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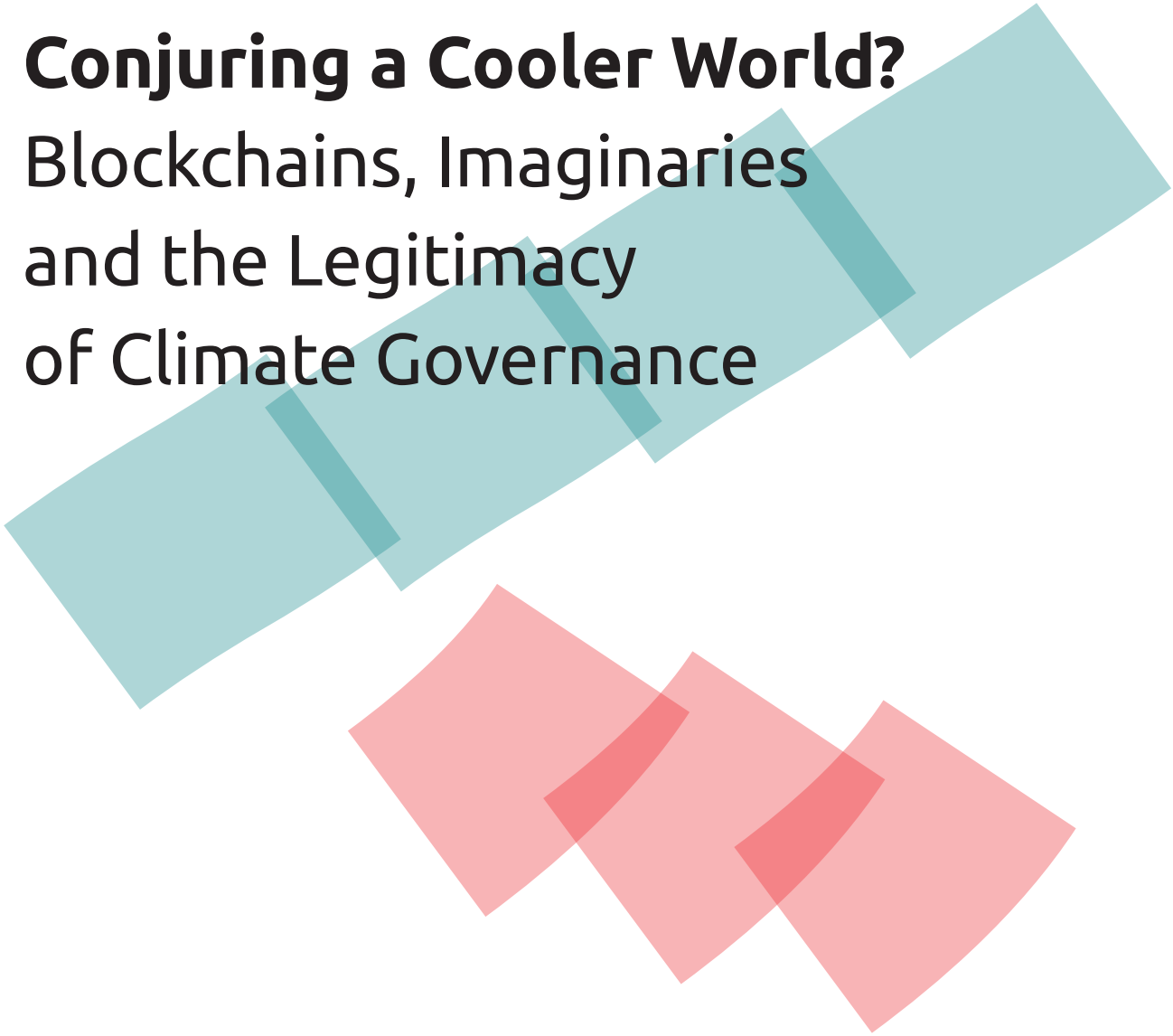
Malcolm Campbell-Verduyn

Conjuring a Cooler World?
Blockchains, Imaginaries and the Legitimacy of Climate Governance



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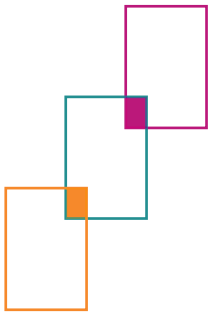

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Conjuring a Cooler World? Blockchains, Imaginaries and the Legitimacy of Climate Governance

Malcolm Campbell-Verduyn

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Preface

We are delighted to present a new Global Cooperation Research Paper on the highly topical issue of blockchain-based climate governance, entitled 'Conjuring a Cooler World? Blockchains, Imaginaries and the Legitimacy of Climate Governance'. In his paper, Malcolm Campbell-Verduyn, assistant professor of International Political Economy at the University of Groningen and currently a senior research fellow at the Centre, critically examines the concept of blockchain-based climate governance projects, with a particular focus on the Climate Chain Coalition. This global initiative was founded in 2017 to advance blockchain-based financing for climate governance in order to help achieve the goals of the Paris Agreement. The paper takes a closer look at the imaginaries and visions behind such climate finance experiments to find out whether there is more to these 'cool' new technologies – can blockchains address the lack of input and output legitimacy that global environmental governance has been suffering from for a while? Malcolm's analysis comes to the important, yet sobering, conclusion that the imaginaries behind such experiments tend to be more interested in 'cool' technologies rather than an actually 'cooler' world in which climate governance is legitimised by improved opportunities for participation and better outputs in the form of reduced emissions. The research paper is recommended reading not only for those interested in a deeper understanding of blockchain technology, but for all researchers and practitioners interested in climate and global governance who want to take a critical look at the potential of such technology-centred solutions to the climate crisis.

Patricia Rinck (Editorial Board)

Conjuring a Cooler World? Blockchains, Imaginaries and the Legitimacy of Climate Governance

Malcolm Campbell-Verduyn[1]

1 Introduction: legitimacy crises and techno-financial fixes in climate governance

Global environmental governance has long faced a legitimacy crisis (Bernstein 2005; 2012). On the input side, apex groupings of state and non-state actors coordinating attempts to address environmental problems have become increasingly inclusive. Yet, decision-making input tends to persistently privilege access of multinational firms and those actors best able to mobilize the necessary capital, time, expertise, and other resources. On the output side, long-standing forms of 'marketized' (Newell 2008; Paterson 2010; Gray 2017) and 'non-state market driven' (Cashore 2002) environmental governance suffer from frequently unmet outcomes. Most prominently, the goal of preventing a two degree Celsius rise in global temperature, set out by the 2015 Paris Agreement, is increasingly perceived as unachievable.[2]

Together, the problematic output and input legitimacy of global environmental governance have generated an ongoing search for alternative paths and mechanisms to enhance participation and meet shared goals. Alternatives have been emanated in 'bottom-up' fashion, for instance the growing movement for fossil fuel divestment. They have also been 'top-down', with associations of multinational firms developing a growing range of 'responsible investment' standards. This paper focuses on an increasingly prominent intersection of such mechanisms in international efforts to harness a novel set

[1] Earlier versions of this paper benefited from feedback by participants in the December 2019 University of Warwick workshop 'Exploring Technology-Led Private Experiments in ESG and Sustainable Governance', the October 2020 Annual Political Science Workshops of the Low Countries, and the November 2020 research colloquium at the Käte Hamburger Kolleg/ Centre for Global Cooperation Research. Insightful and constructive feedback from an anonymous peer reviewer, Dr. Umberto M. Sconfienza, Dr. Janet Hui Xue as well as research assistance by Peter C. Jager and Erwin Voloder are all gratefully acknowledged. Thanks are also due to Patricia Rinck for excellent editorial guidance. The usual disclaimers apply.

[2] Even official UN Environmental Programme (2019) scenarios now view a 3.2 degree Celsius change by the year 2100 as far more realistic.

of technologies in responding to the climate governance's legitimacy crisis. As part of a wider 'technological turn' in global sustainability governance, 'multi-stakeholder' groupings of public and private actors have increasingly turned to digital technologies to confront a range of global governance issues, including climate change (Bernards et al. 2020). The focus of this paper is on emerging efforts to harness one set of emergent technologies, called blockchains.

What exactly 'the blockchain' is continually morphs. Generally, however, blockchains consist of 'blocks' of peer-verified digital transactions that are sequentially added together to form a 'chain' or ledger. Blockchains offer databases of digital transactions undertaken, verified, and published in quasi-anonymous networks of users. The novelty of this set of technologies lies in their ability to draw together geographically dispersed individuals into networks whose cryptographic and time-stamping technologies enable the secure undertaking, recording, and accounting for digital transactions. Applications of this technology have been prominently positioned as potentially improving a wide array of global problems. The intention of initial applications of blockchain to Bitcoin sought to reform global financial governance after the 2007–2008 global financial crisis. By evaluating efforts to re-purpose this carbon-intensive[3] set of financial technologies ('FinTechs') as sustainability technologies ('SusTechs'), this paper more generally provides insights into one set of efforts to materialize the Paris Agreement. In particular, it examines the aim of combatting climate change by making 'finance flows consistent with a pathway toward low greenhouse gas emissions and climate-resilient development' (UNFCCC n.d.).

Meeting on the second anniversary of the Paris Agreement signing in 2017, the United Nations Climate Change Secretariat founded the Climate Chain Coalition (CCC) (UNFCCC 2018). Backed by a number of multi-stakeholder groups with names like the Climate Ledger Initiative and the Blockchain for Climate Foundation, the Ottawa-based CCC promotes the 'blockchainization' of the Paris Agreement. This multi-stakeholder grouping coordinates ongoing experiments with blockchains by and amongst large multinational corporations and start-up technology firms. In partnership and association[4] with one another as well as universities, governments, and international organizations, these groups undertake a range of trials and 'live' applications of this technology in and across agricultural, energy, forestry, and other industries key to combating climate change. Through sub-groups focusing on 'use cases' in particular areas, CCC members share progress reports on achievements

[3] See Stoll et al. (2019) and two main indexes: the Cambridge Bitcoin Electricity Consumption Index (Cambridge Centre for Alternative Finance n.d.) and Bitcoin Energy Consumption Index (Digiconomist n.d.).

[4] Such as the International Association for Trusted Blockchain Applications (n.d.), which is made up of national and regional associations of blockchain firms and backed by the European Commission.

of broadly set goals to curb the global temperature rise in what amounts to a largely private variation on the 'experimentalist' mode of governance that has spread across environmental and global governance (Hoffmann 2011; Brassett et al. 2012; De Búrca et al. 2014; Overdevest and Zeitlin 2020).[5] The CCC's Charter (2020a) outlines its purpose 'to cooperatively support the application of distributed ledger technology ('DLT', including 'the blockchain') and related digital solutions to addressing climate change'. Despite not being explicitly invoked, legitimacy issues clearly underpin CCC goals. On the input side, the CCC is concerned with 'empowering stakeholders' and 'stakeholder capacity building'. On the output side, the CCC seeks to generate 'efficacy' and 'immediate actions by and for blockchain and related digital solutions that contribute to the achievement of this [global] transition [to a low-carbon and climate-resilient economy]' (CCC 2020a).

What kind of 'cooler' world do blockchain-based climate governance projects conjure? Examining White Papers[6] of CCC members[7] and the shared visions emerging[8] across blockchain-based climate experiments, this paper interrogates these technology-centred responses to the legitimacy crisis of climate governance. While the ultimate impacts of the unfolding experiments coordinated by the CCC remain uncertain, evaluating how such projects seek to enhance the input and output legitimacy of climate governance is insightful not only for evaluating their prospects of success or failure, but for illuminating the possibilities that emergent digital technologies more generally provide in addressing the legitimacy crises of global environmental governance. The goal of this paper therefore is less to appraise the *actual* results of what remain ongoing experiments in a particular niche of global efforts to tackle climate change. Rather, it is to generate understanding into how and whether blockchains, as well as other emergent technologies, can—and should—be 'scaled up' or 'scaled down' to address the urgent issue of climate change. The insights generated here are therefore intended to be relevant not only to those interested in blockchain but also to researchers and practitioners of climate and global governance who are continually confronted with novel technologies as possible 'silver bullet' solutions to an urgent planetary crisis.

The central argument is two-pronged. First, and at best, the ongoing 'blockchainization' of the Paris Agreement provides *incremental* improvements to

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5 The precise nature of experimentalist governance varies regionally and sectorally (Ansell and Bartenberger 2016).

6 Originating as documents outlining government policy plans, White Papers have been re-purposed in the wider technology sector to form detailed descriptions of 'new or improved technology in order to generate interest in—and promote sales of—that technology' (Malone and Wright 2018: 114). While oriented more towards investors and professional technologists, they often wax lyrically about their philosophical influences and visions.

7 Many of whom are also involved in CCC (2020b) leadership.

8 As outlined in media reports and CCC-related bulletins that provide 'status updates' on the development of these projects (e.g. Shadrin 2020).

existing forms of market-led climate governance. The novel forms of individual participation and efficiencies these experiments promote are too limited to sufficiently address the input and output legitimacy gaps afflicting climate and environmental governance more generally. Second, at their worst these technological experiments *divert* from efforts to materialize competing visions of climate governance. The focus on technological silver bullets distracts from various 'Green Deals' and forms of 'Green Keynesianism' foregrounding collective rather than individual market-led responses to the legitimacy crises of global climate governance.[9] In short, the world being conjured in blockchain-based climate finance experiments is one foregrounding 'cool' technological experimentation rather than a 'cooler' world in which climate governance is more legitimate through meeting emissions reductions targets and enhanced participation in decision-making.

These arguments are elaborated over five sections. A first outlines the key concept of imaginaries harnessed from Science and Technology Studies to appraise the possibilities and limits offered by blockchain technology in climate governance on their own terms. Two subsequent sections then identify imaginaries in climate governance and blockchain applications, respectively, before a fourth section locates and interrogates the shared visions materializing across transnational efforts to 'blockchainize' the Paris Agreement. This penultimate section assesses whether blockchain-based climate FinTech and SusTech experiments materialize new imaginaries or reinforce existing visions of climate governance. A final section concludes by summarizing the promises and perils of advancing novel technologies such as blockchains as 'techno-fixes' to the fraught legitimacy of climate governance. It also identifies paths for future research at the intersection of imaginaries, climate governance, and technology.

2 Imaginaries: social, technical, political

The imaginary is a frequently invoked yet infrequently elaborated concept. It is typically equated with fictional and immaterial 'dream-like' representations. Yet, imaginaries were also long understood as spaces *mediating* the ideational and the material (Graeber 2015). Drawing on the work of French-Greek philosopher Cornelius Castoriadis, Cameron and Palan (2004: 86) generally understand imaginaries as 'the medium through which everyday practices and problems are mediated and comprehended'. Imaginaries 'render concrete' individual visions, first, in being shared amongst collections of individuals and, second, by materializing as technical artefacts. An interdisciplinary literature

[9] For useful overviews of these alternatives see for instance Pettifor (2019) and Tienhaara (2018).

on imaginaries stressing the *socio-technical* nature of imaginaries usefully 'grounds' this concept in manners that enable scrutiny of the visions being shared and implemented into blockchain-based climate finance experiments.

First, a stress on the *social* nature of imaginaries politicizes *which* individual vision becomes shared between individuals and in *what* manners. Beyond abstract machinations of individual psychologies, imaginaries are profoundly social: they provide 'links which stakeholders can use to communicate with one other [sic] to come to agree on standards and shared practices' (Kow and Lustig 2018: 209); imaginaries 'have a social purpose of enhancing communication within large-scale collaborations' (Kow and Lustig 2018: 212). Imaginaries translate individual visions into socially intelligible forms that can facilitate multi-stakeholder governance that enables actors of varying backgrounds to cooperate in materializing a shared vision. Yet, which individual vision becomes shared amongst groups in which various imaginaries compete for dominance? There are important political stakes tied to the processes through which a particular individual vision becomes first shared amongst a group of other individuals and materializes into technical artifacts. In the case of climate action, Levy and Spicer (2013: 660) stress the 'considerable contestation' over imaginaries that 'are closely linked to the ways in which institutions and economic activity are organized and structured, and the ways people think they ought to be organized and structured'. Imaginaries thus are crucial to the legitimation of power. Drawing on philosopher Charles Taylor, Browne and Diehl stress how an 'imaginary generates the "common understanding that makes possible common practices and a widely shared sense of legitimacy"' (Taylor 2004: 23 in Browne and Diehl 2019: 394). In a similar manner, Chenou (2019: 597) emphasizes how imaginaries 'legitimate the power of certain actors and present certain evolutions that might benefit them as inevitable'. In the case of internet governance, for example,

> imaginaries constitute powerful sources of political ordering. By appealing to political ideals and offering streamlined accounts of events and underlying causalities, they delimit the range of legitimate behavior and the space of rational public discourse. Studying narratives and imaginaries implies a focus on *the how* of political ordering. (Hofmann 2020: 256, italics added)

The how, who, and where of legitimate power and governance greatly depends on the particular vision dominant across hierarchies of other visions (Zhang 2019). The vision materializing amongst groups and into technical artefacts leads alternative visions to remain just that: visions not rendered concrete, or at least far less widely and materially so.

Second, imaginaries are grounded through a stress on the *technical* nature of visions shared amongst groups of individuals. Imaginaries are rendered concrete not only through the social sharing of particular visions but through

what Jasanoff and Kim (2009: 120) emphasize as the 'design and fulfillment of nation-specific scientific and/or technological projects'. This, for example, involves the vision of an 'ozone hole' shared in scientific communities materializing through satellite images (Grevsmühl 2014). New technologies not only ground collectively shared visions but in turn influence which visions gain social currency and are shared amongst individuals in the first place. Chenou (2019: 598) concludes that imaginaries 'are connected to, and partly shape, our understanding of technological change'. As elaborated in the case of blockchain below, technology materializes certain shared visions, but also influences the shared visions materializing across climate finance projects. The main point for now is that shared visions are materially grounded through the type of 'speculative technologies' (Bear 2020) that render concrete 'preliminary processes of speculation' and 'future financial/technological outcomes' (Faustino 2019: 478). Tracing such outcomes to particular visions and the manners in which they are shared amongst particular groups of actors injects 'a more sustained empirical basis to the suggestions that technological development mobilizes dreams, imagination, visions, narratives and, sometimes, some sort of counterpower' (Faustino 2019: 478).

The next sections examine the visions and counter-visions' materializing, first, in global climate governance and, second, in blockchain applications. Drawing out these socio-technical imaginaries illustrates the possibilities and limits of tech-centred responses to the legitimacy crises facing climate governance in two main ways. First and foremost, socio-technical imaginaries help locate *which* visions are being shared amongst the diverse members of 'multi-stakeholder' groupings sponsored by the United Nations and the World Economic Forum, such as the CCC. These reveal how imaginaries 'delimit the scope and complexity of the problem and limit our range of concrete responses' (MacCullum et al. 2011: 2). Second, socio-technical imaginaries focus analytical attention on *how* shared visions of climate governance materialize, or fail to do so. Teasing out how some individual visions are rendered concrete and stand 'in tension or in a productive dialectical relationship' (Jasanoff 2015: 4) with others points to patterns of continuity and change in climate governance. In short, assessing the imaginaries underlying blockchain-based experiments helps to understand both continuity and change in tech-centred efforts to address the legitimacy of climate governance more widely.

3 Imaginaries of climate governance

Visions of climate governance have materialized in relation to one another over the past half century. On the one hand, *collectivistic* visions of climate governance began to materialize in inter-state efforts to address what were increasingly recognized as a litany of environmental problems in the 1960s.

Despite some successes, nation states-centred international agreements were unable to effectively reduce the ongoing rise in greenhouse gas (GHG) emissions. These failures spurred the widespread materialization of more *individualistic* visions of market-based climate governance since the 1970s. What became the dominant imaginary of climate governance materialized alongside a wider socio-political 'trend towards individualization' that foregrounds a vision of 'large-scale—albeit uneven—retraction of state responsibility for economic life' (Christophers et al. 2020: 93).

Individualistic imaginaries of climate governance materialize a vision of climate governance *input* primarily through markets, which, in turn, results in more decentralized *outputs*. Participation is typically conjured 'at narrower social scales—if not always at the scale of the individual, then certainly tending in that direction' (Christophers et al. 2020: 93). A vision of a 'planetary Leviathan' (Wainwright and Mann 2018) materializes less in (inter-)governmental forums than as 'a capitalist planetary sovereign' (Christophers et al. 2020: 89). Governance input through markets and *multiple* disaggregated individual actions cuts across national jurisdictions, typically generating a patchwork of markets that remain 'fragmented, and decentralized, operating without central coordination' (Abbott 2012: 571). This imaginary materializes a vision of 'entrepreneurial' and 'bottom-up experimental climate action' (Sengers et al. 2020) in which 'innovation, entrepreneurship, venture capital and carbon markets allocates a primary role to the private sector in addressing climate change' (Levy and Spicer 2013: 664).

The dominance of individualistic imaginaries of global governance generally, and climate governance specifically, has not entailed an *absence* of collectivist imaginaries. Rather, the failure of international agreements to address rising GHG emissions since the 1960s spurred not only individualistic imaginaries but a (re-)articulation of collectivist visions less centred around nation-states. Visions of 'civic environmentalism' materialized in two main forms of 'stakeholding' since the 1990s (Bäckstrand and Lövbrand 2006: 55). A *reformist* collectivistic imaginary advances a decentralized vision of climate governance. Here, the idea is that anyone can contribute to climate governance, but that neither states nor the 'market alone can generate an equitable distribution of resources or halt environmental degradation' (Bäckstrand and Lövbrand 2006: 56). This vision of 'cross-sectoral cooperation between market, state and civil society' (Bäckstrand and Lövbrand 2006: 56) materializes in public-private partnerships and multi-stakeholder arrangements loosely coordinated by the Group of 20, United Nations, World Economic Forum, and a number of international organizations (Skovgaard 2021). By contrast, a more *radical* vision of civic environmentalism materializes localized forms of climate governance centralized in civil society and state-based climate action. Market-based governance is regarded with deep scepticism in these radical 'alternative

(ecological) worldviews' (Katz-Rosene and Paterson 2018: 71-81).[10] Despite a growing appeal, with possible 'Green Deals' and forms of 'Green Keynesianism' slated to materialize, these more radical collectivistic visions remain alternatives to both the individualist and 'reformist civic environmental' imaginaries of climate governance in which markets are the dominant mechanisms for achieving reductions of GHG emissions (Hale 2016).

Table 1: Imaginaries of climate governance

Imaginary	Input From	Output Form
Individualistic	Market	Decentralized
Inter-State Collectivistic	State	Centralized
Reformist Collectivistic	Market-State-Civil Society	Decentralized
Radical Collectivistic	Civil Society-State	Centralized

The imaginaries of climate governance summarized in Table 1 overlap in a shared stress on technological solutionism (Morozov 2013). Novel applications of expert knowledge—or technologies—tend to be central to climate governance solutions' materializing either through markets, states, or civil society (Oh 2020). Specifically, *financial* technologies are widely envisioned as playing key governance roles. This is particularly the case in individualistic and 'reformist' collectivist imaginaries, where 'a common strategy has been to create financial markets in environmental services as (purportedly) a means to address the problem at hand' (Katz-Rosene and Paterson 2018: 50).[11] Like other sectors of global finance, climate finance 'comes in many forms, deploying widely varying means towards an array of different ends' of which profit-seeking markets are not the sole but, certainly, the dominant form (Christophers et al. 2020: 105).[12] Although a 'relatively immature' (Christophers et al. 2020: 105) corner of the global financial system, climate finance has been boosted by inter-state agreements since the 1992 Kyoto Protocol. Most recently, the 2015 Paris Agreement calls on signatories to overcome the patchwork of global markets for carbon trading, amongst other manners, through market-based technological solutions.[13] Moreover, assumptions that 'the acceleration of technological innovation' can limit the warming of the planet

[10] For a succinct overview of such alternatives see Newel (2019: 107-110).

[11] Particularly in the wake of the 2008 global financial crisis (Helleiner and Thistlethwaite 2013). Of note is that this also includes markets for a range of carbon derivatives hedging against volatilities in these markets as well as carbon offsets for activities verified as contributing to emission reductions.

[12] On international climate finance institutions see Graham and Serdaru (2020).

[13] Including, as described further below, the positioning of blockchain as 'aggregation platform for these fragmented systems while enhancing transparency and automating accounting processes [...] eliminating information asymmetry' (Schletz et al. 2020).

are built into key climate models, like those of the Intergovernmental Panel on Climate Change (2018).

The next sections illustrate the imaginaries informing one set of technological solutions to climate governance. A first examines the general visions materializing in blockchains before a second outlines those specifically evolving in climate applications of the technology.

4 Shared visions materializing in applications of blockchain technology

What the blockchain is continually morphs, as with most technologies as they emerge (Einsiedel 2009). Generally, though, a blockchain consists of 'blocks' of peer-verified digital transactions sequentially added together to form a 'chain' or ledger. This chain forms a 'dynamic database' in which digital transactions are undertaken, verified, and published amongst quasi-anonymous networks of users. As the interdisciplinary field of blockchain studies has identified, various visions are materializing across an expanding array of applications of this emergent technology. Like those in climate governance, shared visions materializing in blockchain projects have been largely dominated by individualistic imaginaries. More collectivist visions, however, have remained present yet struggled to 'scale' both socially and materially.

On the one hand, blockchains materialize individualistic visions of governance. Despite claims of it being an 'apolitical' technology, blockchain developers were 'originally motivated by imaginations of utopian online societies (i.e., libertarianism)' (Kow and Lustig 2018; see also Brunton 2019). Individualistic visions materialized most prominently in the initial and still best known application of this technology: Bitcoin. The first cryptocurrency enacts 'right-wing politics' (Golumbia 2016) and is routinely critiqued for being fundamentally 'antisocial' (Krugman 2013). The visions of governance Bitcoin materializes seek to bypass collectivist institutions affiliated with states, notably central banks, by facilitating direct peer-to-peer monetary transactions between individuals that do not know or trust one another (Campbell-Verduyn and Goguen 2019; Faria 2019). The main 'consensus' mechanisms for verifying transactions between users, called 'proof-of-work', harnesses a highly competitive individualism that situates individuals in race for the reward of a share of transactions. The winning condition of said race is being the first to solve a series of complex equations. The form of governance *input* here involves 'no need to try to cooperate' but only to 'trust in markets' (Swartz 2017: 93-4). In turn, governance *output* is decentralized. The 'distributed' nature of this set of emergent technologies 'make self-regulation a given for many stakeholders based on the assumption that it provides the most suitable

or "natural" regulatory option to fit a plurality of possible contexts that often transcend formal regulatory boundaries and jurisdictions' (Herian 2018: 57).

Since the development of Bitcoin in 2009, an array of further applications of its underlying blockchain technology have sought to materialize the initial cryptocurrency's vision of an atomized world of competitive market individualism. So-called 'decentralized automated organizations' (DAOs) whose initial iteration was a crowdfunding platform called The DAO have tended to rely on 'great individuals' serving as 'first among equals' in attending to the glitches inevitably arising in 'live experimentation' with emergent technology (Campbell-Verduyn and Hütten 2019: 139). Projects like BitNation, launched in 2014, extend an individualistic vision that 'intends, in theory, to sidestep governments' to 'a nation that, aside from being borderless and voluntary, would be competition based' (Faria 2019: 123–124).

Nevertheless, blockchains also materialize communal visions, albeit at far lesser scales. A 'crypto-communist' vision informs blockchain projects that take more collaborative approaches to achieving consensus amongst geographically dispersed individuals (Husain et al. 2020). For example, Co-op Coin materializes a collectivistic vision of governance with 'a much stronger focus on collaborative solidarity' as well as stress on 'mutual cooperation and solidarity, rather than individual competition' (Scott 2017). Instead of the individualistic competition fostered in 'proof-of-work' consensus is achieved in FairCoin for example, through so-called Cooperatively Validated Nodes (CVNs). As Dallyn and Frenzel (2020: 10) explain, 'rather than competing—as is the case with Bitcoin mining—a collection of between 10-20 computers take it in turns to validate transactions every three minutes which is then signed off by the other CVNs in a "consensus algorithm"' (König et al. 2018), a process in which the total number of coins is fixed. This leads to dramatically less energy consumption in validating transactions, and consequently participants often referred to it as an 'ecological blockchain' design.

Other more collectivist experiments with blockchains include 'solidarity cryptocurrencies' (Diniz et al. 2020) and 'distributed collaborative organizations' (DCOs) that, respectively, stand in stark contrast with Bitcoin and DAOs (Scott et al. 2017). An early environmental-related example was the charity 'DAO of whales' that sought to autonomously distribute funds to a user-decided scientific research group studying a specific pod of orcas in the Pacific Northwest (Dupont 2018). BitGreen (2020), a more recent instance of a collectivist approach, emerged in 2017 as a community-driven 'green' alternative to Bitcoin whose computing power and energy consumption is estimated to consume the equivalent to small countries' GHG emissions.[14] Meanwhile, there are Open Distributed Cooperatives (DisCOs) defined as 'locally grounded, commons-oriented and transnationally-networked coop-

[14] Alternative forms of arriving at consensus in blockchain networks are noted below.

eratives focused on social and environmental work' in which 'production is guided not by profit but by social and environmental priorities' (DisCO.coop et al. 2019: 31–33). The visions shared across such projects explicitly prioritize sociability and ecological needs to varying extents. Yet, despite emerging attempts to apply the technology to international humanitarian actions and foreign aid projects (Reinsberg 2019; Zwitter and Boisse-Despiaux 2018), more collectivistic blockchain governance has not been able to 'scale' beyond local and niche applications.

Not unlike climate governance, imaginaries of blockchain governance are extremes that, in practice, tend to materialize in ways that *combine* individualistic and collectivistic visions. Even 'crypto-collaborativists' projects undertake 'public–private partnerships or coalitions that aim to collaboratively experiment with blockchain experiment with the existing political infrastructure as well as create new ones' (Husain et al. 2020: 383). Faircoop, for example, is far from a 'purely' collaborative project. As Dallyn and Frenzel (2020) argue, Faircoop sits rather awkwardly in a continuum between the individualism of existing financial markets and efforts to materialize collaborative visions of governance. It is within evolving attempts to combine individualistic and collectivistic imaginaries in novel ways that efforts to 'scale' this emergent technology through its application to climate governance have emerged. The next section traces the largely reformist imaginaries of multi-stakeholder projects coordinated by the UN-backed CCC.

5 Identifying and interrogating imaginaries of blockchain-based climate finance

This section identifies the combination of imaginaries conjured in blockchain-based climate finance projects coordinated by the CCC. It finds individualistic visions of climate governance to largely be materializing across blockchain projects. Elements of both reformist and radical collectivistic imaginaries are also present yet to far more limited extents. The shared emphasis is on linking spatially dispersed individual actions together in ways that engage neither with the more collectivistic forms of climate governance or blockchain governance outlined above. Instead, two individualistic elements predominate: a stress on 1) wider participation and *input* through enhanced individual market access as well as 2) improved *output* through greater market efficiencies.

By identifying the 'collective vision formation' (Faustino 2019) across blockchain-based projects, this section extends a small but growing literature investigating climate governance projects harnessing this set of emergent technologies. Beyond promotional and technical feasibility studies (e.g. Marke et al. 2018; Franke et al. 2020; Schletz et al. 2020; Schultz and Feist 2020), three

contributions stand out here. First is Reinsberg's (2020: 3) assessment of the potential of climate governance projects that are regarded as 'rife with private-led initiatives using blockchain technology' against a liberal 'normative standard […] to judge blockchain-based global governance imaginaries'. This survey of emerging blockchain applications across sectors, including climate finance, finds the technology to have the 'potential to instantiate decentralized governance platforms that implement liberal ideals of a "fully-automated liberalism" —whereby individual actors and the autonomous contracts that these actors create would work to achieve common objectives' (Reinsberg 2020: 3). Second is Hull et al.'s (2020: 22) comparison of the United Nations Framework Convention on Climate Change (UNFCCC) and the World Bank's blockchain conceptualizations. This study finds that 'far from transforming current modes of governance, it instead privileges and reinforces the currently dominant technocratic, market-friendly and procedural approach to multilateral climate governance' (Hull et al. 2020: 22). Third is Schulz et al.'s (2020: 2) exploratory study of the CCC, which concludes that 'more critical investigation regarding the possibilities and limitations of blockchain applications to support progress on sustainable development is warranted'. In particular, this study points to the need for interrogating 'the cultural imaginaries' invoked (Schulz et al. 2020: 9). In advancing these studies, this section not only identifies shared visions emerging across members of the CCC but provides an assessment of what is an ultimately limited potential for addressing the legitimacy crisis of climate governance.

5.1 Widening market access, enhanced climate governance input?

> Blockchain-enabled financial systems could potentially revolutionize capital access and unlock new investment potential thanks to the possibility of open and transparent access to markets. This can sustainably raise trillions of new sources, thanks to the 'token economy'. (Agudelo 2019)

A first major element of the shared individualistic vision materializing across blockchain climate finance projects is the effort to broaden input in climate governance through market-based participation. In their exploratory study, Schultz et al. (2020: 6) find the CCC's key principle of fostering 'stakeholder empowerment' (CCC 2020a) to be 'relatively vague'. They conclude that it 'remains to be seen how the application of DLT will affect social cohesion and the targeted use of climate finance to reduce inequality'. This sub-section elaborates how the blockchain-based experiments coordinated by the CCC seek to enable more equal access by promoting individual participation in market-

based governance. In 'opening the market to a wider investor base' (Agudelo 2019), blockchain climate finance applications are conjured as 'crowdfunding and peer-to-peer financial transactions in support of climate action' (UNFCCC 2017). More specifically, they seek to enable individuals and actors beyond large transnational corporations and governments to participate in the allocation of climate credits and sustainable finance, first, through 'climate tokens' and, second, through 'climate finance platforms'. This sub-section addresses each of these forms, in turn, before outlining some limits, taking a cue from Husain et al.'s (2020: 388, emphasis added) questioning of whether blockchain-based 'systems are referring to *individual* empowerment or *collective* empowerment—and whether one necessarily translates into the other'.

5.1.1 Climate tokens

Blockchain-based climate finance experiments materialize shared visions of individual market access in a first instance through so-called 'green tokens'. These expand the vision of the initial cryptographic token, Bitcoin, to materialize a form of money and currency accessible to anyone with an internet connection. Like the original 'cryptocurrency', climate tokens link digital representations of a range of 'green' objects and activities to monetary-like reward schemes. The earliest such projects appeared around 2014[15] and created digital tokens representing renewable energy production. SolarCoin represents solar electricity generation while other projects 'tokenize' trees, like ECOCoin, or the planting of trees, like Carbon Coin (ECOCoin 2021). In these experiments, monetary-like rewards of new tokens are provided to incentivize individual participation in market-based climate action.

The initial iterations of climate tokens have remained limited in scale to certain jurisdictions. SolarCoin, for instance, expanded to only four jurisdictions since its inception in 2014. Similarly, the United Nations Development Program-backed 'climate cryptocurrency' Cedar Coin incentivizes tree planting in only one country, Lebanon (Joe 2019).[16] The real-world material limits of these digital 'green' tokens contrast with promises to 'scale up' enhanced participation in climate governance to anyone, anywhere in the world with access to the internet and a cryptocurrency wallet.[17] The shared vision of access

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[15] Digital currencies claiming to be 'linked to the environment' like Ven rely on some of the technologies underpinning blockchains yet tend to eschew the 'cryptocurrency' label or any link to Bitcoin.

[16] Whether or not these tokens are labelled as 'currencies' or 'securities' is usually a legal affair in the jurisdictions in which these are issued (Schletz et al. 2020).

[17] Such wallets are types of bank accounts for storing and exchanging digital tokens. Several wallet providers have been linked to individual climate action. Stockholm Green Digital Finance (2021), a private not-for-profit consortium founded at the 2017 G20 GreenInvest meeting in Berlin, develops 'green asset wallets' that are intended to lower transaction costs of issuing and investing in climate credit products, carbon credits in particular.

seeking to 'lower the barrier to entry' for individual participation in markets for carbon credits (Green 2018) as well as other 'green' financial products and services is ultimately constrained to 'opportunities' for individual access by way of consumption and exchange of green tokens in certain national jurisdictions.

A second, related, iteration of climate tokens is 'native network tokens'. Rather than for exchange in monetary-like fashion *between* projects, these tokens are used internally *within* wider and ambitious, yet increasingly complex, blockchain-based networks. Where 'green tokens' are held and traded in digital wallets, 'native network tokens' remain 'native' to a plethora of climate finance projects. ClimateCoin (2017), for example, is a 'stapling' of carbon credits[18] to the 'CO2 tokens' circulated and exchanged within this particular blockchain network. The 'Unique Fungible Tokens' of the Blockchain for Climate Foundation, a Canadian-based network promoting 'international collaboration on climate change by connecting the national carbon accounts of the world' (Pallant 2018), incentivize individual authentication of carbon credits. CarbonX, another 'native network token', provides incentives for 'individuals to make carbonfriendly decisions' in a carbon trading network co-founded by consultancy ConsenSys and Canadian technology evangelists Don and Alex Tapscott (PRNewswire 2017). Similarly, CBNR token, developed by Hong Kong-based Veridium Labs (n.d.), 'represents a single REDD+ carbon credit backed by a diversified portfolio of internationally verified carbon credits'. 1PL, the 1PLANET native network token, is conjured as a 'digital eco-commodity that represents reductions in CO2 emissions', or carbon credits exchangeable in a blockchain network that 'democratizes access to global carbon markets by tokenizing carbon credits' (Climate Futures n.d.). California-based GEAR, an abbreviation for 'Green Energy and Renewables', provides a blockchain-based 'marketplace' whose GEAR Tokens represent carbon credits (Global Newswire 2019).

Climate tokens materialize an individualistic vision of enhanced participation in climate governance through carbon and other 'green' markets. By 'opening up' existing markets for financial products, individual participation in climate governance decision-making is sought. As Faustino (2019: 487) argues, however, this 'futuristic worldview according to which a user can shape her organization's governance architecture in a modular way, launch her own currency, and exert full control over her own personalized algorithms cannot be attained without the technical infrastructures that support it'. To explore the wider, more collectivistic infrastructures that individualistic blockchain-based climate finance projects attempt to generate, the next sub-section examines climate finance automation platforms.

[18] Worth noting is that carbon credits themselves are representations of a metric ton of carbon dioxide.

5.1.2 Climate finance blockchain platforms

Individual access to market-based climate governance also materializes in and across blockchain-based digital platforms seeking to develop open and automated infrastructures of climate finance. Distinguishing such platforms from other so-called 'climate smart' technologies,[19] is their layering of blockchain-based 'smart contracts'[20] in 'automating' credit provision to 'help make climate finance market more inclusive', as boasted by a leading project called the DAO IPCI (2018b). The vision shared in this and related projects is one in which blockchain applications enable participation of individuals and individual countries in overcoming 'the stringent accreditation requirements for international climate funds' (DAO IPCI 2018b). The Russia-based DAO ICPI, or 'Integral Platform for Climate Initiatives', specifically seeks to 'help developing countries to access climate finance' by actualizing the right-to-development criteria spelled out in article 10.5 of the Paris Agreement (UNFCCC 2015). Projects like the now bankrupt Israel-based Solar DAO also sought to facilitate and channel individual investments into funds that would automatically allocate investments towards solar energy projects.[21] The assets that blockchain climate finance applications seek to broaden access to through automated 'Do it Yourself' digital platforms are financial instruments that have, to date, remained largely 'exotic' to individual investors (HSBC and Sustainable Digital Finance Alliance 2019). The Singapore-based Carbon Grid Protocol, for example, seeks to enable 'the widespread adoption of carbon credits in blockchain as a valuable and readily tradeable asset class' (Carbon Grid Protocol n.d.). In 'connecting carbon to life', another Singapore start-up called Poseidon seeks to spur individual actions, through its blockchain-based climate finance platform, to allow individual to 'be able to *personally* offset' their carbon footprints (Del Castillo 2018).

Blockchain-based climate platforms also provide 'climate services' enabling geographically dispersed individuals and individual firms to *create* their own financial assets. The Carbon Credit Management Platform, developed in a partnership between IBM and the China-based Energy-Blockchain Labs, seeks to 'enable companies to create carbon assets more efficiently' (Lielacher 2017). The platform Greeneum (n.d.), meanwhile, enables individuals to develop Decentralized Applications (DApps) that provide 'incentives to use renewable energy and reduce carbon emission'. UK-based Fasset (n.d.) Enterprise Platform is conjured as a 'marketplace' for owners of renewable energy and other sustainable infrastructure owners to 'tokenize' their assets in raising 'climate capital' while allowing individual investors 'to contribute to the

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[19] See for instance the *Journal of Peasant Studies* 45 (1) forum on 'Climate Smart Agriculture'.

[20] Blockchain-based contracts in which the terms and execution are pre-recorded and automatically undertaken.

[21] This project was taken over by Texan oil & gas firm in 2019 (Burger 2018).

achievement of the United Nations' Sustainable Development Goals (SDGs)'. Finally, Adaptation Ledger, established by the founder and co-chair of the CCC,[22] is a platform

> that creates clear incentives for developing standards (defined broadly) for climate adaptation to organize the essential tools (technologies, practice, metrics, exchange mechanisms and finance, in other words, 'climate services') required to support effective global action on climate adaptation… [by enabling users to undertake] the applied creation of a suite of tools and testbeds to better align adaptation solutions and mobilize adaptation finance. (Adaption Ledger n.d.)

Despite their attempts to broaden individual participation in climate governance, these blockchain-based platforms tend to extend only very limited forms of input. The ability to access and decide who receives funds in these automated platforms, paradoxically, does not automatically enable participation in the development of the rules structuring the allocation of sustainable finance. The actual manners in which these platforms operate, the rules upon which they are based, and the credit decisions they structure may be transparent. Yet, their very complexity undermines rather than encourages participation. This is due to the level of technical knowledge required to navigate these fast-moving technological projects. The promise to herald more inclusive, bottom-up, and market-based participation in blockchain-based climate governance is dulled by technological experiments that largely reinforce existing imbalances in access. For instance, in these projects, individuals are rarely provided straightforward possibilities for shaping the code that structures credit decision-making. Rather, the underlying protocols typically remain controlled by concentrated cliques of 'insider' decision-makers.[23]

Paradoxically then, attempts to widen input through blockchain-based market participation increase, rather than overcome, existing limits on decision-making power in climate governance. These technology-centred projects distract from possibilities of integrating wider input through collectivistic imaginaries. They are also entangled in a second element of shared individualistic visions materializing in climate finance experiments with this set of technologies.

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[22] Tom Baumann also co-chairs International Association for Trusted Blockchain Applications' Climate Action Working Group efforts to develop 'data and digital innovation infrastructure to enhance climate actions' (INATBA n.d.).

[23] Exceptions here are the 'open climate collabathons' co-organized by Yale OpenLab. These are 'designed to leverage collective intelligence to accomplish multiple challenges of a shared goal together'. Their objective is developing 'a platform for contractual automation of rules and mechanisms with financial nature'. Yet even here individual prizes for 'Most innovative contribution' and 'most effective hack' are incentivized through rewards that include quasi-monetary options, like receiving $700 worth of carbon offsets when achieving 'technical bounties' like enhancing carbon pricing automation through 'a smart contract that can automate the calculation and collection of a global carbon price based on provable GHG emissions'(Open Climate Collabathon 2020).

5.2 Market efficiencies, enhanced climate governance output?

> We continue moving towards a society that seeks to digitize all sorts of interactions, building a parallel digital world next to our analog reality. That is why establishing a system that can improve the efficiency of our transactions while lowering our environmental footprint is key. **This is another planet: the digital one. Our planet B is Blockchain and must lead to a better one.** (Agudelo 2019, bold in original)

Blockchain-based climate finance applications seek to improve the output legitimacy of market-based climate governance by enhancing efficiencies in offering better accounting of 'green' bonds, carbon offsets, and other financial products. This subsection details and interrogates the stress on enhanced output, first, through 'real-time accounting' and second via 'decentralized solutions'.

5.2.1 Real-time accounting

'Trading CO2 reductions', hazards the Director of Climate Change at the World Bank, 'may be much more efficient while using distributed ledger technologies' (James Close quoted in DAO IPCI 2018b). Blockchain-based '[p]eer-to-peer trading of natural resources or permits', like water extraction and timber production, can also improve efficiency according to the World Economic Forum (2018).[24] As it 'acts as a shared record, the change of ownership is easily recorded, and there's no need for reconciliation between parties' in 'post-trade' settlement, argues the global bank HSBC (Ledger Insights 2020). Blockchain applications in climate finance are conjured as more efficient 'impact reporting' that enables investors to more precisely account for their 'ethical investments' (see Dimmelmeier 2019). As the founder of 'public benefit corporation' Oliver Russell puts it, blockchain applications in climate finance can better 'authenticate a richer, more accurate global ledger of a company's actual social and environmental performance, providing society with a more realistic assessment of its impact' (Stoddard 2018).

These visions materialize in a flurry of partnerships between blockchain technology start-ups. For instance, Provenance and Climate Analytics provide 'carbon transparency' services measuring GHG emissions across global supply chains (Manivannan 2019; see also Bernards et al. n.d.). Similarly, Cayman Islands-based start-up Allinfra and Big Four accounting firm KPMG have a 'verifiable trail of emissions and offsets records on blockchain' (PRNewswire 2020). So-called 'Proof of Impact' protocols are developed by South Africa-

[24] Through its Mining and Metals Blockchain Initiative the WEF is also tracing carbon emissions of a half dozen MNCs (Partz 2020).

based Ixo Foundation in which users of its Global Impact Ledger are rewarded for authenticating impact claims (Braden 2019). Elsewhere, blockchain-based climate accounting solutions introduced by Singapore-based start-up Poseidon (n.d.) are marketed as being able 'for the first time in history, to precisely address the environmental cost of any transaction'. Most ambitiously yet, the Regen Ledger provides a 'Balance Sheet for Earth' (Booman et al. 2020: 7).

Automation is once again core to the efficiency claims underpinning these projects. The EcoSmart-Protocol developed by Veridium Labs automates complex calculations of corporate environmental impacts to produce the 'correct' number of carbon offsets required to achieve net carbon neutrality (Orcutt 2018). A director at a Morocco-based climate finance advisory and investment firm exclaims that 'blockchain can track compliance with treaties and automatically release incentives, such as tax credits, once certain targets are met' (Carter 2018). A joint report by the British bank HSBC and the Sustainable Digital Finance Alliance (2019)[25] entitled 'Widening Access to Finance Block by Block', argues that blockchain applications increase 'accessibility to issuance' of green bonds by automating and decentralizing what has been a concentrated and inefficient human-centred practice. What this 'real-time' automation then enables is said to be 'the accuracy of impact measurement, efficiency of portfolio management and profitability of investments', as Russian-based Evercity puts it (Shadrin 2020). Materializing across these globally dispersed projects is a shared vision of blockchain technology as enhancing 'the ability to explicitly track the ecological impacts of our actions right alongside the financial' (Booman et al. 2020: 7). This is a vision of enhanced efficiency in climate governance materializing through better *measurement* of what the business magazine *Forbes* exclaims as 'the entire process of accounting for a company's carbon emission and offsetting that pollution' (Del Castillo 2018).

Yet, this improved accuracy of measurement is once again assumed to *automatically* lead existing market-based governance processes to improve outcomes. Little thought is given to how speculation and more unproductive financial trading might also be enhanced along with GHG emissions reductions. The emphasis on efficiencies, for instance, provides little-to-no consideration of the Jevons paradox, which describes how efficiency gains through technologies may end up *increasing* the very emissions of GHGs as well as worsen outcomes and the legitimacy of climate governance.[26] Generating a

[25] A partnership coordinated by the UN Environmental Programme and China's ANT Financial Services Group (Sustainable Digital Finance Alliance 2021).

[26] Newel (2019: 83) elaborates the paradox that 'while efficiencies can be made, resource throughputs reduced, and production, technology and finance undoubtedly mobilised towards greener ends, the direction of travel, as captured in trends towards the overshoot of planetary boundaries suggest not only that the pace and depth of change is not fast enough but that these shifts fail to deal with the basic contradictions of the fantasy of infinite growth on a finite planet.'

potentially larger pool of funds is far from being the main problem of climate finance: however, the *distribution* of such funds is a topic left to the very markets that have heralded inequities and inaccuracies in the first place. Such paradoxes and limits are also apparent in the further emphasis on achieving efficiencies through disintermediation in climate governance.

5.2.2 Enhancing carbon credit efficiencies through (de-)centralization

Equally, characterizing individualistic visions of blockchain-based climate finance is a stress on bypassing collective, centralized authorities. The search for decentralization in Bitcoin's initial proposal to circumvent banks and central banks is echoed in efforts to 'disrupt' existing market-led climate governance in which 'financiers act as intermediaries between buyers and sellers of carbon allowances […], making carbon markets operate much like any standard financial market' in which the likes of auditors and accountants serve as third parties (Katz-Rosene and Paterson 2018: 97). The blockchain platform of Singapore-based New Era Energy, for example, seeks 'to open up carbon credit markets by making them more transparent and accountable, *while removing the need for intermediaries such as brokers or funds*' (Deign 2018, emphasis added). Similar projects conjure blockchain applications as enhancing the efficiency of climate finance governance by getting 'beyond the self-interest of management and company-paid consultants' (Stoddard 2018). Removing the need for these and other 'third-parties' is regarded as beneficial to governance output in reducing 'costs involved in verifying transactions' (Climate Trade n.d.).

As with other novel attempts at decentralization throughout history (Schneider 2019), however, the emphasis on efficiency through disintermediation tends to *re*-intermediate rather than eliminate centralized authority. Blockchain projects, *linking* individual action together to produce a form of global 'climate collectivism', construct *new* intermediaries in their connection-making and attempts at 'building linkages across markets' as the aforementioned DAO IPCI (n.d.: 4) puts it. Projects like the Estonian blockchain Earth Ledger simultaneously advertise that 'Anyone Can Participate' in a 'positive social and environmental impact platform' and 'Grow a Sustainable Start-up' yet only 'incentivizes *verified* users to work together towards the restoration of our Planet' (Earth Ledger n.d.). The Carbon Grid Protocol (2018: 8) developed by Singapore's New Era Energy and supported by both the CCC and the UNFCCC, meanwhile, conjures a 'Proof-of-Green' consensus model that empowers 'Carbon Grid Authority Nodes' as 'independent and accredited validators that have previous experience in CDM or VCS-related protocols, or exhibit, host, or carry out green or renewable energy-related projects, events, or initiatives'. These nodes grant users access to what is billed as its 'digital gateway to green projects & DApps'. Similarly, in the DAO IPCI (n.d.), 'Op-

erators' of climate finance applications are granted control over the following: 'Approval of new Ledgers and issuance of independently assured Units in the amount within the established limit; Approval of New Issuer's access to trading (Marketplace); Approval of the Accredited Auditors List'.

Not only do these attempts at decentralization create *new* intermediaries, but they also persistently include a number of *existing*, centralized authorities. For instance, private-sector initiatives advanced by the Blockchain Climate Institute (n.d.) provide 'a "super-connector" platform for policymakers, corporate executives and blockchain innovators to experiment and adopt the most viable concepts in an enabling environment'.[27] Rather than jettisoning the 'old governors', blockchain-based climate finance platforms mix them with 'new governors' in extending the complexity of climate governance assemblages. The extension of such complexity is illustrated at official events of UNFCCC's Conference of the Parties where events like the 'Decentralized Integrity: Climate Finance and Carbon Markets' showcased a 'live launch' of climate finance applications on the DAO IPCI for green NGOs and the Director for Climate Change at the World Bank (DAO IPCI 2018a; 2018b).

This mix of 'old and new governors' materializing in blockchain-based climate governance projects may very well enable GHG emissions reductions and improve its problematic output. However, important tensions underpin their individualistic imaginaries. An emphasis on achieving efficiencies through decentralization that recreates centralization and 'real-time accounting' that potentially enables financial speculation appears unlikely to improve rapid GHG emission reductions. Future research will be needed to trace attempts at either resolving these tensions or limiting their implications for whether technological solutions can address the legitimacy gaps in climate governance.

5 Conclusion

This paper advanced two central arguments. First, it argued that individualistic visions are shared and materialize across emerging blockchain-based climate finance projects. Second, the ability of these persistently market-based projects to address the problems facing climate governance was interrogated. The ability of blockchain-based climate finance experiments to enhance both the input and output of climate governance through an emphasis on individual access and efficiencies in markets remain, at best, unlikely and, at worst, a distraction for collectivistic imaginaries for addressing the collective problem of climate governance.

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[27] The founder of the organization that later became the Blockchain & Climate Institute edited a book promoting the blockchainization of nearly every aspect of climate finance and its governance (Marke et al. 2018).

Additional research can further draw out the processes materializing visions underlying 'blockchainization' as they emerge. Like other forms of technological change, blockchain applications are imaginative processes whose paths and implications for climate governance evolve in often unexpected manners. It will remain important to avoid understanding paths as predetermined. Emphasis should be put on the often non-linear trajectories of imagination in assessing what ultimately comes from these experiments and 'beyond' them—that is, the actual outcomes generated and the activities they preclude in doing so (Sengers et al. 2020). This paper has noted the absence of linkages with the Green Deals and Green Keynesianism as well as more radical collectivist visions of climate governance. The interplay between individualist and collectivist imaginaries of climate governance will continue to evolve. The ways these 'meet' and materialize in blockchain and other technological experiments will be important to trace. In doing so, limits to imaginaries informing climate action can be further drawn out, such as how efforts at achieving more accessible and efficient forms of market-based governance through experiments with technologies like blockchains can extend techno-solutionist visions of technology 'curing' environmental problems in ways that maintain 'existing market-capitalist social relations' (Oh 2020).

In sum, assessing whether multi-stakeholder initiatives can enhance the output legitimacy of market-based climate governance through novel technologies requires more nuanced examination than is, and likely will be offered, by industry, media, 'thought leaders', and think tanks. Identifying and interrogating imaginaries emanating from these projects is one manner of avoiding either bifurcated tendencies to outright dismiss such projects or as Husain et al. (2020: 391) put it, to just 'regurgitate the imaginaries of blockchain projects without any critical reflection'. Contextualized critique of evolving blockchain-based climate finance projects requires nuanced research that integrates critical assessments of how, for instance, these digital ledgers are linked with other 'adjacent' emergent technologies like artificial intelligence[28] in responding to climate governance challenges (e.g., Kostka et al. 2020). The hope of this paper in contributing to a small literature on blockchain-based climate projects is to catalyse further investigations of both sustainable development initiatives centred around this set of technologies and interrogations of the roles that technology can realistically provide in addressing the legitimacy crises of climate governance.

[28] Discussion of blockchain applications for climate financing typically stresses the need to integrate this set of technologies with the internet-of-things and artificial intelligence, see for instance OECD (2019).

References

Abbott, Kenneth (2012). 'The Transnational Regime Complex for Climate Change', *Environment and Planning C: Government and Policy*, 30(4): 571–590.

Agudelo, Luisa (2019). 'A Global Green Deal: Blockchains for a Better Planet', *Medium*, 27 December, available at: https://medium.com/@micobo/a-global-green-deal-blockchains-for-a-better-planet-c2f9b54160d2 (accessed 27 February 2021).

Ansell, Christopher and Bartenberger, Martin (2016). 'Varieties of Experimentalism', *Ecological Economics*, 130: 64–73.

Bäckstrand, Karin and Lövbrand, Eva (2006). 'Planting Trees to Mitigate Climate Change: Contested Discourses of Ecological Modernization, Green Governmentality and Civic Environmentalism', *Global Environmental Politics*, 6(1): 50–75.

Bäckstrand, Karin and Lövbrand, Eva (2019). 'The Road to Paris: Contending Climate Governance Discourses in the Post-Copenhagen Era', *Journal of Environmental Policy & Planning*, 21(5): 519–532.

Bear, Laura (2020). 'Speculation: a political economy of technologies of imagination', *Economy and Society*, 49(1): 1–15.

Bernards, Nick, Campbell-Verduyn, Malcolm and Rodima-Taylor, Daivi (n.d.). 'The Veil of Transparency: Blockchain and Sustainability Governance in Global Supply Chains'. *Unpublished Manuscript*.

Bernards, Nick, Campbell-Verduyn, Malcolm, Rodima-Taylor, Daivi Duberry, Jerome, DuPont, Quinn, Dimmelmeier, Andreas, Hütten, Moritz, Mahrenbach, Laura, Porter, Tony and Reinsberg, Bernhard (2020). 'Interrogating Technology-led Experiments in Sustainability Governance', *Global Policy*, 11(4): 523–531.

Bernstein, Steven (2005). 'Legitimacy in Global Environmental Governance', *Journal of International Law and International Relations*, 1(1-2): 139–166.

Bernstein, Steven (2012). 'Legitimacy Problems and Responses in Global Environmental Governance', in Peter Dauvergne (ed.), *Handbook of Global Environmental Politics*, 2nd edition, Cheltenham: Elgar, 147–162.

BitGreen (2020). 'Whitepaper', available at: https://bitg.org/whitepaper/#Introduction (accessed 15 February 2021).

Blockchain Climate Institute (n.d.). 'Building a decentralized climate economy in the blockchain era', available at: http://www.blockchainclimateinstitute.org/ (accessed 27 February 2021).

Booman, Gisel, Craelius, Aaron, Deriemaeker, Brecht, Landua, Gregory, Szal, Will and Weinberg, Brain (2020). 'Regen Network Whitepaper', Version 1.3, available at: https://regen-network.gitlab.io/whitepaper/WhitePaper.pdf (accessed 27 February 2021).

Braden, Sven (2019). 'Blockchain Potentials and Limitations for Selected Climate Policy Instruments'. *Climate Ledger*, available at: https://www.climateledger.org/resources/Blockchain-Potentials-Climate-Policy_2019.pdf (accessed 27 February 2021).

Brassett, James, Richardson, Ben and Smith, William (2012). 'Private experiments in global governance: primary commodity roundtables and the politics of deliberation', *International Theory*, 4(3): 367–399.

Browne, Craig and Diehl, Paula (2019). 'Conceptualising the Political Imaginary: An Introduction to the Special Issue', *Social Epistemology*, 33(5): 393–397.

Brunton, Finn (2019). *Digital Cash: The Unknown History of the Anarchists, Utopians, and Technologists who Created Cryptocurrency*, Princeton, NJ: Princeton University Press.

Burger, Andrew (2018). 'Solar DAO Fund Calls off ICO, Launches Three Projects and a "Know Your Customer" Procedure', *Solar Magazine,* 12. February, available at: https://solarmagazine.com/solar-dao-launches-3-projects-and-know-your-customer-procedure/ (accessed 15 February 2021).

Cambridge Centre for Alternative Finance (n.d.). 'Cambridge Bitcoin Electricity Consumption Index', available at: https://www.cbeci.org/ (accessed 15 February 2021).

Campbell-Verduyn, Malcolm and Goguen, Marcel (2019). 'Blockchains, Trust and Action Nets: Extending the Pathologies of Financial Globalization', *Global Networks*, 19(3): 308–328.

Campbell-Verduyn, Malcolm and Hütten, Moritz (2019). 'Beyond Scandal? Blockchain Technologies and the Legitimacy of Post-2008 Finance', *Finance and Society*, 5(2): 126–144.

Cameron, Angus and Palan, Ronen (2004). *The Imagined Economies of Globalization*, London: Sage.

Carbon Grid Protocol (n.d.) 'Decarbonizing Blockchain', available at: http://carbongrid.io/ (accessed 27 February 2021).

Carbon Grid Protocol (2018). 'The Digital Gateway to a Carbon Neutral World'. Available at: http://carbongrid.io/cgrid_wp_draft.pdf (accessed 27 February 2021).

Carter, Lauren (2018). 'Digital solutions for climate finance', *Eco-Business*, 16 January, available at: https://www.eco-business.com/opinion/digital-solutions-for-climate-finance/ (accessed 16 February 2021).

Cashore, Benjamin (2002). 'Legitimacy and the Privatization of Environmental Governance: How Non-State Market-Driven (NSMD) Governance Systems Gain Rule–Making Authority', *Governance*, 15(4): 503–529.

Chenou, Jean-Marie (2019). 'Elites and Socio-Technical Imaginaries: The Contribution of an IPE-IPS Dialogue to the Analysis of Global Power Relations in the Digital Age', *International Relations*, 33(4): 595–599.

Christophers, Brett, Bigger, Patrick and Johnson, Leigh (2020). 'Stretching Scales? Risk and Sociality in Climate Finance', *Environment and Planning A: Economy and Space*, 52(1): 88–110.

CCC (2020a). 'Charter', available at: https://www.climatechaincoalition.io/charter (accessed 27 February 2021).

CCC (2020b). 'Leadership and Partnerships', available at: https://www.climatechaincoalition.io/leadership-and-partnerships (accessed 15 February 2021).

ClimateCoin (2017). 'Crypto Carbon Revolution', available at: https://medium.com/@Climatecoin/climatecoin-crypto-carbon-revolution-cb7f0dbff-5dc (accessed 27 February 2021).

Climate Futures (n.d.). 'Sustainable Living', available at: https://climatefutures.io/for-individuals/ (accessed 27 February 2021).

Climate Trade (n.d.). 'The Time is Now', available at: https://www.climatetrade.com/ (accessed 27 February 2021).

Dallyn, Sam and Frenzel, Fabian (2020). 'The Challenge of Building a Scalable Postcapitalist Commons: The Limits of FairCoin as a Commons Based Cryptocurrency', *Antipode* (online first).

DAO IPCI (n.d.). 'Blockchain Technology for Carbon Markets, Environmental Assets and Liabilities', available at: https://ipci.io/ (accessed 27 February 2021).

DAO IPCI (2018a). 'Blockchain Demo at COP24 Showed Unprecedented Cost Reduction in Direct Climate Action', 14 December, available at: https://ipci.io/blockchain-demo-at-cop24-showed-x10000-cost-reduction-in-direct-climate-action (accessed 15 February 2021).

DAO IPCI (2018b). 'COP24 Discovery: Blockchain Ready to Bring Climate Finance to Most Vulnerable States', 26 December, available at: https://ipci.io/cop24-discovery-blockchain-ready-to-bring-climate-finance-to-most-vulnerable-states/ (accessed 27 February 2021).

De Búrca, Gráinne, Keohane, Robert and Sabel, Charles (2014). 'Global Experimentalist Governance', *British Journal of Political Science*, 44(3): 477–486.

Del Castillo, Michael (2018). 'IBM to Use Stellar for Its First Crypto-Token on a Public Blockchain', *Forbes*, 15 May, available at: https://www.forbes.com/sites/michaeldelcastillo/2018/05/15/ibm-to-use-stellar-for-its-first-crypto-token-on-a-public-blockchain/?sh=1a5a85992001 (accessed 16 February 2021).

Deign, Jason (2018). 'The Startup Aiming to Wipe Out Blockchain's Carbon Footprint'. *Greentech Media*, 5 July, available at: https://www.greentechmedia.com/articles/read/the-startup-aiming-to-wipe-out-blockchains-carbon-footprint#:~:text=New%20Era%20Energy%20is%20planning,-such%20as%20brokers%20or%20funds (accessed 27 February 2021).

Digiconomist (n.d.). 'Bitcoin Energy Consumption Index', *Digiconomist*, available at: https://digiconomist.net/bitcoin-energy-consumption/ (accessed 15 February 2021).

DisCO.coop, Transnational Institute and Guerilla Media Collective (2019) (eds). 'If Only I Had a Heart: A DisCO Manifesto', available at: https://www.tni.org/files/profiles-downloads/disco_manifesto_v.1.pdf (accessed 27 February 2021).

Dimmelmeier, Andreas (2019). 'Sustainable Data, Sustainable Finance? Exploring Technology in ESG Data', paper presented to 'Exploring Technology-Led Private Experiments in ESG and Sustainable Governance' workshop, Warwick University, 15 December.

Diniz, Eduardo H., Kremmer Cernev, Adrian, Rodrigues, Dennis A. and Daneluzzi, Fabio (2020). 'Solidarity Cryptocurrencies as Digital Community Platforms' Web, *Information Technology for Development* (online first).

DuPont, Quinn (2018). 'Experiments in Algorithmic Governance: A History and Ethnography of 'The DAO,' a Failed Decentralized Autonomous Organization', in Malcolm Campbell-Verduyn (ed), *Bitcoin and Beyond*, New York: Routledge, 157–177.

Earth Ledger (n.d.). 'Earth Ledger', available at: https://earthledger.one/ (accessed 27 February 2021).

ECOCoin (2021). 'The ECO Coin: A Sustainable Currency for Planet Earth', available at: https://www.ecocoin.com/ (accessed 15 February 2021).

Einsiedel, Edna (2009). 'Making Sense of Emerging Technologies', in Einsiedel, Edna (ed), *Emerging Technologies: From Hindsight to Foresight*, Vancouver: UBC press, 3–11.

Faria, Inês (2019). 'Trust, Reputation and Ambiguous Freedoms: Financial Institutions and Subversive Libertarians Navigating Blockchain, Markets, and Regulation', *Journal of Cultural Economy* 12(2): 119–132.

Fasset (n.d.). *Fasset*, available at: https://www.fasset.com/ (accessed 27 February 2021).

Faustino, Sandra (2019). 'How Metaphors Matter: An Ethnography of Blockchain-Based Re-Descriptions of the World', *Journal of Cultural Economy*, 12(6): 478–490.

Franke, Laura, Schletz, Marco and Salomo, Søren (2020). 'Designing a Blockchain Model for the Paris Agreement's Carbon Market Mechanism', *Sustainability*, 12: 68.

Gale, Fred, Ascui, Francisco and Lovell, Heather (2017). 'Sensing Reality? New Monitoring Technologies for Global Sustainability Standards', *Global Environmental Politics*, 17(2): 65–83.

Global Newswire (2019). 'FORK Invests in Private Token Sale for GEAR, a Blockchain-Based Marketplace for Environmental Credits', 1 August, available at: https://www.globenewswire.com/news-release/2019/08/01/1895261/0/en/FORK-Invests-in-Private-Token-Sale-for-GEAR-a-Blockchain-Based-Marketplace-for-Environmental-Credits.html (accessed 27 February 2021).

Golumbia, David (2016). *The Politics of Bitcoin: Software as Right-Wing Extremism*, Minneapolis: University of Minnesota Press.

Graeber, David (2015). *The Utopia of Rules: On Rechnology, Stupidity, and the Secret Joys of Bureaucracy*, New York, NY: Melville House.

Graham, Erin and Serdaru, Alexandria (2020). 'Power, Control, and the Logic of Substitution in Institutional Design: The Case of International Climate Finance', *International Organization*, 74(4): 671–706.

Gray, Ian (2017). 'Marketization as Political Technology: Unintended Consequences of Climate Finance in the Democratic Republic of Congo', *Economy and Society*, 46(3–4): 545–575.

Green, Jemma (2018). 'Solving the Carbon Problem One Blockchain at a Time', *Forbes*, 19 September, available at: https://www.forbes.com/sites/jemmagreen/2018/09/19/solving-the-carbon-problem-one-blockchain-at-a-time/?sh=66f253ac5f5e (accessed 16 February 2021).

Greeneum (n.d.). 'Building the Green Future We Want to Live In', available at: https://www.greeneum.net/#!/ (accessed 27 February 2021).

Grevsmühl, Sebastian (2014). 'The Creation of Global Imaginaries: The Antarctic Ozone Hole and the Isoline Tradition in the Atmospheric Sciences', in Schneider, Birgit and Nocke, Thomas (eds), *Image Politics of Climate Change*, Bielefeld: Transcript, 29–53.

Hale, Thomas (2016). 'All Hands on Deck: The Paris Agreement and Nonstate Climate Action', *Global Environmental Politics*, 16(3): 12–22.

Helleiner, Eric (2000). 'Think Globally, Transact Locally: Green Political Economy and the Local Currency Movement', *Global Society*, 14(1): 35–51.

Helleiner, Eric and Thistlethwaite, Jason (2013). 'Subprime Catalyst: Financial Regulatory Reform and the Strengthening of US Carbon Market Governance', *Regulation & Governance*, 7(4): 496–511.

Herian, Robert (2018). *Regulating Blockchain: Critical Perspectives in Law and Technology*, London: Routledge.

Hofmann, Jeanette (2020). 'The Multistakeholder Concept as Narrative: A Discourse Analytical Approach', in DeNardis, Laura, Cogburn, Derrick, Levinson, Nanette S., and Musiani, Francesca (eds), *Researching Internet Governance: Methods, Frameworks, Futures*, Cambridge, MA: MIT Press, 249–268.

Hoffmann, Matthew (2011). *Climate Governance at the Crossroads: Experimenting with a Global Response after Kyoto*, Oxford: Oxford University Press.

HSBC and Sustainable Digital Finance Alliance (2019). 'Blockchain: Gateway for Sustainability Linked Bonds', available at: https://90bf1b73-3763-483f-abf5-1e464e9f1319.filesusr.com/ugd/3d4f2c_a8d74cac6f974984a67f7b-8c05146fbe.pdf (accessed 27 February 2021).

Hull, Jed, Gupta, Aarti and Kloppenburg, Sanneke (2020). 'Interrogating the Promises and Perils of Climate Crypto-Governance: Debating the use of Blockchain Technology in International Climate Politics', paper presented to Annual Political Science Workshops of the Low Countries, Digital Politicologenetmaal Workshop, October 21.

Husain, Syed Omer, Franklin, Alex and Roep, Dirk (2020). 'The Political Imaginaries of Blockchain Projects: Discerning the Expressions of an Emerging Ecosystem', *Sustainability Science*, 15: 379–394.

INATBA (n.d.). 'The INATBA Organization', available at: https://inatba.org/organization/ (accessed 16 February 2021).

International Association for Trusted Blockchain Applications (n.d.). 'Climate Action Working Group', available at: https://inatba.org/organization (accessed 27 February 2021).

International Panel on Climate Change (2018). 'Global Warming of 1.5C', available at: https://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf (accessed 27 February 2021).

Jasanoff, Sheila and Kim, Sang-Hyun (2009). 'Containing the Atom: Sociotechnical Imaginaries and Nuclear Regulation in the U.S. and South Korea', *Minerva*, 47(2): 119–146.

Jasanoff, Sheila (2015). 'Future Imperfect: Science, Technology, and the Imaginations of Modernity', in Jasanoff, Sheila, and Kim, Sang-Hyun

(eds), *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*, Chicago, IL: University of Chicago Press, 1–33.

Joe, Moonyoung (2019). 'Adopting a Cedar Tree Brings Diaspora Money Home', *United Nations Development Programme*, 7 February, available at: https://www.undp.org/content/undp/en/home/blog/2019/adopting-a-cedar-tree-and-bringing-diaspora-money-home.html (accessed 16 February 2021).

Katz-Rosene, Ryan M., Kelly-Bisson, Christopher and Paterson, Matthew (2020). 'Teaching Students to Think Ecologically about the Global Political Economy, and Vice Versa', *Review of International Political Economy* (online first): 1–16.

Katz-Rosene, Ryan M. and Paterson, Matthew (2018). *Thinking Ecologically about the Global Political Economy*, London: Routledge.

König, Thomas, Duran, Enric, Fessler, Niklas and Alton, Roland (2018). 'The Proof-of-Cooperation Blockchain FairCoin', *FairCoin*, available at: https://fair-coin.org/sites/default/files/FairCoin2_whitepaper_V1.2.pdf (accessed 27 February 2021).

Kostka, Genia, Zhang, Xuehua and Shin, Kyoung (2020). 'Information, Technology, and Digitalization in China's Environmental Governance', *Journal of Environmental Planning and Management*, 63(1): 1–13.

Kow, Yong Ming and Lustig, Caitlin (2018). 'Imaginaries and Crystallization Processes in Bitcoin Infrastructuring', *Computer Supported Cooperative Work (CSCW)*, 27(2): 209–232.

Krugman, Paul (2013). 'The Antisocial Network of Bitcoins', *New York Times*, 14 April, available at: https://www.nytimes.com/2013/04/15/opinion/krugman-the-antisocial-network.html (accessed 16 February 2021).

Ledger Insights (2020). 'HSBC, UN-Backed Finance Body Says Blockchain Makes Green Bonds 10x Efficient', available at: https://www.ledgerinsights.com/blockchain-green-bonds-hsbc-sdfa-sustainable-finance/ (accessed 27 February 2021).

Levy, David and Spicer, Andre (2013). 'Contested Imaginaries and the Cultural Political Economy of Climate Change', *Organization*, 20(5): 659–678.

Lielacher, Alex (2017). 'IBM Launches Carbon Credit Management Using Hyperledger Fabric Blockchain', *BTC Manager,* 23 March, available at: https://btcmanager.com/ibm-launches-carbon-credit-management-using-hyperledger-fabric-blockchain/ (accessed 16 February 2021).

Malone, Edward and Wright, David (2018). 'To Promote That Demand: Toward a History of the Marketing White Paper as a Genre', *Journal of Business and Technical Communication*, 32(1): 113–147.

Marke, Alastair (2018) (ed). *Transforming Climate Finance and Green Investment with Blockchains*, Cambridge, MA: Academic Press.

Manivannan, Harini (2019). 'Helping Brands Rise to the Climate Crisis: Discover Our Carbon-Transparency Approach Designed for Growing Businesses', *Provenance*, 22 July, available at: https://www.provenance.org/news/movement/helping-brands-rise-to-the-climate-crisis-discover-our-carbon-transparency-approach-designed-for-growing-businesses (accessed 27 February 2021).

McNeil, Maureen, Arribas-Ayllon, Michael, Haran, Joan, Mackenzie, Adrian and Tutton, Richard (2017). 'Conceptualizing Imaginaries of Science, Technology, and Society', in Felt, Ulrike, Fouché, Rayvon, Miller, Clark, and Smith-Doerr, Laurel (eds), *The Handbook of Science and Technology Studies*, 4th edition, Cambridge, MA: MIT Press, 435–464.

Milkoreit, Manjana (2017). 'Imaginary Politics: Climate Change and Making the Future', *Elementa: Science of the Anthropocene*, 5(62): 1–18.

Morozov, Evgeny (2013). *To Save Everything, Click Here: The Folly of Technological Solutionism*, New York, NY: Public Affairs.

Newell, Peter (2008). 'The Marketization of Global Environmental Governance: Manifestations and Implications', in Park, Jacob, Conca, Ken, and Finger, Matthias (eds), *The Crisis of Global Environmental Governance*, London: Routledge, 77–95.

Newell, Peter (2019). *Global Green Politics,* Cambridge, MA: Cambridge UP.

OECD (2019). *Blockchain Technologies as a Digital Enabler for Sustainable Infrastructure,* OECD Environment Policy Papers, No. 16, Paris: OECD Publishing, available at: https://www.oecd.org/finance/blockchain-technologies-as-as-digital-enabler-for-sustainable-infrastructure.htm (accessed 15 February 2021).

Oh, Chaewoon (2020). 'Discursive Contestation on Technological Innovation and the Institutional Design of the UNFCCC in the New Climate Change Regime', *New Political Economy*, 25(4): 660–674.

Open Climate Collabathon (2020). 'About: # Radical Collaboration', available at: https://www.collabathon.openclimate.earth/copy-of-about-abstract (accessed 15 February 2021).

Orcutt, Mike (2018). 'IBM thinks blockchains can help reduce carbon emissions', *MIT Technology Review*, 19 July, available at: https://www.technologyreview.com/2018/07/19/141404/blockchain-explainer-tokenizing-carbon-credits/ (accessed 16 February 2021).

Overdevest, Christine and Zeitlin, Jonathan (2020). 'Experimentalist Interactions: Joining up the Transnational Timber Legality Regime', *Regulation & Governance* (online first).

Pallant, Joseph (2018). 'Putting the Paris Agreement on the Blockchain', *Blockchain For Climate Development*, available at: https://www.blockchainforclimate.org/our-vision (accessed 27 February 2021).

Partz, Helen (2020). 'WEF Tests Tracking Carbon Emissions with Blockchain Technology', *CoinTelegraph*, 15 December, available at: https://cointelegraph.com/news/wef-tests-tracking-carbon-emissions-with-blockchain-technology (16 February 2021).

Paterson, Matthew (2010). 'Legitimation and Accumulation in Climate Change Governance', *New Political Economy*, 15(3): 345–368.

Pettifor, Ann (2019). *The Case for the Green New Deal,* London: Verso.

Poseidon (n.d.). 'The Solution', available at: https://poseidon.eco/solution.html (accessed 27 February 2021).

Prádanos, Luis (2018). *Postgrowth Imaginaries: New Ecologies and Counterhegemonic Culture in Post-2008 Spain*, Oxford: Oxford University Press.

PRNewswire (2017). 'ConsenSys Introduces CarbonX, a Blockchain Initiative to Fight Climate Change', 22 September, available at: https://www.prnewswire.com/news-releases/consensys-introduces-carbonx-a-blockchain-initiative-to-fight-climate-change-300524455.html (accessed 27 February 2021).

PRNewswire (2020). 'KPMG to Offer New Climate Accounting Capability to Help Clients Measure Greenhouse Gas Emissions', 6 October, available at: https://www.prnewswire.com/news-releases/kpmg-to-offer-new-climate-accounting-capability-to-help-clients-measure-greenhouse-gas-emissions-301146871.html (accessed 27 February 2021).

Reinsberg, Bernhard (2019). 'Blockchain Technology and the Governance of Foreign Aid', *Journal of Institutional Economics*, 15(3): 413–429.

Reinsberg, Bernhard (2020). 'Fully-Automated Liberalism? Blockchain Technology and International Cooperation in an Anarchic World', *International Theory*, (online first): 1–27.

Schletz, Marco, Franke, Laura and Salomo, Søren (2020). 'Blockchain Application for the Paris Agreement Carbon Market Mechanism: A Decision Framework and Architecture', *Sustainability*, 12(12): 5069.

Schletz, Marco, Nassiry, Darius and Myung-Kyoon, Lee (2020). 'Blockchain and Tokenized Securities: The Potential for Green Finance', *Asian Development Bank Institute,* Working Paper, 1079.

Schulz, Karsten and Feist, Marian (2020). 'Leveraging Blockchain Technology for Innovative Climate Finance under the Green Climate Fund', *Earth System Governance*, (online first).

Schulz, Karsten, Gstrein, Oskar and Zwitter, Andrej J. (2020). 'Exploring the Governance and Implementation of Sustainable Development Initiatives through Blockchain Technology', *Futures*, 122: 1–11.

Schneider, Nathan (2019). 'Decentralization: An Incomplete Ambition', *Journal of Cultural Economy* 12(4): 265–285.

Scott, Brett (2016). 'How Can Cryptocurrency and Blockchain Technology Play a Role in Building Social and Solidarity Finance?', *United Nations Research Institute for Social Development,* Working Paper 2016-1.

Scott, Brett, Loonam, John and Kumar, Vikas (2017). 'Exploring the Rise of Blockchain Technology: Towards Distributed Collaborative Organizations', *Strategic Change*, 26(5): 423–428.

Sengers, Frans, Turnheim, Bruno and Berkhout, Frans (2020). 'Beyond Experiments: Embedding Outcomes in Climate Governance', *Environment and Planning C: Politics and Space* (online first).

Shadrin, Alexy (2020). 'How Digital Technologies Can Foster Mobilization of SDG Impact Finance?', *Digital SDG Finance Bulletin,* April, available at: https://ec94d884-4da2-402c-b98f-0cab85f86f83.filesusr.com/ugd/f69cd4_673e0f6fa07140adbe1a82b77a23d596.pdf?index=true (accessed 16 February 2021).

Skovgaard, Jakob (2021). *The Economisation of Climate Change: How the G20, the OECD and the IMF Address Fossil Fuel Subsidies and Climate Finance*, Cambridge, MA: Cambridge University Press.

Stockholm Green Digital Finance (2021). 'Green Assets Wallet', available at: https://stockholmgreenfin.tech/gaw (accessed 15 February 2021).

Stoddard, Russ (2018). 'How the Blockchain Could Transform Sustainability Reporting', *GreenBiz*, 24 April, available at: https://www.greenbiz.com/article/how-blockchain-could-transform-sustainability-reporting (accessed 16 February 2021)

Stoll, Christian, Klaaßen, Lena and Gallersdörfer, Ulrich (2019). 'The Carbon Footprint of Bitcoin', *Joule*, 3(7): 1647–1661.

Sustainable Digital Finance Alliance (2021). 'About SDFA', available at: https://www.sustainabledigitalfinance.org/about-sdfa (accessed 15 February 2021).

Swartz, Lana (2017). 'Blockchain Dreams: Imagining Techno-Economic Alternatives after Bitcoin', in Castells, Manuel (ed), *Another Economy is Possible: Culture and Economy in a Time of Crisis*, Cambridge, MA: Polity Press, 82–105.

Swartz, Lana (2018). 'What Was Bitcoin, What Will it Be? The Techno-Economic Imaginaries of a New Money Technology', *Cultural Studies*, 32(4): 623–650.

Tienhaara, Kyla (2018). *Green Keynesianism and the Global Financial Crisis*, New York: Routledge.

UN Environmental Programme (2019). 'Emissions Gap Report 2019', available at: https://www.unenvironment.org/resources/emissions-gap-report-2019 (accessed 27 February 2021).

United Nations Framework Convention on Climate Change (UNFCCC) (n.d.). 'The Paris Agreement', available at: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (accessed 15 February 2021).

United Nations Framework Convention on Climate Change (UNFCC) (2015). 'Paris Agreement', available at: https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf (accessed 27 February 2021).

United Nations Framework Convention on Climate Change (UNFCC) (2017). 'How Blockchain Technology Could Boost Climate Action', 1 June, available at: https://unfccc.int/news/how-blockchain-technology-could-boost-climate-action (accessed 27 February 2021).

United Nations Framework Convention on Climate Change (UNFCC) (2018). 'UN Supports Blockchain Technology for Climate Action', available at: https://unfccc.int/news/un-supports-blockchain-technology-for-climate-action (accessed 15 February 2021).

Veridium Labs (n.d.). 'About Veridium Labs', available at: https://www.veridium.io/about.html (accessed 27 February 2021).

Voß, Jan-Peter and Schroth, Fabian (2018). 'The Politics of Innovation and Learning in Polycentric Governance', in Jordan, Andrew, Huitema, Dave, Van Asselt, Harro and Forster, Johanna (eds), *Governing Climate Change: Polycentricity in Action?* Cambridge, MA: Cambridge University Press, 99–116.

Wainwright, Joel and Mann, Geoff (2018). *Climate Leviathan: A Political Theory of Our Planetary Future*, London: Verso Books.

World Economic Forum (2018). 'Building Block(chains) for a Better Planet', available at: https://www.weforum.org/reports/building-block-chain-for-a-better-planet (16 February 2021).

Zhang, Chenchen (2019). 'Right-Wing Populism with Chinese Characteristics? Identity, Otherness and Global Imaginaries in Debating World Politics Online', *European Journal of International Relations*, 26(1): 88–115.

Zwitter, Andrej and Boisse-Despiaux, Mathilde (2018). 'Blockchain for Humanitarian Action and Development Aid', *Journal of International Humanitarian Action*, 3(1): 1–7.

Abstract

Meeting on the second anniversary of the Paris Agreement signing in 2017, the United Nations Climate Change Secretariat founded the Climate Chain Coalition (CCC). Backed by a number of multi-stakeholder groups like the Blockchain for Climate Foundation, the Ottawa-based CCC promotes the 'blockchainization' of the Paris Agreement. What kind of 'cooler' world do blockchain-based climate governance projects conjure? This paper scrutinizes the shared visions materializing across climate finance experiments, locating them largely within existing individualistic imaginaries rather than more collectivistic alternatives. It finds the imaginaries of 'cool' technological experimentation to fall short in materializing broader input and more effective output required to overcome the legitimacy crisis facing market-led climate governance.

Key words: *Blockchain, Technology, Finance, Governance, Legitimacy*

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