standing global trends: (1) a growing reliance on private, voluntary codes of conduct, standards, and third-party auditing; (2) global experimentalist governance; and (3) efforts to adapt governance mechanisms to deal with the growing prevalence of informal and illicit economies. In light of this, we argue that uses of technology in multi-stakeholder initiatives have tended to reduce rather the scope for participation in sustainability governance, deepen challenges to participation and transparency, and reinforce rather than transform existing power relations.

In what follows, we outline the above three global governance trends in turn, tracing their intersections with emerging technology-centred initiatives in global sustainability governance. We then conclude by outlining a number of questions for scholars, practitioners and policy makers to consider in interrogating the uses of technology in sustainability governance.

## Technology and private governance

Technology-centred initiatives to improve global sustainability governance are in many ways extensions of the patchwork of private codes of conducts and corporate social responsibility (CSR) policies developed in recent decades. The inability of these corporate-led modes of 'responsible governance' to yield significant improvements for workers and the planet is well-documented (Fransen and Burgoon, 2012; Koenig-Archibugi, 2017; LeBaron, Lister and Dauvergne, 2017). Such initiatives have frequently resulted in mere 'corporate philanthropy' that favours powerful stakeholders over grassroots communities (Orock, 2013). These modes of governance have often reinforced existing inequalities. For example, corporate codes of conduct for worker safety in garment supply chains have been found to pass costs of compliance on to supplier factories. Yet, they do little to alleviate the time and cost pressures placed on suppliers by major branded buyers, who often drive unsafe working conditions in the first place (Scheper, 2017; Taylor, 2011).

Recent responses to these failures increasingly rely new technologies. Big data and blockchain technologies, for example, are increasingly instrumental to a growing range of 'multi-stakeholder' arrangements between private for-profit firms and public bodies seeking, for instance, to protect working conditions or to trace and disclose greenhouse gas emissions and 'conflict minerals' across global supply chains. These experiments are being developed and applied in ways that reinforce existing patterns of governance and relations of power.

Novel technologies are being integrated into the long-standing practices of private professional service firms in monitoring sustainability across global supply chains. Previous research shows how the 'big four' professional services firms (KPMG, PwC, Deloitte, and EY) firms play a significant and growing role in shaping private supply chain governance (Fransen and LeBaron, 2018). The Big Four, along with smaller audit firms and consultancies (e.g. RCS Global) increasingly promote blockchains as means of improving the effectiveness of supply chain governance. Blockchain delivers a record of the origin and journey of the raw materials, which is accessible to all relevant parties yet not manipulable by any single 'node' in the shared digital network. In so doing, blockchains can establish a community of participants and an authoritative record of provenance, and by moving confidential data freely between trading partners, could enhance transparency and accountability. Yet, these developments leave supply chain governance dominated by lead firms, often working with the 'big four' and more specialized supply chain management consultants. The entities developing and supporting such technology-led projects are frequently the same ones involved in existing global supply chain governance. The prominent roles of audit firms and private sector consultants in developing technological solutions to global sustainability governance challenges raise important issues. The profit models of such firms rest primarily on service fees. There is a danger that private actors' profit incentives could further fragment standards and enforcement across the proliferating range of 'sustainability services'. Competition for clients threatens to produce a 'race to the bottom' of the kind seen among credit ratings agencies in the build-up to the global financial

crisis (Kruck, 2011). Equally, such initiatives provide no new standards or enforcement mechanisms and remain reliant on existing forms of factory-, farm-, or mine-level monitoring. In the words of a manager at one blockchain-based audit start-up:

> A blockchain will record an immutable record of custody of a material, the locations it's traveled through, its composition over time, and all that . . . But if you're trying to make sure the wrong material never enters the system in the first place, you need processes to make this work.
>
> (Hyperledger n.d., p. 3).

In brief, blockchain applications for supply chain governance leave market-based forms of governance rooted in 'disclosure' and soft standards largely intact, both in terms of the actors involved and the standards being enforced.

We can see similar issues at stake if we move from supply chain governance to new methods of 'greening' financial markets, another key area where experiments with new technologies are underway. Environmental, social and governance (ESG) investment and ESG ratings have grown rapidly as big data and other technologies have enabled investors to quantify hard-to-measure socio-political variables. Yet, standards for what counts as 'sustainable' still vary. Earlier accounting frameworks related to CSR – including the Global Reporting Initiative and the Carbon Disclosure Project – have been accused of providing an 'alphabet soup' of poorly-correlated indicators (IMF, 2019). More recent industry-led efforts like the Taskforce for Climate-related Financial Disclosures (TCFD) are somewhat better. The TCFD has departed from earlier CSR definitions of sustainability by only including 'financial material' ESG issues. Led by Bank of America chief executive and working closely with the Big Four accounting firms, the World Economic Forum (WEF) has initiated a framework to standardize ESG metrics and link them to the UN's SDGs (Naumann and Temple West, 2020).

Debates over applications of new technologies in sustainability governance need to be situated within these exercises in classification and standardization regarding what qualifies as 'sustainable'. The EU taxonomy, for instance, has been linked to a green-supporting or brown-penalizing factor for capital requirements (Fleming and Brunsden, 2019). More encompassing policies like 'green quantitative easing' suggested by central banks can only become feasible once consensual definitions of green or brown investing are established. Put differently, to realize the potential of technologies, we must first bring the context of private governance to the forefront of discussions about which technologies can and should be used, as well as for which purposes.

The manners in which technology-led experiments in global sustainability governance foreground private over public was also illustrated in many of the immediate responses to the COVID-19 pandemic. The World Health Organization, for instance, began coordinating a blockchain-based data storage and communication platform to address the surge in cyber attacks[2] and mis-information during what it described as the related 'infodemic'.[3] The platform, MiPasa, is built on Hyperledger Fabric a permissioned (e.g. private) blockchain originally built by IBM and whose governing board consists of representatives of large technology (e.g. Hitachi, Intel, Oracle, Microsoft), finance (American Express, BBVA, JP Morgan Chase), professional services firms (Accenture) and other MNCs (Daimler).[4] Beyond blockchain projects, the wider trend towards reliance on private, individual deployment novel technologies in global sustainability governance was prominently encapsulated in the strategic partnership framework agreement signed between the UN and WEF in 2019 for 'accelerating the implementation of the Sustainable Development Goals' (WEF, 2019). The first key focus area of this public-private partnership is harnessing the 'potential of financial innovation, new technologies and digitalisation to increase financing for the SDGs' (WEF, 2019).

In sum, technology-centred arrangements may tend to perpetuate and even expand the roles of private actors in sustainability governance, while potentially deepening the pathologies of existing forms of private governance. As we argue further in the next section, these tendencies are reinforced by a parallel trend of experimentalism in global governance.

## Experimentalist governance

Despite the considerable hype surrounding them, applications of emerging technologies in sustainability governance remain very much provisional and experimental. It is thus useful to consider such initiatives in relation to on-going trends towards experimentalist forms of global governance.

Experimentalist governance involves the setting of goals, trialling of multiple policy measures, continuous monitoring of progress through quantitative indicators, and revision based on rigorous peer review (Sabel and Zeitlin, 2012). Unlike centrally defined and potentially more static forms of management, such looser and 'provisional' governance forms can promote the flexible arrangements necessary to respond to sustainability challenges in environments of uncertainty (Best, 2014). While academic literature on experimentalist governance originated in the study of devolved responses for addressing common concerns in the European Union (Sabel and Zeitlin, 2012), wider forms of 'global experimentalism' have recently been outlined (De Búrca et al., 2014; Nance and Cottrell, 2014). To date, these studies have provided little consideration of the role of technologies in private-led patterns of global governance (Armeni, 2015; Campbell-Verduyn and Porter, 2014). This can overlap with the forms of private governance discussed above – private authorities can rely on experimentalist modes of governance (see Brassett et al., 2012). The distinction is essentially that, in referring to 'private' governance, the concern is with who is doing the governing, while references to 'experimentalist' modes of governance are more about how governance is done.

Critically, engagements both by public and private actors with blockchain, AI, and other emerging technologies are notably experimentalist in character. One example here is in the area of development aid. There are theoretical elaborations on potential applications of blockchain to development aid effectiveness, highlighting the potential of transparent and immutable ledgers to enhance the credibility of policy commitments or address verification problems (e.g. Reinsberg, 2019). Actual policy interventions using these technologies, though, have generally taken precisely the form of trialling multiple measures, measuring outcomes, and constant revision. One notable example here is the German Gesellschaft für internationale Zusammenarbeit's (GiZ) 'Blockchain Lab', which sponsors and organizes pilot projects by public and private actors using blockchain to address challenges directly relating to the SDGs.

Bottom-up, less hierarchical forms of experimentalist governance enabled by new technologies, could in theory enrich sustainability governance by inviting participation from local actors. Linders (2013, p. 430), for instance, writes about potential open data platforms for developing countries to generate a 'sort of TripAdvisor or Yelp for aid' that can encourage local accountability of technology-enhanced programs. In practice, experimentalism's tendency to also offer highly technical solutions may deepen barriers to participation. Experimentalist decision-making often draws heavily on calculative rationalities derived from financial accounting in order to accurately compare the results of the diverse approaches employed to achieve common goals. In their focus on measuring and auditing performance, these rationalities often recast governance as merely a technical and administrative matter. This diminishes the role and input of local knowledge (Shore and Wright, 2015; Strathern, 2000).

Likewise, the growing technology-intensiveness of experimentalist governance narrows the range of non-state actors able to participate in public-private partnerships. It is primarily private companies and the largest INGOs that have the resources to create and manipulate the technologies at the heart of novel solutions to global sustainability challenges (Duberry, 2019). Consequently, smaller and more local actors, in particular from the Global South, may be left out, entrenching existing disparities in access and participation.

Moreover, these disparities may well be amplified as large technology firms seek to maximize both data collection and possession. Private companies' access to a growing amount and diversity of data can thus shape agendas in ways that favour particularistic over collective concerns (Arora, 2016). For example, governments face domestic political pressures and economic challenges that open up space for internationally-coordinated, experimentalist governance of the digital economy. The UN's Global Pulse programme connects academics, private and government actors and UN personnel to generate 'actionable' insights about how Big Data can facilitate sustainable development. But Global Pulse projects in practice are dominated by private businesses and governments, with relatively limited possibilities for the involvement of CSOs. Likewise, geopolitical competition among data powers, such as China, the US and the EU, can encourage domestic experimentalist governance innovations, as these states seek to enhance and secure their own digital capabilities (Mahrenbach and Mayer, 2019). One prominent example is China's Great Firewall, which simultaneously cleared the path for ground-breaking research and industrial development of AI and made it more difficult for non-Chinese businesses to operate in China (Aaronson and Leblond, 2018). Diverse government incentives thus encourage experimentalist governance in the digital economy as a means of achieving preferred outcomes, while reinforcing patterns of political power and participation that may tend towards particularistic rather than collective gains. The crucial roles of large technology firms in sustainability experiments could enable them to define the agendas and goals pursued. The competing pressures faced by governments seeking to both expand their own gains from the digital economy and to use modern technologies further complicate the benefits of experimentalism.

## Governing informal and illicit economies

Finally, efforts to apply new technologies to sustainability challenges have very frequently been driven by efforts to grapple with the growing prevalence of informal economies. Here, our concern is with *who and what* are being governed. Economic informality in this sense has been an important, cross-cutting concern in sustainable development policy in recent decades (see Bernards, 2018; Phillips, 2011; Rodima-Taylor, 2014; Taylor, 2010).[5] Informality refers to the activities and actors that operate outside the regulations and laws of the modern economy (Loayza, 2016). Informal actors who usually represent marginal populations and groups are not able to fully benefit from public services or formal sector protection and risk mitigation, while also not able to contribute to the creation of public goods through taxation and other mechanisms. At the same time, informal sector enterprises may benefit from greater flexibility and dynamism of their activities as well as serve as a source of employment for marginal populations during economic down-turns (Loayza, 2018). The dynamics of local informality are intricate, yet better attempts need to be made to understand the contexts in which many technology-led sustainability governance initiatives are ultimately grounded. Localized informal practices are wrapped up in global value chains, for instance, through casualized labour in agriculture or outsourcing in clothing production. These present particular governance challenges around labour rights and environmental standards (Meagher, 2016).

Technological applications in sustainability governance are often aimed at making informal or illicit economies 'legible' both to regulators and to global capital. Muirhead and Porter (2019) argue that the 'traceability systems' enabled by new digital technologies for tracking the cross-border travel of an increasingly diverse range of objects – including conflict minerals, pharmaceuticals, carbon emissions, and money laundering – form complex, heterogenous constellations between the physical properties of the objects being

traced and the networks and infrastructures used for their management. By enabling clearer visibility and authentication of objects – including intangible ones – traceability systems can, in some instances, help reduce areas of informal or illicit activity. New technologies may render human trafficking more visible and governable (e.g. by tracking illegal financial transactions), broaden awareness of victims' plight and facilitate networking between law enforcement and non-state organizations combatting human trafficking. An example here is the Global Emancipation Network which brings together technology partners such as Microsoft, splunk, Deep Vision AI and others with law enforcement, anti-trafficking non-profits, and businesses in hospitality, finance and transportation to deploy advanced data analytics to make human trafficking more visible as a means of helping to stop it.[6]

Once again, there are important tradeoffs. Rendering local actors 'legible' through technological means in the context of global supply chains dominated by distant lead firms or development projects by metropolitan donors can result in the imposition of external, pre-determined criteria on local spaces and practices. This interplay of informal activities with efforts to promote sustainability through formalization, transparency, and traceability, in turn, has significant, if ambiguous, implications for livelihoods. Efforts to govern artisanal mining are a notable example (Vogel et al., 2018), as are conservation measures (Witter and Satterfield, 2019), both of which are prone to excluding local populations. Technological applications can exacerbate these dynamics, particularly where they double down on the weaknesses of market-led forms of supply chain governance discussed above.

For example, there has been a recent flurry of blockchain applications for preventing child labour in cobalt mining in the Democratic Republic of the Congo, as demand for cobalt (a key component of batteries for electric cars and portable electronics) has surged in recent years (e.g. Lewis, 2019). Most of these programmes aim to prevent child labour by reliably certifying that cobalt has been mined from specific industrial installations rather than from artisanal mines, where most child labour takes place. Even if it were to eliminate child labour from global supply chains, displacing artisanal mining with industrial mining would likely have ambiguous livelihood consequences for mining communities at best. Recent research has highlighted, for instance, growing evidence of labour market segmentation, including a preference for expat workers in industrial mining, as well as limited wage gains for workers moving from artisanal to industrial mining in the Copperbelt, driving a rise in inequality in the region (Radley, 2020; Rubbers, 2019). There are serious questions here that need to be raised about the kinds of risks, and for whom, new technologies might be used to mitigate.

In sum, technological solutions to sustainability issues often boil down to attempts to render complex and geographically dispersed informal spheres of activity 'legible' and traceable. Such transparency efforts have important, yet often underexplored, implications. On the input-side, early processes of technological development and application can be hampered by significant disparities in access to material resources and representation that underpin digital and socio-economic divides. On the output side, transparency provided in evolving technological experiments is geared to the investment decision matrices of financiers, to the regulatory compliance mandates of governments, and to end consumers.

## Suggestions for Research and Policy

Policy making and broader public discussion over the integration of emerging technologies such as artificial intelligence, Big Data, and blockchain into global sustainability governance need to be far more socially and politically sensitive than is currently the case. Recognizing and overcoming these issues is particularly important now as these and other technologies are also being foregrounded in transnational efforts to secure global supply chains and other responses to the COVID-19 pandemic.[7] Digital technologies being applied in complex and evolving environments both shape and are shaped by diverse human, material, and normative elements (Bernards and Campbell-Verduyn, 2019). Heterogenous assemblages combine local inventive practices and cultural repertoires related to new technology solutions with old and new infrastructural pipelines and institutional actors (Rodima-Taylor and Grimes, 2019). The integration of new technologies into multi-stakeholder efforts to address sustainability challenges must be understood within the longer-standing patterns of private authority, experimentalism, and struggles to cope with informal economies in global governance.

By way of conclusion, we highlight a number of areas of concern that must become central to discussion, analysis and implementation of technology-led initiatives in global sustainability governance. These questions are crucial if we are to avoid extending well-known problems in attempting to address global sustainability governance challenges. Unfolding technological experiments do, of course, hold some promise, and constitute quite a wide terrain. They thus need to be assessed on a case-by-case basis. Yet, such assessments can collectively consider important but often backgrounded social, political, and economic relations through which new technologies are being developed and into which they are deployed:

### Realistic evaluation of the potential of new technologies

First and foremost, attention must be given to what new technologies cannot do. Technologies cannot solve problems that are social and political at the root – a point underlined in our discussion above. Many sustainability governance problems concern politics and power. Three guiding questions can encourage a systematic approach to overcome contextual hindrances in employing technology to actualize sustainability goals: Whose problems are new

technologies solving? What new problems might these technologies create? And what other solutions might be foregone in stressing techno-solutionism?

For instance, probabilistic means of detecting likely human trafficking victims through AI applications might be helpful in separating out forced and exploitative forms of mobility from benign ones. However, identifying victims alone is not enough to resolve the knot of issues shaping and driving human trafficking. AIs *cannot* say what should happen after victims of trafficking are located, or resolve the underlying conditions which facilitate trafficking in the first place. Without substantive attention to victims' rights and the overall institutional environment of reinforcing these rights, detection of trafficked people might even render victims susceptible in new ways (e.g. to securitized and criminalized systems of border enforcement).

### Attention to the new distribution of power triggered by the adoption of emerging technologies

We have argued that experimentalist modes of technology-driven sustainability governance can facilitate the introduction of *novel intermediaries and brokers*, while also entrenching the roles of existing actors. Many of the latter actors are private parties, such as audit and consulting companies; many of the former are new tech firms. Moreover, fluid areas of activity enabled via new connective technologies bring together a variety of formal and informal actors.

As we have noted in the discussions of informality and experimentalism above, these developments are creating new political spaces, which can deepen old forms of exclusion and uneven access to participation. For example, the private firms involved in ESG have a potential to promote industry-driven visions of future research and development in environmental governance. These activities can also create new global publics through awareness-raising and lobbying, and define what 'count' as global sustainable practices. There is a need to recognize the costs of accessing these new quasi-public spaces, which can threaten to reinforce existing inequalities and divides. The resources and roles of large, well-funded international non-state organizations in developing AI applications in environmental conservation, and the comparatively limited scope for participation by affected communities, are notable examples here. The new technologies increasingly used in sustainability governance are accompanied by *security* implications, particularly regarding privacy, which are often not been adequately addressed in extant debates. Security technologies are fundamentally 'sites of experimentation', enmeshed in both ethical and practical dilemmas (Bosma, 2019, p. 194). The inner workings of technologies have remained opaque 'black boxes' to many, if not most, stakeholders on grounds of security or economic competitiveness.

To ensure then that local voices – particularly those of affected communities – remain at the forefront of technology-enhanced sustainability governance activities, we suggest the following guiding questions. First, what kinds of actors are new technologies actually (dis)empowering? Second, what kinds of exclusions or inequalities might be reinforced and/or created through technology-centred governance processes?

### Tensions between 'audit culture' and local participation

We have situated technology-led sustainability governance initiatives in the concomitant rise of *private, voluntary codes and standards*. We equally illustrated how experimentalist modes of decision-making that may extend standardized accounting practices and calculative rationales across diverse forms of sustainability governance might do so at the cost of local spaces and practices. The result of merging these 'human accounting' protocols and techniques of financial accounting with those of socio-economic management can be a prioritization of short-term profit maximization and financial markets' agendas over longer-term sustainability needs. In recasting governance as a technical and administrative affair, sustainability accounting can minimize opportunities for and contributions from local actors and knowledge, respectively. Soft-law governance approaches – from emerging ESG standards to labour codes – exacerbate these issues, being both difficult to challenge in case of disputes and posing barriers to binding public regulation or independent civil society monitoring.

These insights should focus attention on the need to interrogate the *kinds of transparency and accountability* sought in advancing common templates across diverse and informal communities. In seeking to render 'legible' activities in grassroots communities, private-driven sustainable governance initiatives may paradoxically by-pass the roles and needs of key local mediators. Bottom-up forms of 'everyday experimentation' and 'frugal innovation' at the grassroots level can be crucial to addressing sustainability issues, yet are often overlooked or marginalized in many current applications (Altamirano and Van Beers, 2018; Leliveld and Knorringa, 2018). Ethical technology standards and frameworks must be developed in collaboration with local communities and stakeholders and by considering local norms and morals. Several guiding questions can help systematize this process of interrogation. First, what *kinds* of transparency and accountability are promoted by applications of new technologies? And, second, who benefits from the forms of accountability that are pursued in specific sustainability governance efforts?

### Asking 'big' questions on the need for participatory and accountable frameworks

We have argued that private-led environmental and sustainability initiatives have a potential to reinforce power imbalances and exclusion when interacting with communities and institutional actors in the Global South. This is because the use and development of new technological solutions interacts with formal and informal, local and geopolitical agendas and interests. The incomplete nature of frameworks and standards governing new digital technologies can do little

to ameliorate these issues. Here again, we need local-specific, participatory development of accountability standards and frameworks in sustainability governance, in particular standards that embody local norms and morals.

From this perspective, stressing the novelty of technological solutions for complex and evolving sustainability challenges can distract from the larger structural issues in which such governance is embedded. Helpful guiding questions here include: What kinds of end-goals should sustainability governance initiatives consider, and for whom? What kinds of sustainability are emphasized in discourses – climate risk, environmental risks, human/labour rights, or others? What political and moral assumptions are bundled into technological applications and their use? Who has access to 'sustech' applications and the capacity to use them? And are such solutions creating new digital divides?

In the current environments of high complexity and uncertainty surrounding sustainable governance initiatives, we argue that ethical, social and political considerations should be given foremost priority. This article has situated the novelty of new technologies in three wider trends to provide pathways for directing attention beyond mere technical considerations. There is undoubtedly room for these and other technological initiatives to be grounded in further trends. We expect that doing so will raise a host of other questions pertaining to the evolving roles of technologies in sustainability governance. We look forward to engaging with them – and encourage public and private actors central to sustainability governance to do the same.

## Notes

1. We are grateful to anonymous reviewer and editors at *Global Policy* for comments on an earlier draft of this article. We also gratefully acknowledge financial support from the Institute for Advanced Studies at the University of Warwick.'Sustainability' and 'sustainable development' are contested and somewhat ambiguous concepts. We are broadly interested here in interventions across the range of policy areas grouped under the United Nation's Sustainable Development Goals (SDG) framework. We recognize real debates about the internal consistency of the SDG framework (e.g. Rai et al. 2019; Hickel 2019), about the politics of measuring SDGs (Fukada-Parr & McNeill 2019), and fundamental contestation over the purpose and nature of the goals themselves (Gabay & Ilcan 2017). We nonetheless argue that the SDGs are useful in delineating 'sustainability' as recognized spheres of action in global policy-making.
2. https://theconversation.com/coronavirus-pandemic-has-unleashed-a-wave-of-cyber-attacks-heres-how-to-protect-yourself-135057 [Accessed 11 May 2020].
3. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200202-sitrep-13-ncov-v3.pdf?sfvrsn=195f4010_6 [Accessed 11 May 2020].
4. https://www.hyperledger.org/about/leadership#governing [Accessed 11 May 2020].
5. We are focused primarily in this section on efforts to govern informal economies, rather than informality in governance itself, though the latter is undoubtedly important in governing a number of policy areas relevant to sustainability and technology (Morin et al. 2019).
6. https://www.globalemancipation.ngo/global-emancipation-network-mission-offerings/ [Accessed 11 May 2020].
7. By the 'usual suspects' noted above such as the Big Four professional services firms (Deloitte 2020), the WEF (Liao 2020), but also scholars (Mashamba-Thompson and Crayton 2020) who "recommend a low cost blockchain and artificial intelligence-coupled self-testing and tracking systems for COVID-19 and other emerging infectious diseases" in sub-Saharan Africa.

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