GDF GLOBAL DIGITAL FINANCE

2021 | ESG Report

DIGITAL ASSETS: LAYING ESG FOUNDATIONS

Exploring the path to sustainability

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Over 135 countries have committed to carbon neutrality, targetting a 2050 date for reducing their net emissions to zero. Clearly, the earlier the pledge the better, but most are centered around 2050, a distant future. Regardless of your position on climate change, there is no excuse to continue the rising industrial levels of CO2 emissions, estimated now to be over 40 billion tons per year, that pollutes our environment and jeopardizes our health.

The impact of transitioning to cleaner sources of energy at full speed has become apparent to many: it has both an economic and social impact, the consequences of which are only starting to be understood.

Many reading this report will be less active, if active at all, in the workforce by 2050 and will look to the next generation to meet this obligation. Those who have come into the workforce in recent years will be in senior positions by 2050 and will be starting to consider retirement. Here and now, it is incumbent on each of us to play our role in helping achieve this target and respond to this global call to action.

2050 may seem a distant horizon but we now have a firm target after many years of discussion on climate action, and it is only by setting targets that we enable ourselves to achieve them. Net zero, a state of net zero carbon dioxide emissions - carbon neutrality - is not just a target. It is a destination to which we collectively embark on an existential journey to better balance the needs of society, the environment, and the planet.

In the pursuit of net zero, it will be important for us to bring to the forefront other key sustainable measures around social diversity, biodiversity, and governance, including many of the UN's Sustainable Development Goals, to help achieve if not accelerate the achievement of net zero. We must not become overly consumed by a singular net zero target to the detriment of other important sustainable measures.

Recently, the public discourse on crypto mining and the energy intensity of blockchain and proof of work consensus mechanisms have been negative. The narrative often appears intellectually dishonest in its assertions and conclusions, which lack underlying data and fact-based evidence. No comparisons are drawn to the consumption of energy of the traditional mechanisms of fiat or asset creation, usage, and retirement, nor to commodity extraction, harvest, usage, and disposal, and their relative contribution to carbon and environmental impact.

Our broad, diverse, global digital assets community has never been put off by unbalanced, biased, or inaccurate criticisms, whether centered on crypto's utility, usage, crime, risk, and now environmental impact. We carry on diligently building the digital future of financial services. We openly engage with policy makers and regulators who, in some instances, demand a higher level of scrutiny than in traditional financial markets.

Since our inception, GDF has convened the global crypto and digital assets community on the sustainable agenda. Crypto and digital assets, and their underlying technologies, play an important role in enabling the digital infrastructure and funding to finance, measure, transparently account for, and report on the achievement of net zero targets.

In honor of COP26 and publicly engaging in rational and productive action on achieving net zero, our report editors Anastasia Kinsky and Madeleine Boys have curated a number of outstanding contributions from the GDF membership and community to publicly raise awareness of the research, strategies, and programs that are here now, and demonstrate the leadership that the crypto and digital asset sector plays in helping to achieve sustainability. ■

ABOUT GDF

Global Digital Finance is the leading industry association advocating and accelerating the adoption of best practices for digital assets. Our goal is to promote and underpin the greater adoption of market standards through shared engagement forums with industry participants, regulators, and policy makers.

Editors' Introduction

Anastasia Kinsky
Head of Programs & Content, Editor

Madeleine Boys
Community Manager, Assistant Editor

The extraordinary growth that we have seen in the crypto and digital asset sector throughout this year has brought with it much attention from across media platforms, not all of which has been positive.

With the industry in the spotlight, our global community has a welcome opportunity to communicate the nuances of the crypto-energy consumption debate, as well as the broader social utility of digital assets. We asked our members to contribute their thoughts and research with the goal of deepening the wider understanding of digital assets' role in sustainable financial systems.

We were privileged to include the **Cambridge Centre for Alternative Finance**'s observations on Bitcoin's carbon footprint. Michel Rauchs and Alexander Neumueller look to raise the level of public debate on digital asset energy consumption, clarifying that neither side of the argument has a definitive answer for now.

Though it may not be the climate disaster presented by many, there is certainly room for improvement as we progress toward net zero. **Zumo** highlights how we might improve the methodologies used to quantify the environmental impact of digital assets. In the push for improvements to the energy inefficiencies across the sector, **BitMEX**, **Coinbase**, **Coinrule**, and **Abu Dhabi Global Market** have called for the industry to convene to produce stronger data transparency on crypto's climate impact, and to set industry-wide environmental targets.

We must assess digital assets just as we have judged legacy industries: by taking the social utility of the product into account while deciding how we address the environmental challenges that they present.

The utility of digital assets and distributed ledger technology (DLT) provides solutions to some of the challenges posed by ESG investing. **R3** and **DLA Piper** set out the value of DLT in green bonds and data reporting; and **The Digital Economist** argues that digital trust and ownership will be vital to the World Economic Forum's "Great Reset" of capitalism.

On achieving sustainable finance that is socially inclusive, **Archax** shows us how tokenization can democratize financial markets. Regarding access to finance and funding, **Hogan Lovells** demonstrates how a sustainable future will depend on SMEs being able to leverage digital solutions. **Stobox** gives use case examples of tokenization being used to fund SMEs in Sub-Saharan Africa.

Bequant highlights further uses, from improving global remittances to banking the unbanked. Although of more immediate value to emerging markets, recent global challenges, including COVID-19 and the climate emergency, do well to remind us that no one is immune to detrimental financial crises.

The use cases for digital assets extend to biodiversity: **ResponsibleRisk** and the **Porini Foundation** show us how rewilding projects can become 'bankable' through non-fungible tokens (NFTs), with creativity and financial services meeting to support conservation efforts. **Cardano**'s new partnership with Veritree looks to bring transparency to reforestation.

In this increasingly digital world, the overwhelming message from our community is that digital holds the key to sustainable finance. **Z/Yen** summarized industry frustrations with anti-crypoasset narratives in their article *Don´t Throw The Digital Baby Out With The Climate Bathwater*, in which he calls for industry leaders and policy makers to not hinder cryptoasset trading activity at the expense of mandatory innovation in financial markets.

We hope the report accurately reflects a community that is dedicated to improvements: improvements to public discourse, self-improvement concerning the industry's carbon footprint, and improvements to legacy systems that are necessary for achieving the Sustainable Development Goals. With many thanks to our contributors, GDF looks forward to seeing how the industry will further convene to deliver on digital assets' contribution to ESG. ■

THE ENVIRONMENTAL IMPACT OF DIGITAL ASSETS

Behind the Scenes: A Critical Assessment of the Bitcoin Sustainability Debate

Michel Rauchs
Digital Assets Lead
Cambridge Centre for Alternative Finance

Alexander Neumueller
Digital Assets Researcher
Cambridge Centre for Alternative Finance

In the spotlight

Bitcoin has seen a phenomenal rise in popularity in recent years, not least driven by a rapid surge in price, market capitalization, and total users (or rather, holders). At the same time, Bitcoin has also come under increased scrutiny for its seemingly insatiable demand for energy. Now on par with the level of entire countries, concerns about Bitcoin's electricity consumption – and in particular the resulting environmental implications – are mounting amongst environmentalists, financial institutions, and policy makers. In times of intensified decarbonization efforts to combat climate change, this has sparked a heated debate between supporters and critics about the need for intervention.

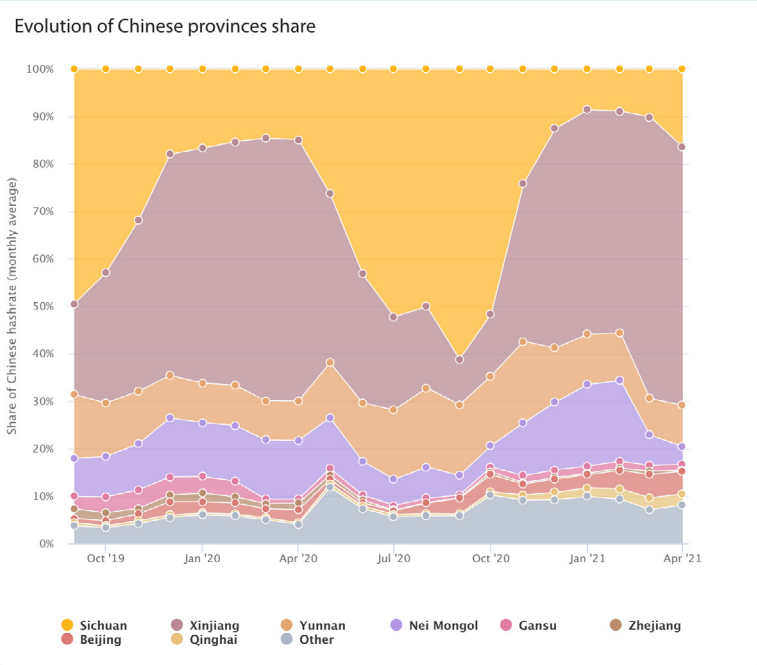
Opponents argue that Bitcoin is a climate disaster responsible for destroying decades of progress made on environmental issues. Proponents counter that Bitcoin mining is one of the most sustainable and greenest industries on the planet. Neither claim holds up when subjected to the test of evidence. And yet they are emblematic for the deplorable state of the public discussion. Sensationalist headlines, unsubstantiated claims, and technical inaccuracies are commonplace, as are deliberate misrepresentations, personal attacks, and mutual accusations.

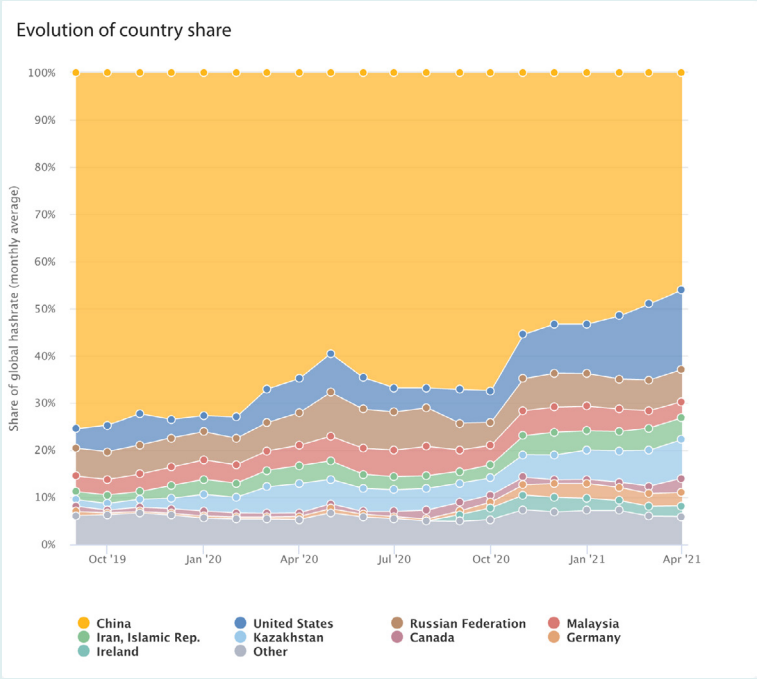
Given the considerable environmental, financial, and social interests at stake, it is hardly surprising that the debate is fraught with emotional bluster and technical blunder. There is undeniably a political element to it: vested interests on both sides of the spectrum fight tooth and nail to influence decision-makers, creating an environment where key policy and investment decisions risk being swayed by one-sided rhetoric and cherry-picked data points. It is therefore more important than ever to recognize that the question of Bitcoin's environmental footprint is more nuanced and complex than a cursory glance might suggest.

What does the data say?

Aside from politics and special interests, there are other, more practical reasons for the lack of confirmatory evidence and insights. To begin with, Bitcoin's electricity consumption cannot be directly measured. Instead, theoretical models produce estimates that can widely differ depending on the underlying methodology and implementation. When we designed the Cambridge Bitcoin Electricity Consumption Index (CBECI) in 2018, we carefully evaluated different options before settling on what we – still – believe to be acceptable trade-offs. But models naturally have limitations. It is therefore imperative for decision-makers to understand – and, indeed, critically evaluate – the key assumptions upon which these estimates rest.

Having a reliable estimate of the total power consumption is just the first step, though. The environmental impact of this consumption depends on the carbon intensity of the energy sources used to generate the electricity. This, in turn, requires a detailed understanding of the geographical location of mining





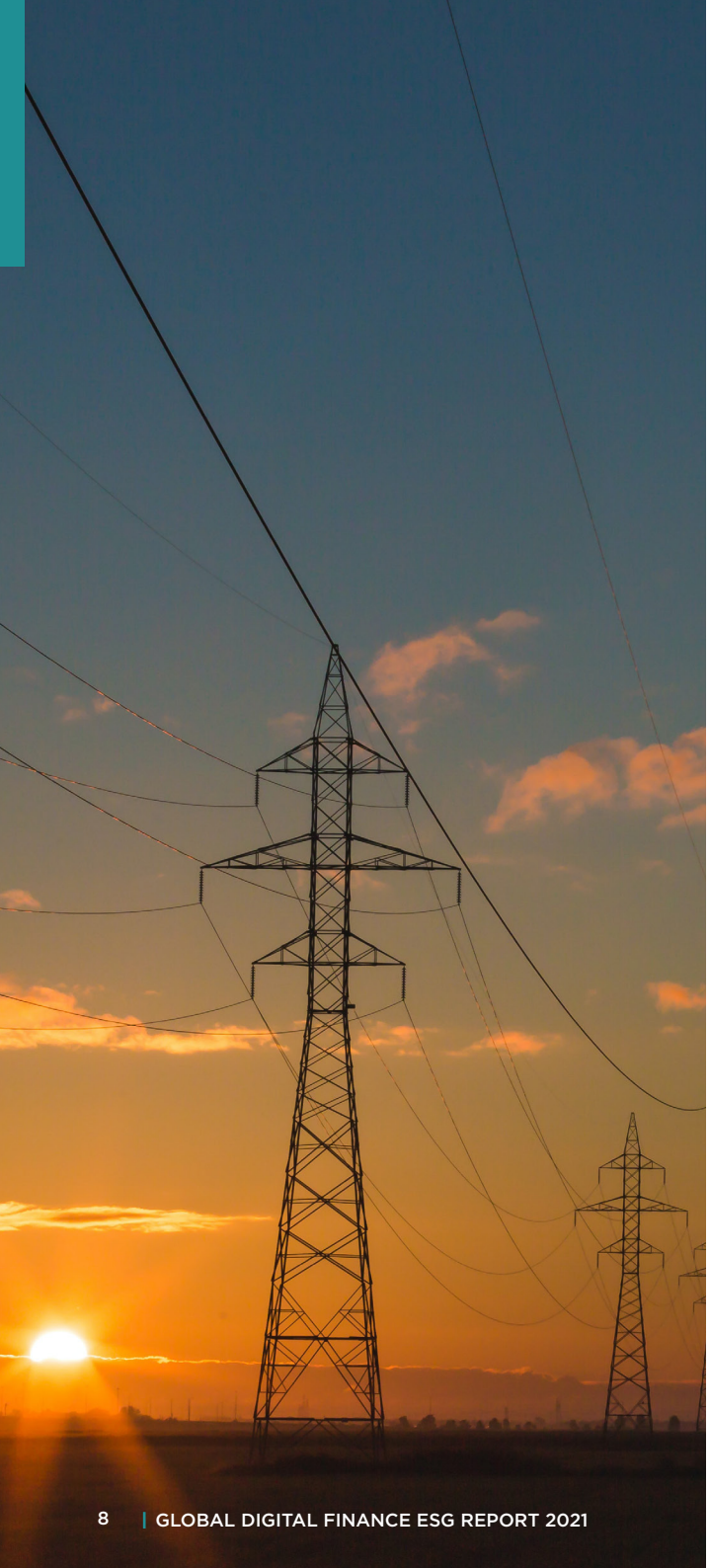
Source: *Cambridge Bitcoin Electricity Consumption Index (CBECI)*

facilities and local power mixes. Several studies have suggested that renewable sources constitute a growing share of Bitcoin mining, but estimates vary considerably (ranging from approximately 30% to more than 70%). A possible explanation for these discrepancies, aside from methodological differences, can be found in the dynamic nature of Bitcoin mining which causes the global power mix to fluctuate throughout the year. Estimates that lack a time dimension are unable to capture subtleties like regional miner mobility or seasonal changes in local grid composition.

Confronted with a general shortage of robust empirical data points on this issue, in 2020 we embarked on a new project that, with the continued support of four partnering mining pools, has since resulted in a unique longitudinal dataset on regional miner distribution spanning the period from September 2019 to April 2021 (with further updates scheduled regularly). Despite the inherent limitations – finding an appropriate methodology that is both scalable and consistent is challenging – the findings were revealing.

For one, the data confirmed for the first time the seasonal migration patterns within China that had previously only been anecdotally observed. These migrations, between hydro-rich Sichuan during the monsoon season and coal-rich Xinjiang during the dry season, materially affected the energy profile of Bitcoin mining in China. Since the data also revealed that China was responsible for two thirds of total Bitcoin hashrate up until Q3 2020 (see figure above), the migration had a substantial impact on global Bitcoin emissions throughout the year. However, with the recent exodus following the government crackdown on the mining industry, miners are spreading further across the globe – making it likely more difficult to track them in the future.

By linking our datasets on electricity consumption and regional hashrate distribution to the carbon intensity of local power mixes, we hope to provide a continuous estimate of Bitcoin's carbon dioxide emissions in the future. Yet, there is more to sustainability than 'just' carbon emissions. For instance, there is also the generated e-waste from the disposal of special-purpose mining equipment. There are other greenhouse gases that are emitted throughout the hardware supply chain from production to delivery, from the set-up of facilities to the transportation of units. And then, of course, there are the offices, vehicle fleets, business travels, and all other sorts of potential Scope 1-3 emissions-relevant assets and activities of mining companies that could be further considered. Where do you draw the line, really?



One of a kind

These examples illustrate just some of the real-world complexities that a robust environmental assessment needs to consider. But another issue preventing a more balanced public discussion, often less obvious and clear, is the prevalence of conceptual and technical misconceptions regarding Bitcoin itself. For instance, there is a widespread belief that electricity consumption automatically must rise over time, although Bitcoin does not require a pre-defined threshold of electricity to function.

The Bitcoin network is also commonly compared to traditional payment systems in terms of the carbon footprint per transaction. However, electricity consumption is linked to block production rather than transaction processing. Therefore, this comparison tends to be mainly theoretical and of little practical relevance without additional context – let alone the fact that many transactions are cleared 'off-chain' through private intermediaries like custodial exchange and wallet services, instead of being settled on the blockchain itself.

This last example highlights a deeper issue with comparisons in general. While important for putting things into perspective, they can only provide partial insights at best – because there simply is nothing else quite like Bitcoin in the world today. Even within the world of cryptoassets, Bitcoin occupies an exclusive place as a global, politically-neutral settlement system that enables permissionless transfers of a synthetic commodity asset free from discretionary management. Proof of work, the key driver of Bitcoin's electricity appetite, plays a fundamental coordination role that enables the network to self-organize in the absence of human subjectivity and intervention. Calls for replacing this mechanism with less energy-intensive alternatives neglect the potential risks to Bitcoin's main value proposition as trade-offs and transition hazards remain understudied.

Bitcoin also appears to be held to a different standard when it comes to 'permissible' energy usage. Naturally in the eye of the beholder, judgments about the moral legitimacy of the use of energy seem to be arbitrarily applied to Bitcoin but less so to other controversial industries and activities. Much of this is the product of personal preferences and values that create a false dichotomy which lies at the heart of the debate: can the Bitcoin network's activities be considered 'good' and 'socially useful'? Those who disagree with the premise regard every use of resources by the network as wasteful by definition. But what some regard as waste, others see as the key pillar for ensuring the system's value proposition.

Light on the horizon?

Given all these factors, the debate seems to have reached a polarizing impasse with no clear solution in sight. But not all hope is lost, as the industry appears to undergo a change in mindset. A growing number of mining firms have recognized the need for greater transparency and started to voluntarily disclose information and participate in research projects such as the CBECI. Private initiatives, extending well beyond just the mining sector, have formed to promote sustainable practices amongst members and collect pledges for active decarbonization. Some asset managers and exchanges have begun offsetting their activities

through carbon credits, while others are contemplating the idea of so-called 'green Bitcoins' that are carbon-neutral.

This is not just due to a sudden awakening to environmental concerns, of course (e.g. sustainability issues were already discussed as early as 2009). Rather, the growing pressure from public opinion, caused by the subject's omnipresence in the media, and the resulting concerns about consequential policy intervention, seem more probable drivers. The largest push for decarbonization may, however, ultimately come from the investor side. Since investment decisions are increasingly bound by stringent ESG rules, future flows of funds into (or out of) the ecosystem will largely depend on whether Bitcoin can meet set sustainability criteria.

Some suggest that these considerations pose a potentially existential threat to miners, creating a natural financial incentive for the industry to actively decarbonize. Others doubt the effectiveness of a purely market-driven approach and call for additional policy responses. What means will prove most impactful remains to be seen. As the world is moving towards decarbonization, so will Bitcoin – but only if the environmental externalities are adequately priced in. Because ultimately, mining operations will continue to be dictated by economic rather than ideological, ethical, or environmental principles.

What are the main takeaways, then?

At present, no satisfactory conclusion about the actual scale and extent of Bitcoin's environmental footprint can be drawn. A radical thought experiment suggests that, in a hypothetical worst case, Bitcoin could produce as much as 158 million metric tons of carbon dioxide this year, or roughly 0.48% of the world's total emissions in 2019 (assuming an annualized consumption of 100 TWh). While this is by no means a small feat, it is still far away from the climate disaster that opponents often paint. Actual emissions will be significantly lower given the non-trivial share of renewables that already power the network – although the exact proportion is likely less than what ardent supporters commonly claim. To the chagrin of decision-makers, there are no easy answers – just many shades of grey, as further exemplified by the ambiguous effect of Bitcoin mining on broader incentives for power generation. On the one hand, Bitcoin mining may encourage the build-out of sustainable power generation capacity by changing the long-term economics of renewable infrastructure projects. On the flipside, additional mining demand for low-cost and stable power can also lead to the re-commissioning of old, polluting power plants – or at least extending their economic lifetime. It is undoubtedly a double-edged sword.

We need more data, insights, and education to raise the level of public discourse. We need to discount the emotive rhetoric and start looking at facts, irrespective of personal opinions and preferences. We need to properly identify the consequences of potential (in)action, whether they are of financial, economic, regulatory, legal, social, environmental, or ethical nature. And above all, we need to promote a general willingness amongst stakeholders to engage more intensively with the arguments and concerns of the other side. Only then can the underlying issue be seriously addressed. ■

Meeting Crypto's Environmental Questions Head-On

Alexander Höptner
CEO
BitMEX

Sustainability is the challenge of our time. Bitcoin - and cryptocurrency in general - is the transformative technology of our time. So it's only natural that this industry faces tough questions about the environmental impact of the technology that enables our work. And we as industry leaders need to embrace this challenge head-on.

Crypto has not been lacking in creating waves, but its environmental impact is perhaps the issue that has caused the most controversy and consternation, and certainly in the last year. There are a couple of reasons behind this. We think understanding, and acknowledging them, is crucial to galvanizing the industry to respond positively.

First, we should be mindful that the debate about the utility of crypto is still raging, and those who are skeptics of the technology use its environmental impact as an opposing talking point. This criticism is usually ill-founded, verging on outright disingenuous. We work in this industry because we are confident about the fundamental utility of crypto. But not everyone feels this way, so we should engage constructively with those willing to do so in good faith.

Second, a key tenet of Bitcoin (and other cryptos) is decentralization. The fact that no one person, or group of people, controls the Bitcoin protocol is the key to its resilience and utility. This makes Bitcoin indestructible and radically inclusive at the same time. Yet, many of the proposed solutions to Bitcoin's environmental impact emanate from perceived centralized, or exclusive, groups like Michael Saylor and Elon Musk's Bitcoin Mining Council. Community members know that if they give power and influence to centralized actors, they could end up regretting it. Just look at the crypto world's love affair - then breakup - with Elon Musk earlier this year.

That being said, as leaders in the industry, it is up to us to make a strong commitment to invest in a future where crypto is ever more responsible. That's why BitMEX has recently committed to becoming carbon neutral, starting by offsetting the carbon caused by withdrawals from the platform. This is important because it allows us to mitigate the environmental impact of our current activity while we make more structural, long-lasting plans. We were glad to announce that we've invested $100,000 in reforestation, REDD+, and forest management projects around the world to offset carbon consumption not only for our Bitcoin transactions, but also the servers we run to power BitMEX. We'll continue to be vocal about challenging others in the industry to do the same.

But mitigating the environmental impact of our current activity is only a first step. As an innovative industry, we can and should do more than just offsetting carbon emissions. I see two ways to move forward from here.

First, we need to invest in education about the true environmental impact of Bitcoin and other cryptocurrencies, increasing access to reputable sources of information. Estimates of the size and severity of Bitcoin's carbon footprint vary widely, but we are in a position to lend our expertise to help settle the debate. As part of our education efforts, we should also broaden people's understanding of the true utility of Bitcoin and other crypto as revolutionary technologies that will improve lives. The more time we spend communicating about the macro benefits of crypto - economic empowerment, trustless transactions, DeFi, and Web 3.0 - the more people will see the true power of the technology, rather than thinking it's all about CryptoKitties.

Second, we should work with - and invest in - people and organizations who are committed to using innovation to lower cryptocurrency's structural environmental impact, but who will do so in a way that respects the fundamental utility of the technology and its highly decentralized nature. We will find our breakthrough by creating incentives for research and development, but also by letting blockchain technology be part of the solution.

Finally, it should be acknowledged that many of these solutions are in very early or theoretical stages. Our industry is still relatively nascent - and certainly when compared to the structures of traditional finance. But as responsible innovators, we need to move quickly, and be held accountable for what we say we will do.

There's a lot at stake here, and we owe it to ourselves, each other, and the coming generations to make progress. ■

Improving Transparency and Sustainability of Digital Assets

Wai Lum Kwok
Senior Executive Director – Authorisation
Abu Dhabi Global Market

Digital assets hold considerable potential for transforming financial services. They can broaden financial inclusion and facilitate cross-border trade flows, for example, through cheaper, faster alternative payment methods. They can also improve the resilience of the financial system, for example, by allowing greater transparency and certainty over trade settlement.

As with any industry and new technology in the past, digital assets must overcome concerns regarding sustainability to achieve this potential. One aspect is the amount of energy consumed by digital assets such as the Bitcoin network. As of 16 June 2021, the Cambridge Bitcoin Energy Consumption Index (CBECI) estimated that the annualized electricity consumption of the Bitcoin network was 92 terawatt-hours (TWh). This is equivalent to nearly 80% of the United Arab Emirates' (UAE) estimated electricity consumption for 2019 (119 TWh).

The significant energy drain of digital asset networks such as Bitcoin has raised questions over their long-term benefits to the economy. The ongoing growth in digital assets and mining demand for silicon chips is associated with a corresponding increase in e-waste, as mining hardware grows obsolete and is discarded.

Policy makers and ecosystem stakeholders should take active steps to understand the underlying drivers and risks in these environmental concerns. If not appropriately addressed, these issues will result in a higher environmental footprint and impact adoption of the technology.

Consensus mechanisms

The largest contributor to blockchain-based digital assets' environmental footprint is the need to expend significant computational power to have the right to commit a transaction to the blockchain for the network to confirm and provide global consensus. Achieving consensus on the state of the blockchain is essential to distributed systems like the blockchain.

Consensus mechanisms based on proof of work (PoW) can require particularly high levels of computing power and hence electricity consumption relative to other mechanisms. For example, the Bitcoin consensus mechanism requires multiple participants to independently solve a cryptographic algorithm. This is inherently energy inefficient because participants are duplicating work.

In contrast, other types of consensus mechanisms e.g. proof of stake (PoS), are more efficient from an environmental point of view. Unlike Bitcoin's PoW model, a single qualifying participant is randomly selected to determine consensus.

Data gaps

Evaluating the environmental impact of digital assets is challenging because estimation methodologies can differ significantly in approach. For example, the CBECI takes a bottom-up approach that estimates electricity consumption based on the types of hardware available for mining. In contrast, the Bitcoin Energy Consumption Index takes a top-down approach that estimates electricity consumption based on miner income.

Moreover, given the global nature of digital asset networks and the distribution of computing power, the energy mix and usage profile in a particular location may vary and have different environmental impact. Some mining pools may tap on renewable energy going forward, while others may continue to use more traditional grids running on fossil fuels to support the PoW consensus-based blockchains. The global disparity in energy mix makes it difficult to predict the future viability and sustainability of the PoW mechanism for blockchains.

This lack of well-founded data makes crafting effective policy challenging. The effectiveness of any policy intervention (such as restricting the use of PoW-based digital assets) will be difficult to assess if there is no data to measure and attribute the impact of the policy against other market forces in the digital asset ecosystem (such as a sustained drop in digital asset prices).

Potential steps forward

The ADGM has a strong interest in helping digital assets achieve their potential in a sustainable manner. In 2018, the ADGM introduced the first comprehensive regulatory framework in the MENA region for digital assets, including virtual assets, digital securities and stablecoins. In 2019, the ADGM took further measures to advance its Sustainable Finance Agenda, including the Abu Dhabi Sustainable Finance Declaration. Such measures have furthered the UAE's intent to strengthen its capacity to promote a green and inclusive economy and ensure the sustainability of the UAE's economic growth.

Based on the challenges outlined above, policy makers could consider exploring the following potential avenues for greater involvement:

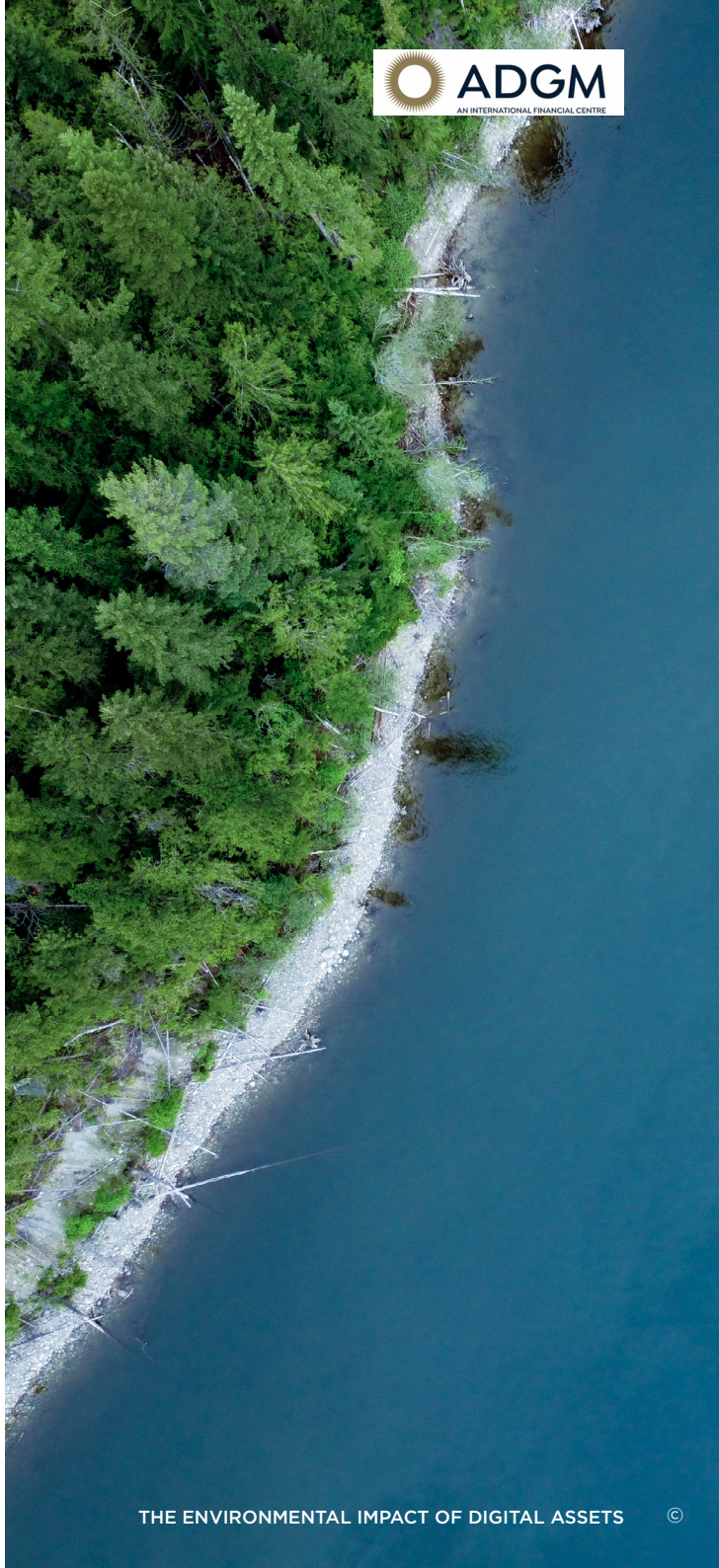
Move away from the use of energy-intensive consensus mechanisms for digital assets: While it may be challenging to determine the exact environmental impact of digital assets, it is quite clear that the energy consumption to operate their networks is significant. Policy makers could work together with industry stakeholders to develop technologies and encourage the use of more sustainable typologies for network consensus and resource requirements for distributed ledgers. Where warranted, we could consider means to moderate the use of such assets. This could include placing caps on holdings of PoW-based digital assets, placing additional prudential requirements on those holdings or imposing levies on transactions of such assets.

Improve transparency into digital asset energy usage: To better inform and calibrate policy interventions, policy makers could consider measures to encourage digital asset participants to disclose regular, timely and accurate data on computing power being expended on the blockchain network and provide location-specific distribution.

Discourage the use of non-transparent digital assets: Policy makers and industry stakeholders could consider measures to discourage the use of digital assets where participants do not publish information on energy consumption. Where possible, policy makers should leverage the inherent transparency of the blockchain to ensure that interventions are well targeted.

Environmental, social and governance (ESG) investors also have an important role to play. When making investment decisions, ESG investors should take into account the ESG impact of the specific digital assets under consideration, including whether participants in such assets have been sufficiently transparent about their technologies' energy use. This would augment policy interventions by imposing market discipline on digital assets.

These discussion points and proposals are intended to provide a starting point for further deliberation and dialogue amongst all participants on the relevant issues in order to find solutions to the environmental impact and sustainable use of digital assets. ■



The Foundations of Climate Leadership in the Crypto Economy

Faryar Shirzad
Chief Policy Officer
Coinbase

The climate crisis is a defining challenge of our time that will require action across the global financial system. And despite our industry's youth, we're not exempt. Climate risks threaten to reduce enthusiasm for crypto amongst otherwise loyal advocates and suppress capital investment by ESG-conscious stakeholders. This discourages innovation and, over time, poses risks for every crypto market participant committed to a DeFi future, from the smallest validator team to the largest cryptoasset service provider.

One of my first actions at Coinbase was to ask my colleagues to prioritize how to minimize crypto's environmental footprint. We aren't just looking at Coinbase (we directly use very little energy), but ecosystem-wide. There's much more work ahead, but unlike many legacy industries, crypto is actually well-positioned to lead on climate.

Here are some of our early thoughts on what we think climate leadership may look like for the crypto economy.

Foster candid discussion and gap-filling research to produce high-quality, universally accepted data and consistent, transparent disclosure on crypto's climate impacts

First, crypto companies must understand their climate impacts, which requires gathering, maintaining, and transparently disclosing high-quality data about their electricity consumption and energy mix. Crypto companies will then need to calculate their Scope 1-3 greenhouse gas (GHG) emissions. This will enable them to design mitigation portfolios and consider targets, such as net zero. They may also want to consider sustainable office operations, transportation modes, water intensity, work-from-home policies, and more.

Numerous ESG reporting and ratings frameworks exist to track and disclose climate (and other environmental) impacts, but none are particularly well-tailored for crypto. It may be time for our industry to partner with established leaders in carbon accounting and reporting to develop a bespoke, standardized framework for assessing and disclosing the climate impacts of crypto mining, trading, and holdings. A commitment to voluntary ESG reporting would align crypto firms with a large majority of the top 50 companies by revenue in the Fortune 100, which made climate, renewable energy, and/or environmental sustainability disclosures.

No matter the framework, crypto's climate disclosures must include the good with the bad. Bitcoin offers a case-in-point. Mining previously undertaken in China's Xinjiang province that relied on government-subsidized coal-fired generating facilities harmed the environment and public health. Mining powered by existing surplus hydroelectric capacity in Sichuan, by contrast, arguably had no direct warming impact. In other words, mining can be carbon intensive, but need not be. If customers, agency officials, or the press see our sustainability efforts as "greenwashing," the reputational damage and follow-on oversight consequences could be severe. Radical transparency is a part of crypto at its core. Our reporting mechanisms should be similarly transparent.

Forge industry coalitions and develop constructive relationships with policy makers to create aggressive but achievable environmental targets

The crypto community will need to use a robust and coordinated approach to having our voices heard in shaping future climate-related legislation and regulatory actions. To date, there have been at least five carbon pricing bills, six climate bank proposals, as well as numerous signals that mandatory U.S. Securities and Exchange Commission (SEC) climate disclosure rules are imminent. It's in our interest – and the interest of sound public policy – to participate in these processes so as to ensure that legislation is rooted in evidence–based data and reflects an understanding of crypto's underlying technology.

Crypto is developing quickly and gaining public acceptance as a valuable part of the economy; however, crypto will not enjoy the same long–off ramp to decrease climate impacts that traditional financial institutions and other legacy industries have enjoyed. We need to combat climate misinformation with demonstrable climate progress. As a result, where economically feasible, participants in the crypto economy should strive to lead our counterparts in tech and traditional finance. That means: investing in rigorous carbon footprinting, using that information to develop ambitious mitigation targets, achieving

those targets with high-quality nature-based carbon-removal projects (not merely offsets), and reporting our progress, at a minimum, to the Carbon Disclosure Project (CDP).

Leadership also means owning up to the net effects of crypto mining. Bitcoin, at least, is self-solving. Soon enough, the last Bitcoin ever to exist will be mined, reducing the network's overall energy consumption. But even where networks transition to less energetically demanding protocols, mining activities will continue to depend on an energy mix that may include fossil fuels for the foreseeable future. An industry-wide effort to pool resources and invest in expanded renewable energy projects, coupled with investments intended to facilitate the decommissioning of coal-fired generating plants, could significantly mitigate that residual carbon footprint.

Take bold action now

Progress towards decarbonizing crypto is not only possible, but feasible in the near term. The industry's first steps have already begun to take shape:

- **First**, major industry players should consider actions to green their own houses. These may include matching electricity needs with 100% renewable energy and decarbonizing their operations using high-quality carbon removal projects, amongst others.
- **Second**, we should partner with established leaders in carbon accounting and reporting to develop a realistic Scope 3 (value chain) carbon accounting methodology purpose-built for crypto, as well as a standardized ESG disclosure framework for crypto mining, trading, and holdings, so as to maximize our compliance with government regulatory mandates to come and the public's understanding of our true environmental impacts.
- **Third**, the industry should organize and pool data to facilitate the publication of an annual sustainability report for the crypto ecosystem, a first-of-its-kind, industry-wide status report validated by third-party academic and other auditors that cuts through the noise and misinformation to serve as a defining "single source of truth."
- **Fourth,** we should coordinate ecosystem-wide renewable energy purchases at scale – to offset mining operations, facilitate the decommissioning of coal-fired generating capacity, bring new solar and wind supply online, and develop creative private-governance mechanisms to incentivize all participants in the crypto economy to offset or abandon residual fossil fuel use.

With these and other steps, there will be no doubt that this ecosystem can rally together to take charge of our climate future. ■

The Development of Sustainable Consensus Mechanisms

Increasingly within the crypto industry, ESG and sustainability are at the forefront of many discussions. These opposing viewpoints centre around the differing opinions regarding the proof of work (PoW) and proof of stake (PoS) consensus mechanisms. The purpose of these systems is to offer users a fault-tolerant mechanism that provides security, fairness, and efficiency. However, it is essential that the adopting new technologies meet functional and social needs. It is crucial that crypto businesses support mechanisms that are energy efficient and will lead to a greener future.

As of late, it has become popular to regard PoW as an inferior technology that has longer processing times and requires higher energy consumption. In particular, the use of non-renewable energy sources to power Bitcoin mining has called into question the sustainability of the mechanism in an increasingly eco-friendly world.

Steps have been taken to address these issues, such as the recent formation of the Bitcoin Mining Council in North America. This council aims to promote energy usage transparency and accelerate sustainability initiatives worldwide. Initiatives like this will only further increase the proportion of renewable energy used to power mining activity. According to the Bitcoin Mining Network Report published by CoinShares in 2019, approximately 73% of energy currently used to power mining activity is from renewable energy sources. This is not to say that this will always be the case. As electricity is the main cost for miners, they tend to cluster in regions with extremely low energy prices such as Southwest China and the Pacific Northwest. These areas are dominated by cheap and underutilized hydropower. To keep miners in regions that rely on renewable energy, costs must be kept low. This makes PoW susceptible to fluctuating renewable energy consumption. The same report published by CoinShares also found an increased migration of miners into coal-dominated regions like Kazakhstan and Texas.

Environmental sustainability is one of Coinrule's core values. As such, we have decided not to hold currencies that run on PoW mechanisms, such as Bitcoin, as our base currency, as there is not enough assurance to guarantee that these currencies are 'green'. Furthermore, arguments against PoW are becoming increasingly persuasive as currencies which use PoS position themselves as greener and more sustainable.

A PoS miner is limited to mining a percentage of transactions that reflects their ownership stake. This means the computational complexity and therefore energy consumption of PoS is radically lower than PoW.

Looking forward, it is hard to fully support PoW models without considering the high energy consumption associated with mining. We believe that despite a promising renewable energy mix for PoW mechanisms, PoS offers a more sustainable mechanism for the future. This is not to disregard PoW assets like Bitcoin, but to suggest there are better, more efficient assets that are more suited to large scale adoption. ■

Gabriele Musella
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DIGITAL ASSETS' ROLE IN ESG

Don’t Throw the Digital Baby Out With the Climate Bathwater

Simon Mills
Associate
Z/Yen

The shear idiocy of human beings is in danger of losing its capacity to shock. Faced with an existential threat to their continued species survival, rather than pouring all their efforts into attempts to reverse or even halt anthropogenic climate change, some still cling to magical thinking and hope we can persevere with inherited models of production and consumption as we coast toward disaster.

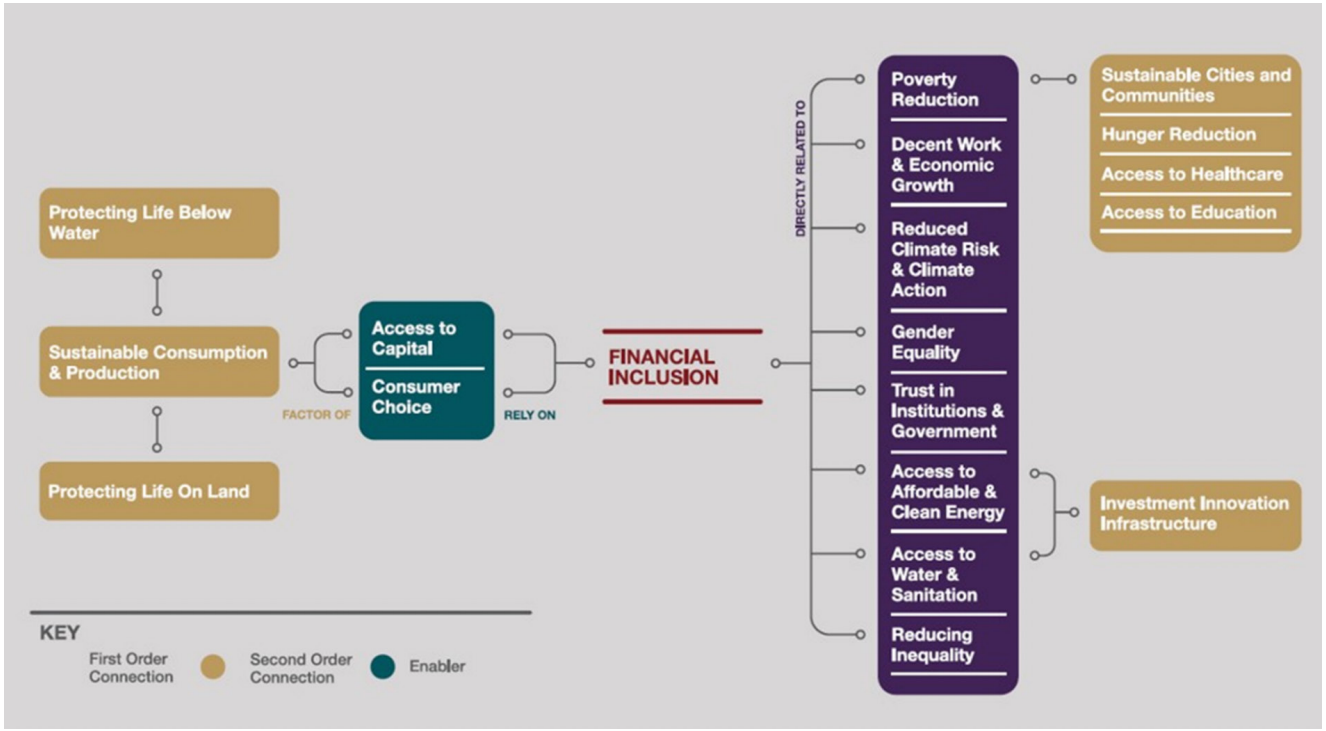
Cryptoassets, whether intangible coins or pictures of cats, now generate more than 90.2 million metric tons of CO2 per year and consume more energy than small nations such as Malaysia or Sweden (around 110TWh per year). That said, the industry and policy makers are addressing this issue. Countries such as China are beginning to push regulation of mining, causing seismic readjustment in the value of Bitcoin. In response some platforms, such as Ethereum (which is the basis for most NFTs), have plans to transition to a proof of stake system which will reduce the energy consumption of Ethereum-based cryptos and blockchains by an estimated 99.5%.

However, tempting as it is to roll one’s eyes at the perceived folly of people willing to speculatively trade Bitcoin, it is important not to lump all of fintech into this category.

Fintech – *“the integration of technology into offerings by financial services companies in order to improve their use and delivery to consumers”* (Investopedia) - offers a host of benefits to sustainability and the fight against climate change.

Financial inclusion – banking the unbanked (through smartphone networks), giving official identity (and agency) to the billions who have none, providing insurance for farmers in developing nations and crowdsourcing finance for small businesses – is just one area that has caught the attention of forward thinking international financial centres. An excellent example can be found in Labuan IFBC in Malaysia, which is assessing how fintech enabled financial inclusion can be used to deliver the UN Sustainable Development Goals.

Smart contracts are another technology delivering the (green) goods – from simplifying the contracts for green bonds, to providing supporting infrastructure on green loans and providing chain of custody and provenance for responsible supply chains. Distributed ledgers, with their ability to validate, record, and track transactions across a network of decentralized computer systems, are revolutionizing the banking and insurance sectors, and allowing the creation of a host of new products and services that can support the transition of a low carbon economy.



Source: ***International Financial Centres: Facilitating Financial Inclusion Via Digitalization (Z/Yen 2021)***

'Digital fairy dust' is not a universal panacea. Significant challenges remain if we are to use fintech to restructure our financial systems to provide support in our fight for biodiversity, social justice, and climate change. Goodness knows it needs it: COVID-19 dealt a hammer blow to the world economy, setting back progress on the Sustainable Development Goals by years. Fintech offers a host of benefits which could enable low-carbon green growth, enabling developing economies to bridge this gap and deliver stable, equitable growth for their citizens.

However, though the rise of fintech may mean that the physical constraints of infrastructure and systems have been removed as an obstacle to trade, significant legislative and policy barriers remain and are likely to increase.

Conflation of fintech with cryptocurrency's public image is not helpful. Development economics and financial technology are complex topics. Many policy makers are ill-versed in the fundamentals of financial services and easily swayed by public opinion.

The merging of fintech and green finance represents an enormous opportunity to square the circle in the creation of lucrative new markets and the delivery of public goods. However, to unlock this potential, policy makers and the public must be brought on side. To address this, financial centres should work together to frame the right questions for policy makers, regulators and financial service providers on the implications of embedding fintech into financial systems and how this can deliver on sustainability, ESG, and climate action.■

The Necessity of Ambition: DLT and the Growth of Sustainable Finance

Todd McDonald
Co-Founder & Chief Product Officer
R3

As summer in the northern hemisphere nears its end, many are assessing the impact of climate change on a season that brought extreme heat and devastating weather events across the world. With extreme weather becoming all too commonplace, public concern, government action, and private enterprise are converging to produce a surge of interest in sustainable finance.

Funding a more sustainable future will require herculean effort in relatively short order. A joint report from Boston Consulting Group (BCG) and the Global Financial Markets Authority (GFMA) in 2020 estimated that $100-150 trillion of investment will be required globally to transition to a low carbon economy. Hoping to boost this effort, in July, the European Union (EU) finalized ambitious action plans to reduce barriers to funding climate goals which they estimate will require over €300 billion annually, or 2.3% of GDP.

Financing of this level, and for an issue this important, will require concerted effort from all stakeholders, public and private. The digital financial industry can play a crucial role in supporting the growth of sustainable finance by reducing barriers and injecting pace into an asset class that must scale quickly to meet public and climate needs. As demand grows, so will the need for digitization, and our industry can help ensure sustainable finance is transparent, efficient, and effective in supporting the global effort to meet ambitious sustainability targets.

Growth of green

The BCG/GFMA report further estimated that around 21% of the overall financing needed globally would come in the form of bonds, commonly referred to as "green" or "KPI-linked" bonds. Generally speaking, green bonds are defined as such if they support a broad range of sustainable investment. On the other hand, KPI-linked bonds are tied directly to performance metrics (for example, emissions reduction in a "transitioning" industry like energy production). Both green and KPI-linked bonds are well suited for digital financial innovation as their issuance, maintenance, and redemption can be digitized in order to link them more effectively to their sustainability aims or performance metrics.

Demand for green and KPI-linked bonds has grown significantly in recent years, although still only representing around 0.4% of the global bond market and only 4% of overall corporate bond issuance in the EU. (Despite disruption in the market due to COVID-19, global green bond issuance still grew, albeit at a slower rate, and this rate is expected to tick up again as recovery progresses.) This is still far short of the financing needed to wholly fund sustainable development.

Moreover, growth in the green bond market has been accompanied with caution amid concerns about greenwashing, a term that reflects the lack of standardized taxonomy to ensure funds are directed precisely toward their stated aim. Currently, there are no global standards as to what constitutes a green bond or any appropriate metrics. This certainly invites risks that some bond issuers will want to capitalize on an additional avenue to raise cash, with little oversight or accountability to deliver on investor expectations.

Another challenge for the ability of the green bond market to scale at pace is reliance on burdensome administration. Most bond markets, not just the green ones, depend on manual processes at some point during the asset life cycle. Paper-based or non-automated systems are a well-known barrier in the industry and, for green and KPI-linked bonds especially, they hamper not only scalability, but also the reporting of results, an essential feature of green and KPI-linked bonds.

This has created legitimate concern amongst investors as to assurance that funding will produce the marketed sustainable outcomes. In fact, this is what the EU seeks to address in their recent publication of green bond standards. Digital financial services would increase accountability and reduce barriers over the lifecycle of a green bond, making them more attractive as investments and spurring the gargantuan demand growth needed to support sustainability imperatives.

Digital finance for sustainable finance

Within digital finance, distributed ledger products

offer many potential efficiencies for the bond market, which the World Economic Forum highlighted includes establishing a single source of truth for bond terms, automating settlement, as well as coupon and repayment instructions. From R3's perspective, much of this potential is beginning to come to life as our industry matures. From our involvement in a wide range of digital assets projects, including SIX's Digital Exchange we've seen how offering atomic settlement and scalability that meets the standards of regulated financial industries can unlock tremendous value in the digital financial ecosystem. In debt markets, we're excited about the potential for partners like Agora to automate the asset lifecycle for corporate bonds.

The unique benefits of distributed ledgers converge neatly with the opportunities and challenges of green and KPI-linked bonds and make some blockchains well suited to mitigate concerns about greenwashing. Specifically, distributed ledger-backed green or KPI-linked bonds can provide transparency and accountability by enabling automated and immutable KPI progress tracking that in turn provides assurance that funds are being used for their stated purpose. Confidence in this asset class and its attractiveness could be even further advanced through the application of interest rate penalties when benchmarks are not met, a unique opportunity offered by green or KPI-linked bond issuance on a distributed ledger.

A distributed ledger also offers potential upside to reducing administrative costs, which would further bolster the market. However, analysis of the suitability of distributed ledgers should not stop at the financial products themselves. Rather, it must extend to the underlying technology, as well. To ensure distributed ledger solutions are not undermining the aim of a sustainable financial product, digital financial solutions should not rely on energy-intensive data processing and storage methods and must also provide sufficient scalability for the potential size of the market. Investors should seek assurance of these aspects to reduce the potential for greenwashing all the way down the stack.

At R3, we've seen how innovation in the bond market can unlock hoped-for efficiencies utilizing peer-to-peer data processing that provides appropriate scalability and does not impede the sustainability commitments of firms. Solutions that rely on proof of work consensus mechanisms, and therefore outsized energy consumption due to mining requirements may not be aligned with the intention of sustainable investors. For this reason, solution providers should be forthcoming about disclosing their energy footprint as it relates to all aspects of the asset lifecycle.

It is important to note the technological benefits of digital finance and distributed ledgers should not be viewed as a panacea to challenges in sustainable finance, which faces other political and economic headwinds. However, sustainable finance has the potential to be a truly digitally native industry and is a crucial way our industry can contribute to the global imperative of transitioning to a carbon-neutral future. Leveraging distributed ledgers to make the green bond market more transparent, efficient, and accountable will only increase investor confidence, hastening the ability of the market to scale in accordance with the needs of corporations and governments to meet their climate goals. ■

Digital Currencies and ESG: Strange Bedfellows?

BEQUANT

Martha Reyes
Head of Research
Bequant

ESG and digital assets have more in common than meets the eye. At first, they both faced rejection by incumbents and investors. They then gained popularity and finally recognition by politicians and regulators, having been nudged by public pressure. They are relatively new asset classes coming into their own, with key issues to resolve.

They also attract individuals with strong convictions. Today, politicians, and even some governments, are starting to embrace digital currencies and blockchain technology, realizing its potential and popularity amongst voters. Some of the main incumbents, financial institutions, have done a complete about face from outright rejection to providing access to the new technology for their clients.

Digital assets and DeFi may become more mainstream as more people understand the potential benefits, both social and financial. The idea that ESG has financial implications and can lead to better investment returns, in addition to the social and environmental goals, is now firmly entrenched. Studies show that investors can beat the index all while doing good for the planet and society. As a result, ESG investing has been expanding at 30% per annum over the last five years, on the back of strong client demand. Bloomberg projects assets under management (AUM) could climb to $50 trillion +, over a third of total investments.

Blockchain technology has the potential to help address some ESG goals. It should be nurtured by those espousing ethical considerations, while accepting that meeting ESG criteria is a gradual process, as has been the case in traditional assets.

The digital asset industry's role

Given the importance of the issues, global awareness and the size of the addressable market, the digital asset industry would advance its adoption and sustainability if it worked towards transparency and self-reporting, engaging with the ratings agencies and data providers.

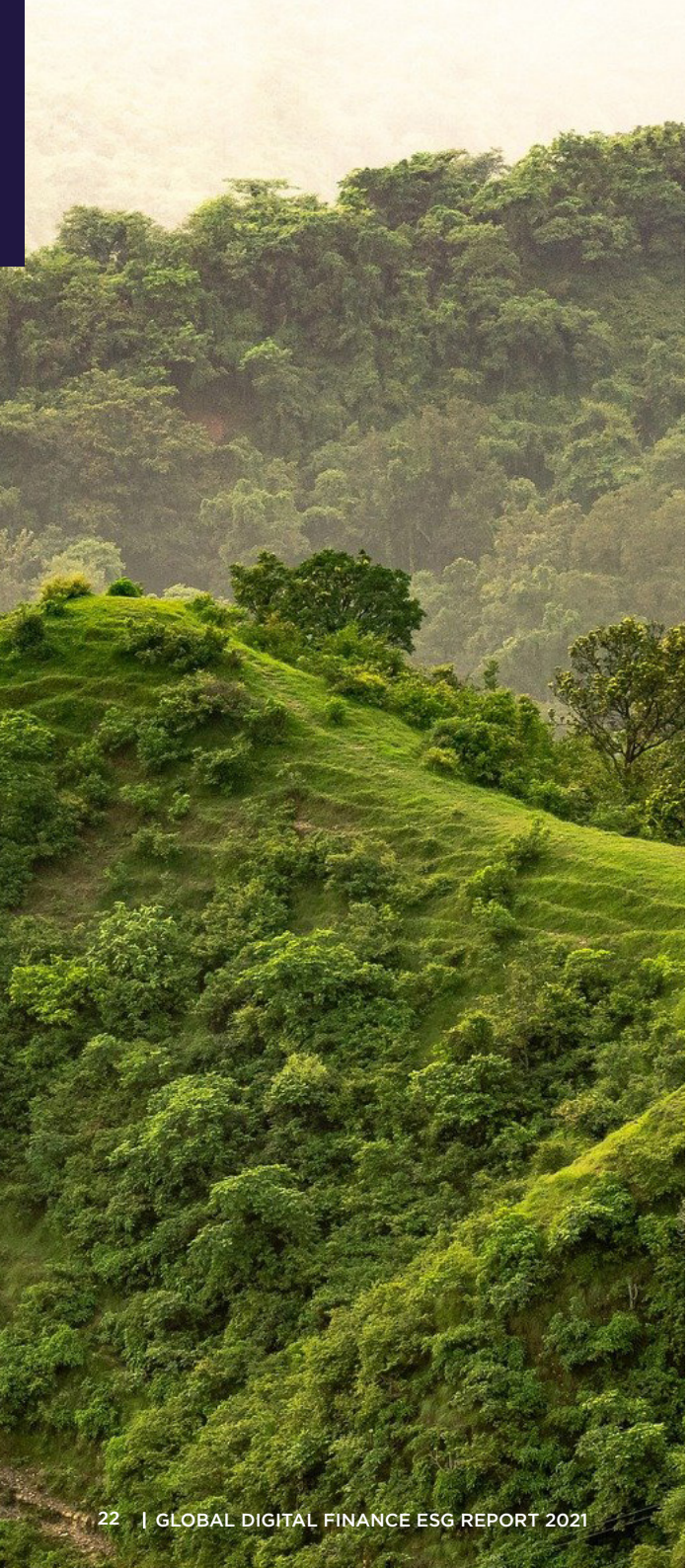
The decentralized nature of many protocols and the sheer number of projects in existence make this a challenge. It could also add extra costs and burdens to a nascent sector that may be already dealing with stricter KYC and tax reporting requirements, hurting start-ups and benefiting larger projects. There is a balance to be struck and the process will take time.

More than just an E

There has been so much written about the supposed conflict between ESG and digital assets. It helps to take a step back and define what is meant by ESG investing as it can mean different things to different people. In particular, ESG goes beyond climate challenges, and also addresses social impact and governance concerns. The overwhelming ESG concern amongst investors is climate risk, especially post-Paris Agreement (2015) and here is where crypto has faced the most backlash. On the energy front, only Bitcoin and Ethereum, as proof of work protocols, faced scrutiny. The community has responded well, with great strides made in a short period of time in terms of transparency and reporting. However, with the COVID-19 pandemic, there has been more of an emphasis on inequality and sustainable finance, both issues where digital assets have bragging rights. Less attention has been placed on the social inclusion and equality aspects of the digital industry. This will come as awareness grows and here is where the industry can shine.

Global remittances is the area that has received the most limelight, with billions to be shaved off transfer fees across the world. The World Bank currently suggests that fees are between 5-7% of transactions, a substantial amount given remittances are expected to hit almost $1 trillion in five years (Allied Market research). Given the security, faster transaction speeds and absence of banking account requirements, it is easy to see why we are seeing high adoption rates in the case of remittances.

Another powerful argument is that cryptocurrencies are used as a store of value. Though not universally relevant, it has been vital to many people in countries with failed economic models, namely Argentina, looking to preserve their wealth.



The technology has aided organizations in countries with repressive governments to find ways to source funding, Russia being a case in hand. Stablecoins have been used to transfer funds to those who do not have access to banking services. In the future, if technology extends to property rights, that would be a huge advancement in the developing world, where the rule of law can be weak and an important factor in economic development.

Perhaps in the developed world, some of the above issues may seem distant. As inequality has increased even in wealthier countries, the impact can be felt closer to home, where younger generations have a low net worth versus previous ones due to stagnant wages and runaway asset prices. DeFi has provided individuals with better rates on their savings, eliminated banking fees, and offered the opportunity to invest in fractionalized art or real estate, areas that were traditionally the preserve of the wealthy.

Governance is perhaps the Achilles heel of digital assets. This ranges from risks such as hacking and rug pulls to a lack of diversity within the community. That said, these risks are hardly exclusive to crypto. The development of DeFi and Decentralized Autonomous Organizations (DAOs) has posed new questions for us on governance, with degrees of centralization and the control of keys being debated across the community. The ability to choose the direction of a project through governance tokens opens new possibilities for governance and a new meaning to the term "democratized finance". The shape that this will take, and the impact on the wider financial system is still not clear.

Despite the risks, demand will likely continue to expand as people become cognizant of the benefits of blockchain technology across many segments. The recent amendment debate in the US Congress has probably done a lot to ratchet up awareness even more. We have seen adoption of innovative technology in other instances where risks have not necessarily deterred uptake. As we see the industry mature, it will be able to focus on improving its overall ESG reporting standards and cope with additional regulatory burdens or taxation, drawing in more participants by doing so. ■

Tracing Funds and Impact: Digital Assets and Climate Finance

Blake Goud
CEO
RFI Foundation

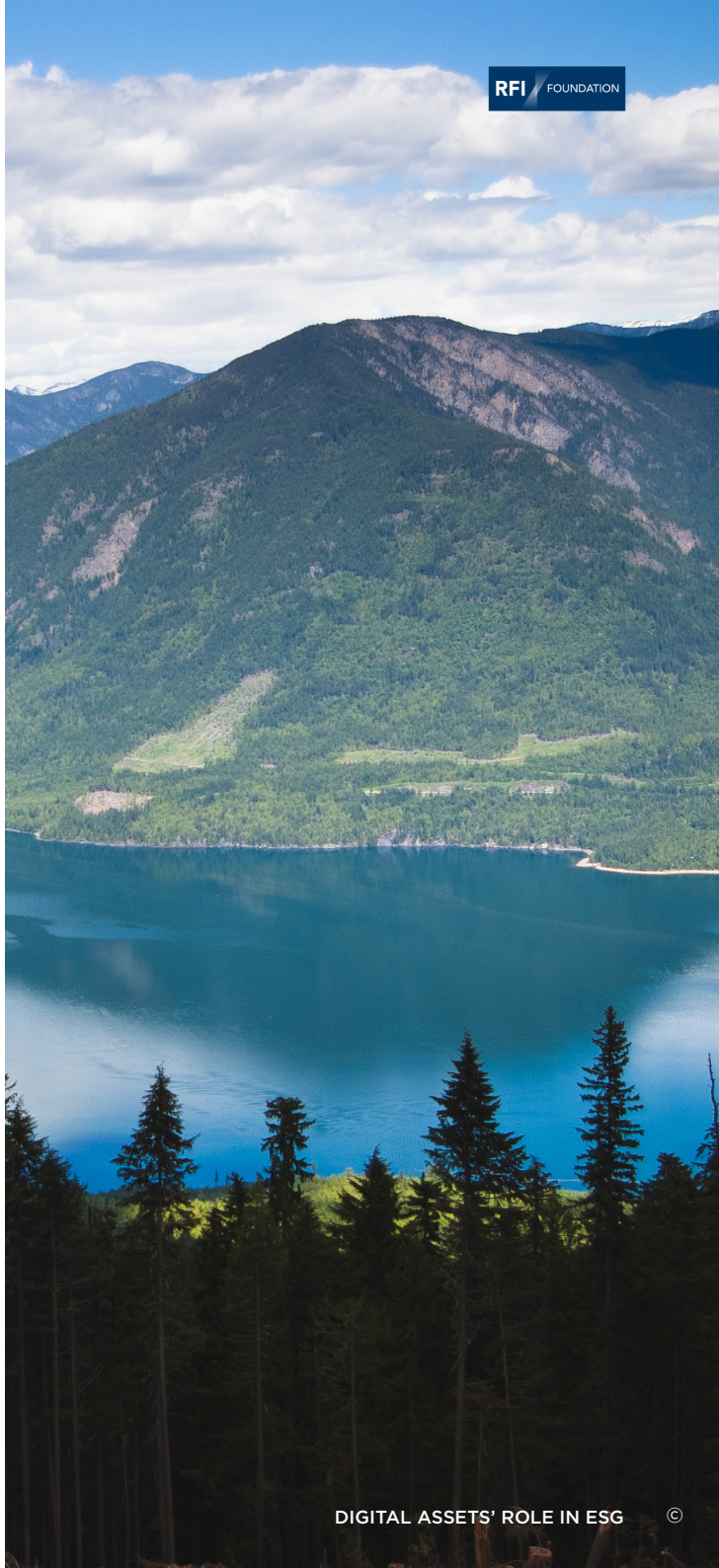
As digital assets grow to become a more important part of the financial sector, it will be important that they bring something new besides just 'digitalization' of the status quo. At COP16 in 2010, developed countries pledged to mobilize $100 billion in climate finance per year by 2020. A recent status update based on data through 2018 concluded that "climate finance counting towards the $100 billion had been on an upward trajectory, *but still falling short of the $100 billion per year by 2020 target.*"

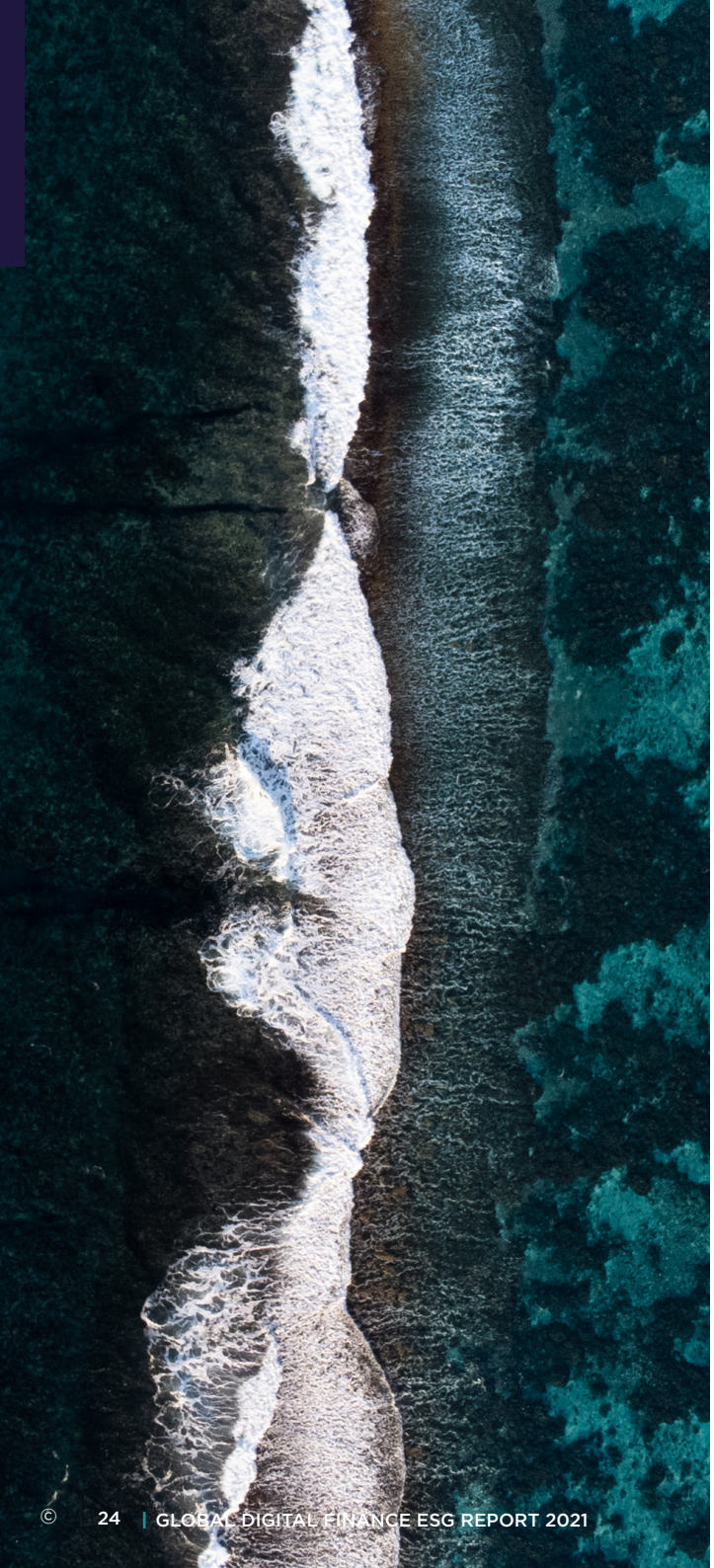
The Independent Expert Group on Climate Finance, which wrote the status report, reiterated that the commitment from developed countries should be a floor and not a ceiling. Even so, it remains difficult to track how much funding has been provided, let alone how much impact it has created. There remains disagreement about what types of funding should be counted towards this pledge, and how much has been mobilized. The G7, in its Communique released after its Carbis Bay Summit in 2021, reiterated the commitment to $100 billion per year and extended the time frame through 2025, but did not increase its annual commitment.

On the allocation side, although there have been efforts to speed up disbursement, official sources of climate finance, such as the Green Climate Fund (GCF), remain torn between capabilities of project partners and stringent due diligence requirements for donors. The GCF disbursed a record of $2 billion in 2020, an amount that is unlikely to increase to the realistic funding needed to address climate mitigation and adaptation needs for developing countries.

Digital assets could provide a way to increase flows of climate finance while improving transparency about how the funds are being used. For example, donor countries could introduce tracking of funding allocation by linking disbursements with digital traceability on blockchain, whether these funds are disbursed through international institutions like the GCF, through direct bilateral efforts, or through development financial institutions.

The issue today that is holding back development is not a lack of funding. The crucial challenge is the information asymmetries to track supply and demand, and the ability to use finance for nature-based solutions. Unlike direct greenhouse gas mitigation projects, such as renewable energy projects where tracking project impacts is relatively straightforward, there is still an





acute shortage of data to demonstrate the degree to which nature-based projects are bankable.

In the wake of the COVID-19 pandemic, the world saw climate change rise on the global agenda. The far-reaching and severe impacts of the current public health crisis raises our awareness of how pervasive global issues can be in everyone's lives.

Climate change, which is currently affecting regions of the world that is home to 85% of the global population, can no longer be dismissed as a far-off problem as it had been previously. The problems we are already facing as a result of climate change are acute and growing exponentially.

The risks will continue to increase so long as climate change mitigation is slowed by the ability to take financing from willing investors and donors, and use it in a way that makes a difference. The current ways of connecting sources and uses of climate finance do not show indications of being scalable or efficient enough, and fall short in their ability to track different sources of public and private funds.

Technology such as blockchain, which underpins digital assets, provides some of the key characteristics needed to help build traceability into investment flows for climate mitigation. Currently, these efforts have largely been demonstration projects, or confined to limited investment flows. The digital asset sector has a role to play, but they cannot do it alone.

Digital assets have the potential to contribute to improving the efficiency of fund mobilization and distribution for climate finance. They can enable us to know where funds are available, where they are needed, and how to unlock flows from one place to another more smoothly and quickly.

Public funding is a catalyst for a lot of climate investment, whether through direct grants or loans, blending finance with private investors, or projects initiated by development financial institutions. These institutions can be catalysts for investing more in climate finance and tracking how much is mobilized every year. Incorporating blockchain and digital assets in that process can enable a common understanding and measurement of where committed flows are coming from and what they're funding, helping us to up the volume of climate finance going to emerging and developing countries. ■

The Role of Emerging Tech in ESG and Sustainable Finance

Michael Durrie
Chief Content Officer
The Digital Economist

The current pandemic and its socio-economic impacts have laid bare many different vulnerabilities inherent in world economies. Above all, the crisis has exacerbated scarcities of essential goods and economic inequalities. Yet none of these flaws are new. In fact, economies of scarcity have always been vulnerable to shock events. In addition, competition for limited resources has led to war throughout history – and up to this very day. This does not have to be the case. With digital technologies, we are now able to produce unlimited resources of many kinds, and make them universally available.

For this to happen, the global economy must transition to digital-first systems with a marked separation from physical resources. Digital technologies can support a transition to greater accountability and adherence to environmental and governance considerations, commitments as well as sustainable, equitable, and inclusive finance.

"If digital abundance can be separated from physical scarcity, it may allow both conservation and regeneration of the physical resources and enable humans to unleash their spirits in the virtual world: health systems, financial systems, energy systems, food systems, supply chains, you name it," says Navroop Sahdev, Founder and CEO of the global impact organization The Digital Economist. "It's about ending the resource war."

Many of the digital tools required to achieve this already exist, yet still need more widespread implementation and societal acceptance to be effective. Only then will we see the creation of abundance on a scale that would enable a transition from a global economy of scarcity to one of plenty.

More than crypto

In terms of what emerging tech can do to create an economy of abundance, sustainability and equity decoupled from physical scarcity of resources, we are only at the beginning. Distributed ledger technology (DLT), including blockchain, has the potential to support work toward the UN Sustainable Development Goals (SDGs) on an unprecedented scale. DLT solutions are already in place across multiple industries, providing a single source of truth that is incorruptible by the interests of a central authority. This enables reliable accountability based on tracking and tracing, rendering it very nearly impossible for shady players to "game" the system. Universal corporate and government standards for sustainability, which have been slow to develop or even nonexistent over the past 40 years, could be established.

In terms of climate change reduction and mitigation, this means moving past the constraints of traditional unit economics (carbon cap-and-trade solutions, auctions) to foster trust through technology like DLT, but also including big data, machine learning and wide-scale deployment of Internet of Things (IoT) tech (such as sensors, cameras, satellite data etc.). Such initiatives are within reach and more urgently needed than ever in light of the currently fragmented climate action community and the absence of accountability regarding climate pledges.

Surveillance capitalism: A one-way street?

In a time of "surveillance capitalism," in which online data capture has become more important for profitability and growth than the traditional provision of goods and services, it is time to leverage data in the service of SDGs and financial equity rather than corporate shareholder value alone. This can be achieved, in part, by returning data ownership to the individuals who generate those data.

Those who create value through their online behavior have a right to take part in the resulting revenue stream. In addition, by using current and future data surveillance technologies to record the behavior of corporations and governments, it is possible to automatically account and report on their contributions to improving sustainability and resilience for all stakeholders. In other words: let's make surveillance capitalism a two-way street.

In practice, this can take on forms like the Open Earth Foundation, a non-profit organization that has

launched the Open Climate project. It aims to rectify a major accounting and accountability discrepancy: that climate risk is not fully accounted for when it comes to valuations, accounting, indexing and investing. Distorted incentives continue to drive an extractive approach to our planet's resources and ecosystem. The Open Climate project employs open innovation and emerging tech to establish a nested approach and link actions and incentives of regional and global players to climate-related outcomes.

Martin Wainstein, founder of both the Open Earth Foundation and the Yale Open Innovation Lab describes two overarching objectives: "Restoring trust and accountability through an open global climate accounting system with consensus on the state of the planet and large-scale capital deployment into securitized climate action projects that produce job creation opportunities for local communities, facilitated by decentralized finance technology and automation."

Wainstein also maintains that the UN Framework Convention on Climate Change (UNFCCC) needs significantly more support and collaboration on digital innovation. "We have more data processing technology on our mobile phones than in the current technology we have to manage global climate accounting from countries," says Wainstein.

The digital economy

The US Green New Deal is a strong indication of growing awareness that a return to business as usual in the aftermath of the COVID-19 crisis is not an option. We need a reset on a global scale to take on the challenges to come, a new digital economy that reflects a system's perspective that sees humankind as part of nature. Ultimately, humankind needs the planet – the planet does not need us. The World Economic Forum has defined this imperative as the Great Reset of capitalism.

Elements of this reset include digital trust, digital abundance, digital currencies and digital art, as well as fractional digital ownership in the form of tokenization. DLT and blockchain will play a major role, which raises energy consumption issues, as mentioned above. However, with the transition to lower-energy consensus processes and increased renewable energy usage, these can be overcome. As serious as concerns about any technology that consumes excessive electricity are, this challenge is a speed bump, not a brick wall. The need to move toward mass, mainstream adoption is more urgent than ever to realize the financial inclusion, transparency and efficiency gain these technologies can deliver. ■

Bringing Programmable Transparency to Reforestation

Eva Oberholzer
Chief Growth Officer
Cardano Foundation

Planting trees is one of the cheapest, most intuitive ways to capture carbon, which is why an increasing number of both institutional and commercial organizations have established reforestation initiatives. Last year, the World Economic Forum launched their Trillion Tree Campaign. A walk through any supermarket in the developed world will reveal a plethora of consumer products, from shampoo to beer, that pledge to plant trees upon purchase.

Yet, despite this progress, one issue has continually undermined the promise of reforestation: transparency.

Currently, there is no standardized method for verifying crucial information about the trees in reforestation campaigns. Data blanks proliferate around even basic information such as which species of tree has been planted, where and by whom. Even rarer is the confirmation that the trees planted grow beyond seeds; that they are not prematurely lost to logging or disease; and that the carbon sequestered is of a meaningful amount.

The result is that a worrying number of tree-planting initiatives have been exposed as greenwashing schemes with a negligible environmental impact. This has caused widespread mistrust and woeful underfunding of reforestation initiatives.

Veritree-Cardano Foundation partnership

The Cardano Foundation seeks to highlight the power of blockchain technology for good. By enabling transparency and traceability in the reforestation industry the Foundation is contributing to environmental sustainability. Cardano is already popularized as a green blockchain due to our energy efficient proof of stake model, and as a mission-driven blockchain committed to building a fairer, more transparent world.

Cardano's design infrastructure enables the principle of programmable transparency: allowing third parties to verify the identity of the value chain actors involved in transactions, data collection, and review processes. This enables the authentication of secure records.

Accordingly, we have partnered with technology company Veritree, to combine our blockchain technology with state-of-the-art tree-tracking technology, which provides irrefutable, entirely transparent, on-chain proof that the trees have been planted, verified, and claimed.

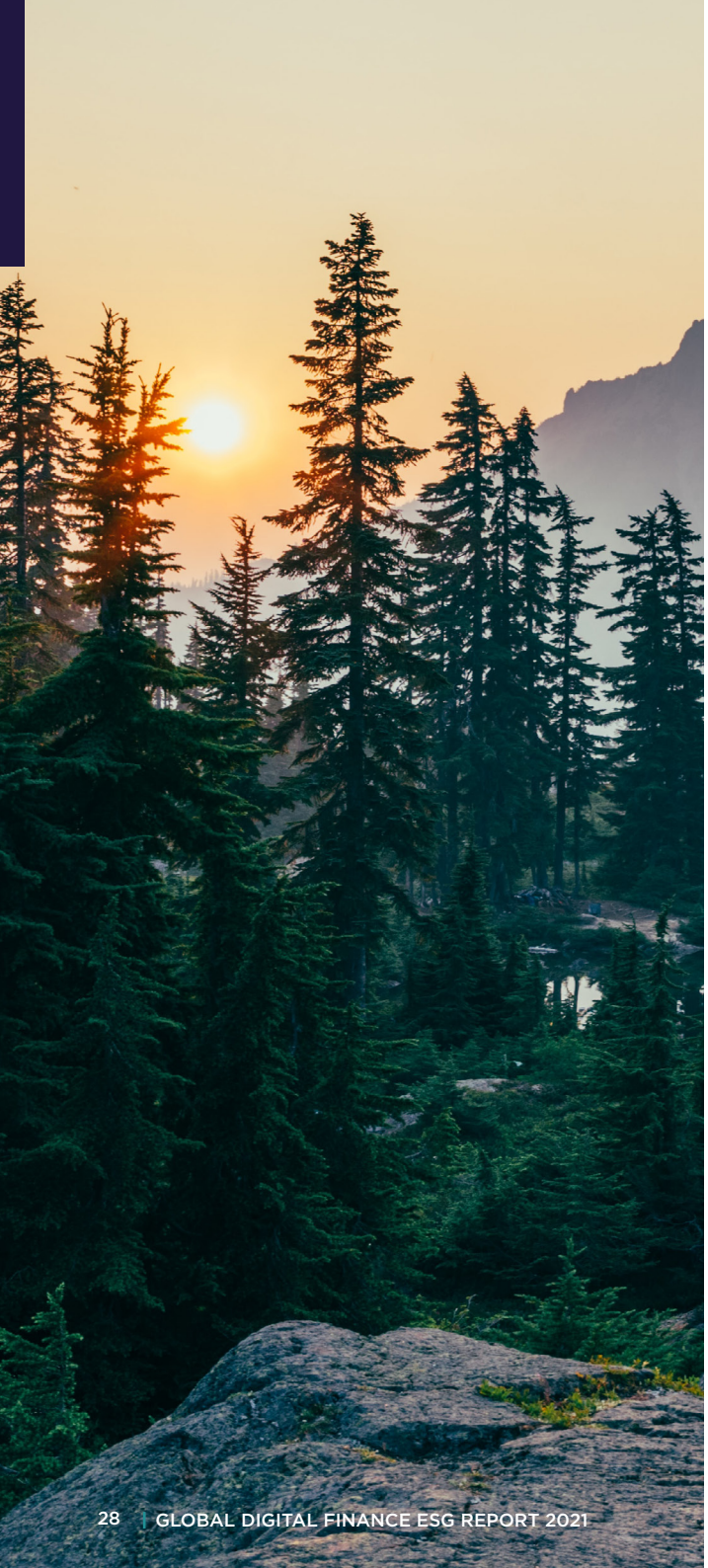
During the 2021 Cardano Summit, we launched the first Cardano Global Impact Challenge to plant 1 million trees in the #CardanoForest in Madagascar and potentially, depending on donation volume, in Kenya and Southeast Asia.

Members of our global community are invited to donate our native token ADA to Veritree in exchange for Veritree utility tokens, or "NFTrees", which will be redeemable for Tree Planting Certificate NFTs once Veritree plants the trees in 2022. In the 12 days since launching the challenge, 321,000 trees have been donated by Cardano ecosystem partners, stakepool operators, and individual ADA holders.

Collecting data from the field

The Veritree technology stack includes proprietary data collection and aggregation tools, used to collect and monitor the work at planting sites. The data will all be hashed and stored on the Cardano blockchain. First, the planting area is registered on the system, creating a permanent location for all data coming out of that area. Planting is done in sessions of 5,000–15,000 trees, and trees are counted, photographed and submitted. Planting sessions are tagged to the planting site and stored in a repository. The NFTrees allow donors access to this repository and the ability to track their trees, observing where and when they were planted, and viewing attributes such as height, size, amount of carbon sequestered, and impact created.

As Veritree submits planting updates from the field, Cardano will announce Redemption Periods during which the NFTrees can be redeemed for the Digital Land Restoration Certificate, a piece of limited edition



digital art, and in some cases naming rights granted to higher donors.

Two leading Cardano community digital artists will be designing the NFT art collection for this first edition Initial Tree Offering: Stellar Hood and Cardano Trees NFT. Cardano Trees are fully on-chain evolutive art trees that live and grow on the Cardano blockchain. Stellar Hood provides interactive depictions of nearby galaxies.

The Cardano Veritree NFTrees puts planting in the hands of the donor and will drive adoption through the sense of intimacy and ownership of the positive environmental impact it fosters.

The future of programmable transparency

The #CardanoForest was not Cardano's first programmable transparency collaboration.

Earlier this year we partnered with Scantrust to provide a unique supply chain traceability and anti-counterfeit solution to Baia's Wine, a biodynamic family-owned micro-vineyard nestled in the Imereti region in Western Georgia. We applied Scantrust's secure QR codes to Baia's Wine bottles and linked them to various data points. This includes the wines' supply chain and production history, for example, the date and location of crushing and fermentation. Those data points are subsequently anchored to the Cardano blockchain using transactional metadata for a complete supply chain record.

Not only does this prevent counterfeiting, but also it allows Baia's Wine to distinguish themselves from competitors by digitally communicating their product's intricate and traditional process.

Together, Baia's Wine and the #CardanoForest illustrate the power of programmable transparency to bring verifiability and trustworthiness to initiatives around the world, and to bring individuals closer to their impact. As more investors seek to support and confirm the credentials of sustainable enterprises, the Cardano blockchain aims to provide the authentication services to make this possible. ■

Digital Securities: Democratizing and Disrupting Financial Markets

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There is much talk around digital securities and how they will disrupt financial services and democratize capital markets for everyone. But what are the drivers behind this and how will the changes heralded be brought about?

The old versus the new

First, it is important to understand the difference between traditional securities and their purely digital counterparts.

If you look at how securities exchanges have traditionally operated, they typically trade limited hours a day and largely focus on local markets, targeting local brokers or investors. Trading is regulated and electronic, but when it comes to post-trade, the process is complex and inefficient, involving any number of intermediaries who all are frequently forced to reconcile information with each other.

With the advent of blockchain technology and cryptocurrencies, the market infrastructure providers re-imagined the way instruments could be traded. For cryptocurrency exchanges, 24/7 trading became commonplace, markets were accessible globally with limited intermediaries and settlement was instantaneous. But this was mostly achievable because of the unregulated nature of these instruments and venues.

Building on what has been pioneered by crypto, is the concept of tokenization. Tokenizing an asset means breaking it up into a number of parts, each with the same value and each linked to the underlying asset's value. These fractional ownership tokens can then be traded and the 'ownership' and 'value' associated with each token transferred accordingly. This kind of fractional ownership is nothing new – it's basically the same as buying and selling shares in a company. But blockchain technology has transformed how this can take place and extends the process to other types of assets. Importantly though, once you are tokenizing real-world assets, the resulting tokens – or digital securities – become regulated instruments.

Post-trade efficiencies

In the traditional world, the typical trade flow could be an investment manager placing an order into an execution or order management system. This trade then gets routed to a broker. The broker submits the order to an exchange, where it rests until it is matched and the trade occurs. At this point, execution data is captured and relayed to the parties involved and their various counterparties — usually into each party's own internal accounting or portfolio system. The two main reasons that they all do this is that they have regulatory responsibilities to keep books and records and that they do not necessarily trust the other parties involved.

What is interesting is the fact that even though only one trade took place, everyone has their own version of events. Multiple data silos are created that all have to reconcile with each other. If the data silos don't all agree, multiple parties are involved in trying to fix the problem. This is time consuming, inefficient and expensive.

With blockchain comes a solution: a common network enabling all parties involved in a trade to see the same trusted source of data and have access to the exact same transaction details. Now, we have a situation where everyone can see their transactions and know that all other parties see the same transaction at the same time. A truly distributed ledger. Taken to the extreme, this streamlines and removes a lot of the post-trade friction points and inefficiencies that exist today and has real potential to disrupt all traditional financial markets.

Democratization of markets

In the traditional world, to invest in illiquid assets like private companies, investors typically have to go directly to the company to buy shares. If they then want to trade out of them, they have to do that over-the-counter (OTC) or bilaterally with someone else – if you can find them!

To invest in semi-liquid assets, like a hedge fund, you complete a subscription document, and if you then want to redeem, you would have to submit a redemption in line with the underlying asset manager's redemption cycle.

Finally, if you're trading something liquid on a public market, an investor can go to their local broker. If they wanted to trade an international stock, there may be another broker in the mix too. This introduces an additional layer of fees.

So, whilst theoretically investors can currently access different markets, there are a lot of intermediaries involved and the whole process tends to be quite inefficient.

With tokenization and the creation of secondary markets for digital securities, we get to a point where investors are able to access a market for all types of assets, everywhere, and invest in any of the opportunities that are listed. Up until now, much of the capital markets space has really only been open to a limited set of parties. We believe all issuers globally, including small and medium-sized enterprises (SMEs), should be able to access capital markets for capital formation, and similarly all investors should be able to access all investment opportunities.

Digital securities have the potential to deliver on all of this by bringing everyone as close as possible to the market, reducing costs and increasing efficiency. Couple this with the aggregation of different market segments, and we have the makings of a genuinely global, democratized marketplace. ■

NFTs and Challenges Associated with Natural Capital Credits

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With an increased focus on the power consumption of blockchain and its carbon footprint, the opportunities it presents to support ESG efforts are being questioned. This scrutiny is quite right and as we seek to replace one problematic paradigm, we need to ensure we do not create another. That said, distributed ledger technology's (DLT) traceability and the utilization of digital securities on smart contracts offer important solutions for avoiding greenwashing in ESG data disclosures.

Non-fungible tokens (NFTs) have made headlines of late, with everyone from Christie's to Paris Hilton looking to harness the benefits of digitizing art. But the benefits of NFTs extend far beyond fine art and music. Those who sit at the centre of creativity, capital raising, and technology are leveraging NFTs to protect ecosystem biodiversity.

The challenges financing rewilding projects

During a recent workshop run by Finextra and ResponsibleRisk called SustainableFinance.Live, industry leaders collaborated to discuss the financial services industry's investment in projects that restore ecosystems and can sequester carbon.

While significant efforts have been made, there are challenges to financing and scaling these projects. In order to create sustainable business models, ecosystem recovery, otherwise known as 'rewilding', must be linked to natural capital credits - carbon credits that demonstrate combined carbon, social, and biodiversity benefits. To do this, progress must be carefully tracked and verified.

Using DLT infrastructures and standards, ESG data can be efficiently stored and accessed. Reporting monitoring and validation of the DLT-based data is significantly more efficient and resilient to single points of failure and the challenges that centralized authorities pose. Progress can be tracked in units, and then traded, performance-tracked, and accounted for. With regards to rewilding projects, these 'units of change' can be beneficial to any entity that generates sustained revenues from land.

Natural capital credits also suffer from supply-side challenges. Paul Jepson, nature recovery lead at Ecosulis, explained that while market demand for natural capital credits is growing, the supply of bankable projects is limited. To address this problem, Jepson suggests "buying the rights to rewild."

By introducing the ability "to rent the right to restore ecosystems," Jepson believes that a portfolio of 30-year leases enabling financial players to rewild the land could become a bankable asset. "People are more willing to lease land than sell it. Leases also have the flexibility to deal with the complexities of land ownership, land tenure and so forth."

Improvements to the ecological integrity of the land will need to be measured on a scale, and it is this scale that carries the opportunity for conversion of units of change into tokens. Tokens can be split into different categories so that buyers can purchase stakes in rewilding projects.

Leveraging NFTs

Where does the NFT come in? The token - which would be located on a permanent blockchain - would take the form of digital art. This art would be embedded with data on location, and depict the state of the ecosystem. Over time, the piece of art would change to reflect the progress of the land in question.

A smart contract would provide the holder of the token with usage rights and the ability to resell that token. Jepson reiterated that this would encourage organizations to invest in the social ideal of restoring ecosystems over a timescale of 20 to 30 years, with the overarching aim of achieving climate neutrality through bankable projects.

Alongside building a DLT-based global, accessible CO2 marketplace, the Porini Foundation is taking on the Green List Marketplace with an NFT project. In cooperation with the International Union for Conservation of Nature (IUCN) and nature protection organizations like Nature Seychelles and the Swiss National Park, the Porini Foundation is launching a marketplace for digital #NatureCollectibles. These collectibles are a limited edition of digital representations of an endangered species. The revenue goes directly to the area that enables the protected species to survive.

The key point in the Green List Marketplace is the adoption of a Harberger Tax concept. All the collectibles are for sale all the time. If another person wants to buy a collectible it can do so anytime. The price increases a factor x1.5 with every sale. The revenues of each sale are automatically distributed among resellers, IUCN and Porini Foundation, and ensure a permanent revenue stream for all stakeholders.

Crucially, the Porini Foundation is keen to ensure that the marketplace is accessible to those who have not traditionally been part of the 'cryptosphere'. Retail consumers can buy the collectibles in a normal online shop with fiat currency. To receive them they have to download a mobile app which is a blockchain wallet. All transaction costs are paid by Porini Foundation. In making the user experience as simple as possible, the hope is to attract users regardless of the limits of their blockchain knowledge.

In the last 30 years humanity has seen three waves of digitization. In the first wave data and communication were digitized which led to the adoption of Internet, webpages, and emails. In the second wave of digitization, communities were digitized. As a result, individuals and organizations adopted social media.

What we currently see is the slow but steadily growing adoption of the third wave of digitization where values and assets are being digitized. As a consequence, we will see a broad range of ways of handling value in new digital channels. Tokenization offers solutions to tracking progress within ESG projects. NFTs introduce the creative, human element to this progress, attracting capital in innovative and sustainable ways.

As we work to protect our planet, we will continue to weigh the risks and benefits of digital assets, and shape the role that they will play in the third wave of digitization. While ensuring that the underlying technology is efficient, we must keep in mind the solutions that digital assets offer for enhancing ESG-related projects. ■

Sustainable Finance and Digital Solutions for SMEs

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As governments around the world look to "reset" the global economy following the pandemic, it is increasingly evident that the transition to net zero requires speedy, innovative and scalable solutions and must mobilize the "ripple" effect of small and medium-sized enterprises (SMEs). SMEs are often referred to as the backbone of economies, and for good reason. They are diverse in size, strategy and sector and, in many countries, make up more than 90% of enterprises. They also account for 70% of employment worldwide, taking skills and income to underserved communities creating social cohesion and addressing inequality issues. SMEs are themselves some of the world's greatest emitters of greenhouse gases. They are therefore uniquely placed to contribute to a just transition to a climate-friendly and sustainable future.

Despite this, access to finance has remained a key challenge for SMEs. Whilst it is difficult to estimate the financing gap for SMEs globally due to the diversity of organizations involved, according to the International Finance Corporation (IFC), there is a micro, small, and medium enterprise (MSME) financing gap of over $5 trillion, with women-owned businesses accounting for 32% of that financing gap.

Governments and regional bodies around the world are focused on creating sustainable and digital strategies such as the "EU SME Strategy for a Sustainable and Digital Europe" but it is important that any SME financing strategy is also aligned with these strategies, enabling them to access the finance in order to digitalize and "green" their own business models, products, services, and processes. Additionally, SMEs will need support gathering data on their own business practices to monitor and disclose their progress on sustainability.

Main challenges facing SMEs in accessing finance

SMEs have historically faced a range of internal and external barriers affecting their ability to access finance directly and indirectly. These have included: lack of resources and experienced employees and managers; lack of, or insufficient, collateral for the purposes of security and guarantees; and information asymmetries between financial institutions and SMEs. Typically, SMEs have also lacked access to a diversity of finance limiting their potential for growth and scaling up.

These challenges and barriers are often more pronounced for new organizations, innovative ventures, and also underserved groups including women, youth, seniors, and migrants. The development and evolution of mainstream sustainable finance is not, for the most part, specifically addressing the challenges that SMEs face with the unintended consequence of amplifying rather than lowering these barriers.

There is a significant opportunity for both policy makers and SMEs moving forward to engender greater participation in the commercial economy and reduce some of these barriers. It is important that jurisdictional taxonomies and frameworks do not focus just on large public companies, as if often the case. SMEs represent 99% of all businesses in the European market and ensuring that policy, frameworks, and legislation are targeted directly at the core of this economic engine is critical to the success of any roll-out of green finance to this segment.

With the race to net zero, it is also important that policy makers do not lose sight of other important ESG factors like gender, racial, and social diversity. Developing incentives for SMEs to achieve this type of diversity through labor support schemes and tax incentives can help accelerate the segment in its contribution to net zero objectives by mobilizing a more diverse

workforce and reducing some of the existing social and economic barriers. This can be especially effective in supporting areas of (historic) regional unemployment and immigration influx.

Digital solutions to enable SMEs to access finance

Recovery packages across the world, such as the EU's SME Strategy, are including support for a transition to sustainable and digital economies and business models with extensive support programs for "greening" of SME activities. This includes, for example, setting up a Green Tech Investment Initiative to support digital innovations and green tech solutions in the EU. New digital infrastructure which is easily accessible by SMEs is being put forward as an important solution to many of the issues identified above, particularly in the context of data collection and information gathering.

Before COVID-19, new technologies, data, and players were emerging to enhance financial innovation. This included a fintech revolution with rapid progress in the area of payments and lending and the use of advanced disruptive technologies such as blockchain, artificial intelligence (AI), cloud and high performance computing. All of these can enhance the competitiveness and potential of SMEs. Innovative fintechs have improved financial inclusion in many developing countries using the existing mobile phone infrastructure, and this technology can also improve SMEs' access to finance in those countries. One example is M-Pesa, which allows the unbanked in Kenya to transfer money between accounts linked to their mobile phones. This makes sending and receiving payments much simpler. According to one study, nine in ten Kenyan SMEs use M-Pesa.

More sophisticated technologies such as tokenization, based on blockchain, can connect SMEs to investors with a matching investment profile and SMEs can also raise money through crowdfunding using cryptoassets. One major advantage of using cryptoassets is the ability to access a wider pool of investors from anywhere in the world. This is potentially easier than raising traditional bank or venture capital funding. As a result, innovative SMEs with a contribution to make to a greener recovery will be able to scale faster than they otherwise would.

AI and cloud computing can give SMEs greater flexibility and efficiency. For example, AI can automate administrative tasks allowing employees to focus on more productive activities for the growth of the business. Access to cloud computing allows SMEs to use a computing service flexibly when they need it, rather than committing to a fixed arrangement with a supplier. Although each individual application may only have a relatively small impact, taken together they could have a significant effect on SMEs' ability to grow sustainably. These technologies complement recovery packages such as the EU's Green Tech Investment Initiative. The recovery packages direct the SMEs in an environmentally responsible direction and digital solutions can then accelerate their growth, contributing to a more sustainable economy overall.

The diversity of financing options which are accessible to SMEs through technology also include non-

traditional players and data-driven technologies, and products in the fintech sector such as supply chain financing. Supply chain financing, amongst other things, improves sellers' cashflow by reducing the time they wait for payment of invoices at funding cost based on the buyer's credit rating. Supply chain financing can also directly encourage sustainability. For example, in 2016, Puma, BNP Paribas, and the International Finance Corporation (IFC) used supply chain financing to reward sustainable suppliers. Suppliers with favorable sustainability scores awarded by Puma would receive more favorable financing from BNP Paribas or the IFC. Arrangements like these could be powerful incentives toward sustainable practices.

Digital solutions offer the diversity and flexibility to create the tailor-made finance solutions for SMEs that are essential given the diversity and range of SMEs. For example, Recognise is a UK bank dedicated to SMEs. These types of financial institutions aspire to tailor options to individual clients based on their business needs; the promise of a personalized relationship is key to how they distinguish themselves from traditional banks. Recognise worked with Mambu and various fintechs to provide a software-as-a-service platform that could enable this level of flexibility.

Sustainable finance and SMEs

The growth of the sustainable finance sector (with the Organisation for Economic Co-operation and Development (OECD) estimating over $30 trillion of global assets incorporating ESG factors in 2020) has been accompanied with a proliferation of law and regulation, soft law and voluntary codes, trade association principles, and reports and guidance on every aspect of sustainable finance and related issues. The challenge for all organizations (regardless of size) is to decide what is necessary, useful, and relevant depending on their operations, business model, sector, region, and country.

A key challenge for the sustainable finance sector remains data (both qualitative and quantitative) and disclosure - crucial not only because sustainable finance and investment decisions are based on data and disclosure, but also due to the increased focus on ESG risk and sustainability "washing". The market has moved to enhance transparency, reduce risk, and ensure the credibility and integrity of sustainable finance products, with the European Banking Authority (EBA) publishing its "Report on management and supervision of ESG risks for credit institutions and investment firms" and trade associations such as ICMA, the LMA, APLMA, and LSTA tightening up product-related principles and guidance with a view to dealing with the risk of green/sustainability "washing".

It is recognized that SMEs often lack the resources and experience to navigate the fragmented and complex sustainable finance legal, regulatory, and information landscape. As a result, they may lack knowledge of sustainability-related risks and opportunities for their businesses, and of sustainable funding options and products, and related eligibility. This may prevent them from integrating sustainable business, models and practices.

The sector challenge relating to data and disclosure has also emphasized rather than lowered information asymmetries between financial institutions and SMEs. SMEs are often unable to invest in the relevant infrastructure and processes required to identify and collect relevant information, and for the purposes of on-going monitoring, disclosure and reporting of sustainable information.

The focus on ESG risk, climate stress testing, and sustainability washing have all led to a tightening of internal lending conditions. This can have an adverse effect on the sustainable finance options for SMEs, which have historically relied on bank funding. The absence of relevant sustainable data, policies, strategies, and information has created issues for SMEs trying to access mainstream sustainable finance products such as sustainability-linked loans.

The lack of data and information also manifests itself as a general market failure. Compared to software start-ups for example, green or clean tech SMEs are seen as high-risk, capital intense, and with longer or more complex financing needs. The result is the substantial underinvestment in innovative SMEs. In the longer term, if SMEs do not integrate sustainable business models and practice, they may find themselves losing their competitive edge and unable to access sustainable finance or otherwise paying a premium for that finance.

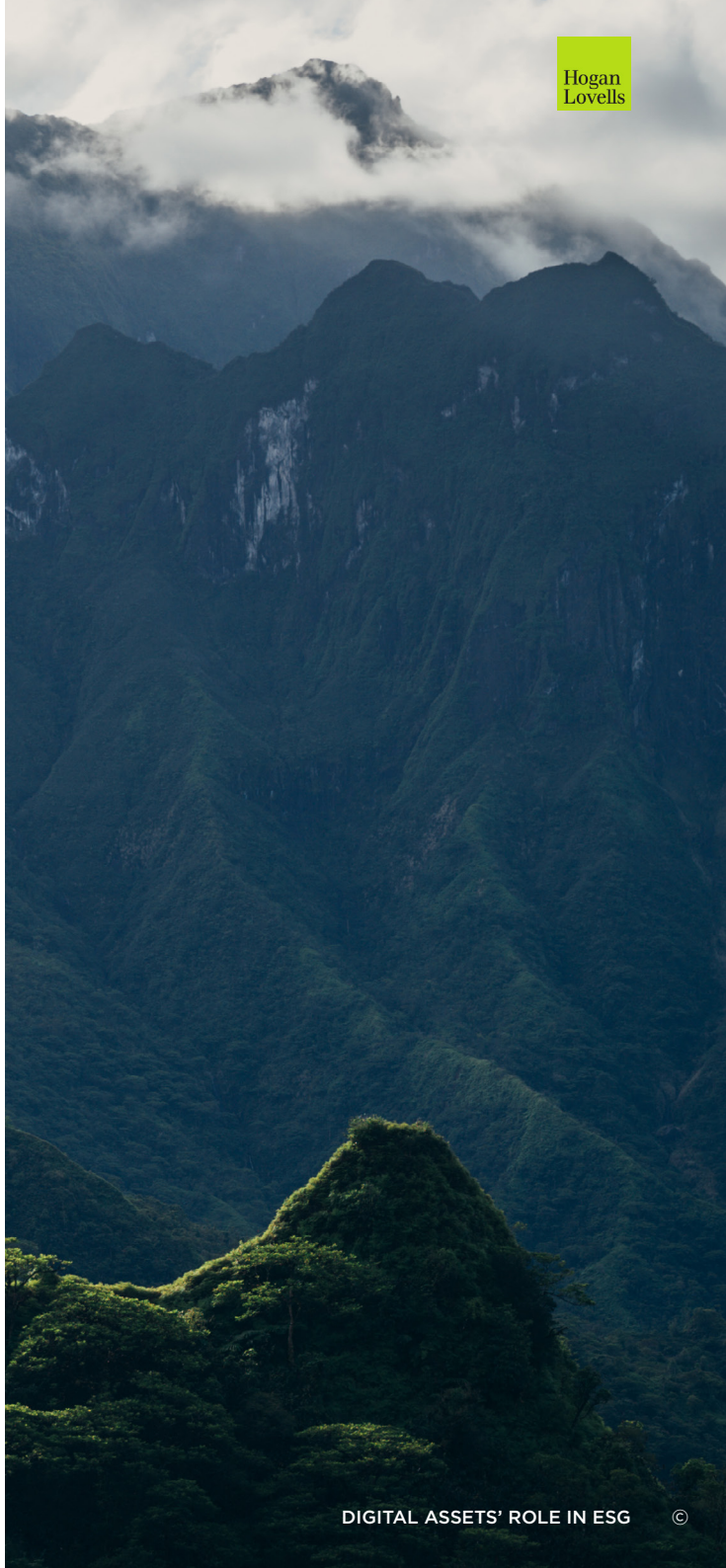
Since the challenges of gathering and verifying data and communicating it to lenders and investors appears to be part of the problem for SMEs, it is perhaps not surprising that digital is part of the solution. Technology ought to be able to help break down the information barriers and help sustainable-finance-focused investors gain the confidence to invest in SMEs.

Recently, The City of London Corporation and the Financial Conduct Authority have collaborated on a Digital Sandbox to create a digital testing environment and to support financial services' innovation. The virtual ecosystem addresses challenges in tech development such as access to data and industry collaboration and is innovative in the tools and features it provides. This includes the testing and development of new products and services for the purposes of ESG data and disclosure.

The pilot phase concluded in February 2021. Although it is still too early to measure long-term outcomes, the pilot's evaluation report indicated promising results based on data from surveys, interviews, and other sources. Amongst the benefits were faster product development, the testing of technology such as AI, and networking opportunities. A second phase is about to begin – applications for firms and individuals will close in October 2021 and testing will begin in January 2022. The aim of the sandbox is to enable transparency in disclosure and reporting on sustainability, especially on the characteristics of corporate assets and the profile of their supply chains (e.g. open source and eco-friendly decentralized ledgers, centralized platforms), and the automation of the assurance of a listed issuer's ESG data and validation of its ESG-labelled corporate bond issuance (e.g. Internet of Things, decentralized ledgers, centralized platforms, satellite imaging, AI). A further objective is to make the ESG qualities of particular products or services more transparent to consumers.

In turn, these features should allow improved access to finance for SMEs. Recovery plans such as the Green Tech Initiative are directing SMEs in an increasingly sustainable direction. Digital solutions can help those SMEs attract investment and then gather data on their own sustainable practices to attract further green financing. This virtuous circle, enabled by digital solutions, has the potential to make the economy as a whole more sustainable.

In conclusion, a sustainable future depends on an SME sector that is well financed and empowered to embrace sustainable practices. The sustainable finance sector not only needs to focus on large companies that have established sustainability strategy policies and reporting, but also needs to find a way of engaging with and funding SMEs that do not. Digital solutions are starting to help with that, as well as offering innovative financing tailored to the SME sector. This ought to help the sector play its part in building back better. ■



The Impact of ESG on Emerging Digital Ledger Technologies

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Environmental, social and governance (ESG) priorities are increasingly shaping the development and use of new technologies. Some technological developments, such as carbon-capture technology and other GreenTech, were driven by ESG imperatives. In other cases, technologies have been commandeered to assist in achieving ESG goals. In addition, ESG concerns are evident in many of the regulatory and supervisory frameworks that seek to guide and control the evolution of emerging technologies.

However, the varied and ubiquitous nature of ESG considerations can make them difficult to appropriately navigate when developing and using certain technologies. The current state of distributed ledger technology (DLT) is an example of how layers of ESG considerations have created ambiguity about how a technology should be viewed from an ESG perspective and how perception of the technology may help shape its future development, use, and regulation.

DLT as an ESG enabler

DLTs, such as blockchain, are increasingly being used to enable the delivery of sustainable infrastructure for a low-carbon future. Across the energy sector, developers seek to leverage DLT technology to help decentralize energy distribution, control energy networks through smart contracts and provide demand response services linked to electricity usage and supply forecasting.

Cryptoassets generated through blockchain also have the potential to make the financial system accessible to people who cannot access the traditional financial system due to economic, social, or geographical conditions that prevent them from opening a bank account. Progress in this area may be accelerated by the advent of stablecoins and government-issued digital currencies, which could result in cost-effective distribution of funds in the context of social programs.

ESG-related concerns

Blockchain validation processes may give rise to environmental concerns due to excessive energy consumption and electronic hazardous waste. Although certain studies indicate that Bitcoin network energy consumption is significantly lower than that of the traditional financial economy, Bitcoin does not operate at the same scale as traditional financial institutions, and concerns remain about the huge amount of energy needed to add new blocks to proof of work (PoW) blockchain protocols like Bitcoin and Ethereum. To stay competitive and increase energy efficiency, companies may invest in upgraded hardware for blockchain processes, but this comes at an environmental cost as the hardware is not easy to repurpose or recycle, and recent reports have found that redundant units create approximately 24.28kt of hazardous electronic waste each year.

Tackling these concerns

One way to reduce the energy consumption of a blockchain protocol is to transition it from a PoW to a proof of stake (PoS) model. PoW protocols require miners to solve complex mathematical equations generated by the protocol, with the first miner to solve an equation and present proof to other miners being able to add a new block to the blockchain and receive a financial reward. Miners attempt to gain a computational edge over others by using energy intensive mining machines that excel at rapid

computations. In contrast, PoS blockchains often use a network consisting of a set number of "validators" that contribute their own crypto in exchange for a chance to validate a new transaction, update the blockchain, and earn a reward. PoS blockchains may have as few as 11 validators vs. the hundreds of thousands if not millions of miners on the Bitcoin blockchain. Reducing the number of miners/validators leads to a corresponding reduction in the computing power necessary to update a PoS blockchain and can thus result in a blockchain achieving significantly higher transactional efficiency and lower energy consumption.

Further ESG complexity

However, adopting a more environmentally friendly PoS blockchain model can be complicated by regulatory frameworks designed to ensure consumer protection. For example, the US Securities and Exchange Commission (SEC) and other global regulators believe that many cryptoassets used on blockchains have characteristics indicative of a "security" that falls under their regulatory authority, a designation which can have an existential impact.

One factor the SEC weighs heavily in favor of a cryptoasset being a "security" is the existence of a defined group of persons responsible for managing a blockchain or blockchain-related project that asset purchasers reasonably expect to rely on to realize future profits. This is due, in part, to concern that a small group of managers with power over a blockchain or access to its software can lead to informational asymmetries that managers can exploit to take advantage of unsophisticated investors. PoS blockchains with centralized governance, including blockchains with too small a validator pool, run the risk of creating the kinds of control and informational asymmetry issues that may cause global regulators to step in.

Another avenue explored by some companies seeking to position Bitcoin mining as 'sustainable' is to procure energy from renewable energy sources or to enter into corporate power purchase agreements. However, companies must consider the reputational risks associated with greenwashing and the focus by stakeholders on verification and reporting (which may necessitate steps such as embedding audit rights in the underlying power purchase agreements).

We may be at a pivotal moment in relation to the impact of ESG on the development of potentially transformative technologies. Ethereum, the second largest blockchain protocol in the world, is already in the process of a complicated transition from a PoW to a PoS model. Many attribute this shift, in part, to public concern about energy consumption. Examples like these suggest that DLT, which remains in its relative infancy, may be much more heavily influenced by ESG-related concerns than prior technologies with the same transformative potential. ■

CASE STUDIES AND METHODOLOGIES

How Asset Tokenization Advances Climate Initiatives

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There are real issues at present with green and sustainability-linked investments. It is difficult to connect real-world evidence of benefit as the result of the funding to transparent, accessible, and authentic data. Tokenization is flexible, adaptable, and automated, making it a useful solution for our climate-related goals.

Asset tokenization is a process whereby a typically illiquid asset is converted into digital assets – distributed ledger technology (DLT)-based tokens which have a fractional value of the original asset, issued with rights in respect of that asset.

Commercial property is a good example. Just as there are a number of ways to own interests in a property, there are a number of ways to create tokens by reference to property interests. Currently, fractionalization in property is limited. The basic underlying freehold unit of the property, at that level, cannot be subdivided without interaction with the land registry. Whilst land registries are advancing with digital, this type of interactivity is a long way off. So, a freehold may be held in a vehicle or trust in order for interests to be unitized for investors via digital tokens. The tokens reference an indirect interest in the property via the vehicle. This might be a propco-type arrangement or a fund, with a portfolio of assets underlying.

Alternatively, if it is let, a landlord can grant interest in income from the property. Interest in debt secured on the property can be granted, including by direct lending, combined with a share in the relevant security via a trust, or via sub-participation granted by a lender. There are a number of examples in the market beyond real estate – this process can be applied to works of art, expensive machinery, vehicles...there is an ever expanding list of possibilities.

One main benefit of tokenizing assets is that it increases their liquidity, allowing the tokens to be traded on appropriate secondary markets. Fractionalization means that investors can also purchase tokens that represent very small percentages of the underlying assets, making investing much more accessible. The smart contract automation underlying the tokens can make administration, trading, and operations much more efficient, with disintermediation reducing fee burden.

What does all this have to do with climate goals?

Compared to traditional ownership methods, asset tokenization provides a much more stringent, direct way to integrate environmental performance targets and reporting into assets, supporting the monitoring, reporting and verification (MRV) aspects of climate-related projects. In addition, because tokens are fractional interests, and the right to data can be associated with a very small holding, data accessibility inefficiencies that we see in traditional markets are eliminated. Everyone who owns a token has data rights associated with that token, as well as the economic rights such as capital, interest, and income.

The drawback of fractionalization is influence. On the one hand, as we know from observing governance dynamics in large cap, broadly held listed companies, there is a lack of influence over corporate behavior in the absence of strategic shareholder action (e.g. via activist shareholder groups and funds).

On the other hand, large single counterparties, such as significant secured lenders, do have influence. This may be through their contracts under covenants and enforcement rights on default, or their relationships with the business and senior executives. In theory, a fractionalized holding system would allow activist groups and public opinion to take on some power of influence. However, it is more likely to be expressed in a negative way (demands for cessation of activities, removal of the CEO, or similar) rather than more positive influence which can come through long-standing, trusted relationships. This is a challenge which should be explored further as tokenization becomes more prevalent.

Here, we will look at two case studies: first, the application of asset tokenization in a sustainability-linked loan, and second, a climate technology improvement scenario. As a result of the multiple useful features of tokenization, the potential for use in climate-related project funding is vast. That said, it is relatively

unexplored. These two case studies are provided as "seed" scenarios, on which we would hope many more applications can be built.

Sustainability-linked "debt" type arrangement

An example of where tokenization would bring advancement to climate initiatives is through sustainability-linked loans. These work by importing key performance indicators (KPIs) from the asset and its surrounding ownership context into the loan. Then there is a margin variation (interest increase/decrease) associated with meeting or failing to meet the applicable targets.

We can envisage a transaction where efficiencies are vastly improved by the borrower issuing asset tokens which are bought by funders, instead of raising a loan in the traditional way. Assume the loan is a traditional secured loan. It contains sustainability-linked covenants, together with associated manual reporting of the KPIs from the borrower, via the sustainability auditor, to the lenders (in respect of financials, this would generally be borrower/its accountants to the lender). The lender reviews, considers reporting to monitor KPI performance, and takes action in respect of defaults accordingly.

Instead of borrowing a secured loan, a fractionalized asset token can be issued to provide rights to periodic payments arising from the income generated by that asset (i.e. interest). This interest would vary in amount based on certain data inputs, the right to a redemption sum at a future date (i.e. capital repayment), and the right to take control of the asset, including for purposes of liquidation, if certain covenants have been breached (this is likely granted to a trustee or similar party on behalf of the asset token holder). Frequently, the security we implement in a regular finance transaction is based on an absolute assignment, with a proviso for reassignment on the redemption of the underlying liability. This structure would similarly provide for the trustee, receiver, or third-party service provider to manage the tokenized asset ownership and protect the token holders' interests.

If the tokens create something so similar to the existing standard arrangements, you might wonder why tokenization is necessary. And the answer is that tokenization really begins to differentiate in the area of data input, monitoring, and reporting on all aspects of the funding. Smart contract automation incorporated into tokens can accommodate automated actions on the back of oracle and manual data inputs. Data inputs on science-based pathways and targets, combined with real-time evidence obtained through oracles, from carbon emission monitors, accountant recording systems, public registries and more, can automatically be linked to the token.

If we take a simple carbon emission KPI, a science-based pathway may provide for a target outcome on the reduction of carbon emissions in a specific period of time. With a token, this target can be easily adjusted based on updated science-based inputs over time. Then a carbon emission monitor can report in real-time into the token on whether or not the KPI is being met. It may be that this whole data piece remains as information only (i.e. does not have financial consequences for the asset owner/token holders) until an external auditor has reviewed and verified the data. However, upon

that oracle data point being satisfied, the return on the token can be directly adjusted in line with the reported result. There is no further reporting, monitoring, or checking, and there is considerably less delay between action and impact.

Furthermore, there are key ethical considerations around what to do with the sustainability-linked "upside" for funders as a result of these transactions. It is not appropriate in many cases for funders to benefit from increased returns where the funded asset is failing to achieve relevant targets or goals. Another benefit of tokenization is the ability to sub-divide ownership fractions so that a relevant charitable organization, carbon innovation fund, or similar appropriate beneficiary, can take the interest in any "upside" in a "special benefit" token, which distributes the relevant value to the extent that this is being paid out in a straightforward and fully transparent manner.

Asset investment in climate-related tech improvement

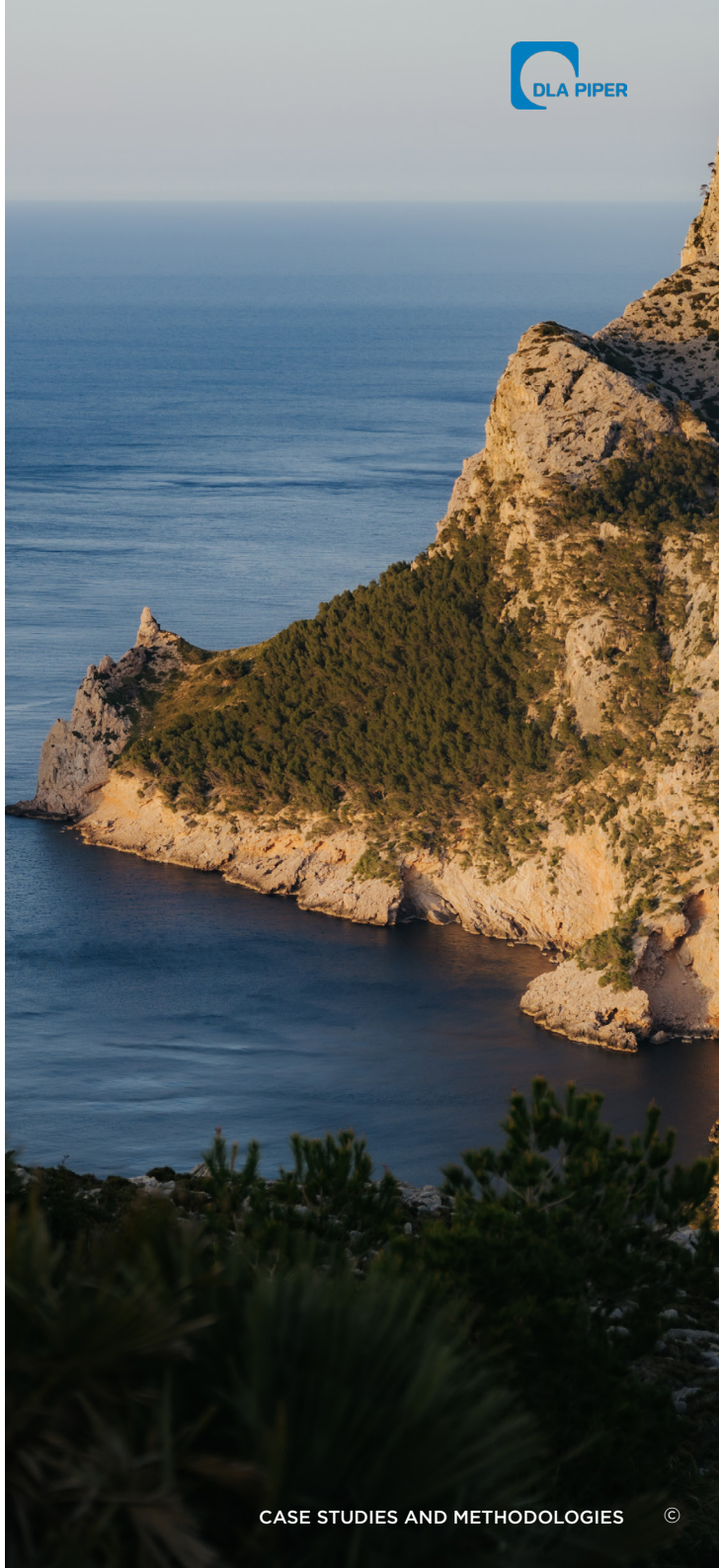
In an asset investment scenario, the owner may want to raise funds for development or acquisition of climate emission improvement technology for the asset. For example, they may be looking to develop a carbon capture kit for energy assets, which would improve net zero performance, reduce the need to rely on offsetting, and may one day produce its own income streams through application in industries such as concrete production, farming or perhaps even in synthetic diamond production.

Tokenization can provide benefits for funders in this project such as purpose monitoring, automated milestone reporting, evidencing outcomes and improvements, and creating a link to financial benefit. For example, an automatic allocation of savings on offsets can be made to the token-holding investors, and profit sharing in fee streams that may ultimately arise from circularity within repurposing of carbon could also be linked in. This begins to take on material relevance in the context of repurposing carbon captured into high-value industrial use cases such as diamond production. The ability to create the link to future income streams via smart contracts is likely to be highly attractive to the up front funders.

As with all aspects of digital assets, there may be taxonomy and regulatory perimeter complexities with this type of pursuit. Some of the ways in which this can be achieved may result in securities token issuance, for example. But in a number of respects, that does not really matter. The benefits associated with tokenizing assets for the delivery of climate-related goals are still available if this can be integrated up front.

In conclusion

Tokenization offers data integration (including oracle sourcing), automation, and real time functionality, together with the potential fractionalization and disintermediation advantages. This makes it a tool that is highly suited for achieving climate-related goals. Integrating this with a token-based, voluntary carbon trading or carbon offset system (reflecting realistic carbon pricing) would look a lot like progress. We may have to wait a while to see this in action, but fintech as an industry is core to advancing climate initiatives by getting this up, running, and fully integrated into global financial markets. ■



Tokenization as a Tool for Financing Sustainability Ventures in Africa

Borys Pikalov
Co-Founder, Head of Business Analytics
Stobox

Africa is a key region for sustainability efforts. Sub-Saharan Africa's population is growing at 2.7% per year, faster than any other region. Its population is expected to double by 2050. It is also expected to be one of the areas most vulnerable to climate change, with agricultural production and food security projected to be severely compromised.

Tackling the economic and political challenges posed by climate change, and indeed other crises, will require considerable investment. The International Monetary Fund (IMF) has recently highlighted that the impact of the COVID-19 pandemic will mean that African states will need $1.2 trillion through 2023. Non-profit efforts are not enough; sustainable economic growth is created by business financing.

Challenges of financing SMEs in Sub-Saharan Africa

However, finding the investors to finance sustainability projects has its challenges. The investment is long-term; many impact bonds can take up to 20 years to mature. At the same time, these bonds cannot be traded on secondary markets, creating liquidity risks. Only a small handful of rich institutions with long planning horizons can wait for such long periods. These same institutions, such as pension funds, are usually relatively risk-averse and tend not to invest in emerging markets.

The region also suffers from a lack of infrastructure. The banking sector and capital markets are underdeveloped and cannot satisfy capital needs at an affordable rate. While small to medium-size enterprises (SMEs) are crucial for economic growth, these are not covered by conventional large investment firms. For private investors to be able to access these markets, they will need the correct infrastructure.

What is tokenization?

Tokenization is a combination of legal and technical procedures that transfer securities (e.g. shares or bonds) into a form of a token that can be traded on the blockchain. Investors put money into businesses by purchasing their tokens.

Tokenized markets can be accessed on a global scale. Through digitized platforms, tokenization opens Africa for international capital and allows these businesses to access a diverse range of investors - not only institutional ones but also common retail investors. More than this, tokens are easy to trade. Investors don't have to wait 20 years for the maturity of bonds – they can simply sell them on a secondary market. As investors don't have to wait for companies to go public, the overall risk is reduced, making the investment more attractive.

Lastly, these investments can be used in various protocols of decentralized finance to enhance return. For example, tokens can be used as a collateral against a loan, which itself can be invested further.

The potential for enhanced returns, further liquidity, and mitigated risks make companies based in African countries increasingly attractive to investors in a global, digital market.

In particular, this opens doors for SMEs

In order to ensure that SMEs based across Africa have access to capital, Stobox is working with a client to launch a tokenized exchange. Investors anywhere in the world will be able to access the digital platform to invest in the SME of their choice. With reduced barriers to entry, SMEs will have access to a wider market.

Another project being led by Stobox focuses on teak farmers based in Ghana. While these farmers may own the land, they lack the capital to harvest and sell the teak. Stobox is working with a client who is raising $15 million to help farmers monetize their teak plantations, supporting operations from harvesting to shipping to India and China. The project is funded through tokenization.

Digitization provides solutions to challenges of financing the parts of the economy that will help us achieve the Sustainable Development Goals. Through tokenization, we can provide access to capital to the projects and SMEs that are key to sustainable economic growth. ■

EQONEX: ESG Preparedness and Resilience

Richard Byworth
CEO
EQONEX

At EQONEX, our ecosystem of businesses has been built for the long term; focusing on regulation, reputation, governance and security as our core values.

We are the first Nasdaq-listed crypto ecosystem with an exchange, and will not compromise on regulatory, reputational, or security risk. We believe in a fair and transparent trading environment that incorporates market leading liquidation processes that are equitable for all participants. The broader EQONEX ecosystem of asset management, custody, investment products, trading tools, lending and capital markets has also been designed with the environmental, social and governance agenda expected of a publicly listed company.

Governance

We hold ourselves to the high standards of governance. We have an effective corporate governance framework, including a Board of Directors with a majority representation of independent members. We have a separate Board Audit Committee and a Board Risk Committee, into which our Executive Risk Committee reports.

We operate a standard three lines of defence model to ensure that the business is well controlled, and any risks are identified and where possible mitigated. Four of our Executive Committee members are in roles focused on control and governance. Furthermore, we do not conduct any proprietary market making on our exchange. We rely on established and highly regarded market makers and strategic partners ensuring market integrity equivalent to traditional regulated markets.

All assets listed on the EQONEX exchange pass through a listing committee. The committee assesses tokens across a pre-defined set of metrics, including security, technology, decentralization, and utility. Assets that don't meet the listing criteria will not be listed. This provides a level of investor protection that is required in this nascent industry.

Following a business combination with Nasdaq-listed 8i Enterprises Acquisition Corp, EQONEX Group Ltd made history in October 2020 by becoming the first company operating a cryptocurrency exchange to be listed on Nasdaq. This was a watershed moment for both EQONEX and the cryptocurrency industry, as it presented the first opportunity for US capital markets participants to be able to buy directly into the equity of a digital asset ecosystem.

As a Nasdaq listed company overseen by the US Securities Exchange Commission (SEC), we strive to lead the industry in best practices for corporate governance.

A focus on regulation

We have chosen to operate in compliance with some of the most developed regulatory frameworks and well-regarded regulatory jurisdictions in the world. In doing so, we have sought to lead the way in delivering a properly regulated and well governed business.

The EQONEX Exchange is currently operating under an exemption granted under the Payment Services Act (2019) from the Monetary Authority of Singapore (MAS). Choosing to operate under this regime demonstrates our commitment to upholding high levels of governance and adherence to world leading regulation.

A foundational pillar of our ecosystem is Digivault, our highly secure digital asset custody solution. Based in the UK, it is registered with the UK Financial Conduct Authority (FCA) as a Custodian Wallet Provider. In being the first stand-alone digital custodian to receive this registration we have demonstrated our ability to innovate at speed within a stringent regulatory framework.

Digivault also operates to the highest industry security standards, using FIPS140-2 validated hardware security modules (HSMs). Digivault is industry-accredited via the UK government-backed security standard, Cyber Essentials Plus and is ISO 27001 certified. Both hot and

cold wallets are penetration tested to CREST standards of certification. We have been uncompromising in the design and build of Digivault, with a laser focus on security and governance.

Social

EQONEX has set out to attract the brightest talent in the market. Our firm invests heavily in the development of our people and fosters an ambitious yet inclusive corporate culture. Our team is made up of a diverse group of people, represented by a broad base of nationalities around the world. Our Board meets Nasdaq's SEC-approved Board Diversity Rules, with Chi-Won Yoon as Chair and Lisa Theng, Managing Partner of CNP Law LLP, appointed Board member in 2021. Our firm continues to look to attract more female talent at a Director level.

It is important for us to scrutinize the social impact of the financial value chain. EQONEX adheres to all relevant AML and CTF regulations and in doing so conducts robust due diligence on our customers, suppliers and partners.

Environment

The environmental debate has been highly polarizing and continues to garner a lot of attention. We engaged Intelligence Squared, the global media company renowned as one of the world's leading forums for live debate, to robustly explore the key issues faced by the industry. The series included an exploration of Bitcoin's impact on the environment.

Each of the events were hosted by Anne McElvoy, senior editor and head of podcasts at The Economist, and on the topic of the environment we heard from acclaimed macroeconomist Lyn Alden and researcher Max de Vries. The debate highlighted the findings of the Bitcoin Mining Council and the fact that Bitcoin mining uses a high ratio of sustainable energy, given the propensity of miners to seek out the cheapest and often unused energy sources.

Bitcoin's energy usage remains a contentious topic but we are committed to engaging with this debate openly, whilst continually assessing the rapidly evolving sector as other technologies develop. At the corporate level, EQONEX is planning to conduct a carbon footprint analysis in 2021/22 to define a reduction strategy and consider carbon offsets.

Looking to the future

It is apparent that the industry is often dominated by polarized debate and can always do more to improve standards. With sustainable investment practices on the rise, EQONEX will strive to ensure that it complies with both increasing regulatory requirements and stakeholder expectations, in line with the ESG goals of institutional investors.

In 2021/22, we will seek to take a structured approach to assessing ESG issues of materiality that may affect our business and stakeholders. EQONEX will also look to implement blockchain-enabled reporting solutions in collaboration with leading industry partners to address our clients' evolving requirements for compliance and transparency in ESG-related disclosures. ■

Quantifying Environmental Impact: Approaches and Methodology

There is currently no standard, universally applied methodology to calculate the electricity consumption or carbon footprint of cryptocurrencies. Different methodologies apply different assumptions, which can vary significantly in their modelling and perspective of the problem, though we have good-quality sources available, and the Crypto Climate Accord will shortly be producing specific guidance for the sector in this area.

To take Bitcoin as our master example and point of reference, the two commonly referenced approaches are the per transaction model, which expresses environmental cost in terms of the blockchain transaction; and the 'mined now' model, which calculates the environmental cost per Bitcoin mined over the most recent period. The 'mined now' model is the methodology used by initiatives such as the Green Bitcoin Project.

In addition to these approaches, Zumo has developed a 'mined since genesis' model, which calculates electricity consumption based on Bitcoin mining but averaged out over the entire period since the BTC genesis (first) block. This aims to factor in and average out the unknown of when a particular Bitcoin was mined, and therefore the energy consumption associated with it at the point of its creation.

Zumo also uses a 'share of the BTC network' method to calculate the electricity consumption attributable to

Kirsteen Harrison
Environmental & Sustainability Adviser
Zumo

Zumo as a share of the usage of the whole BTC network at a specific 'snapshot' date.

These models will be made publicly available by Zumo in the early part of next year following testing as part of our net zero strategy. Whatever method is used, it is important to clearly state assumptions and data sources and be transparent about those all the way through the process.

It should be noted that different stakeholders may (and likely will) use different methods according to the specific nature of their activities. These accounts may at times overlap, depending on the context. The guiding principle of these standards is not to avoid counting emissions, but rather to ensure that everyone involved carries an appropriate level of responsibility

The table below compares various methodologies for visualising or attributing BTC electricity consumption.

Methodology	Source	Typical result	Pros	Cons	Best used for...
Transaction model	Digiconomist	1781.61 kWh/ transaction	Easy to calculate. Allows comparisons with other payment methods.	Attributes all electricity use to the transaction rather than block reward. Results in a skewed figure as transactions do not drive electricity consumption.	Illustrative purposes.
Mined now model	Green Bitcoin Project	270 MWh/BTC	Reflects energy cost of mining BTC in 2021.	100% focused on newly generated supply - does not factor in the utility of securing the network for all existing BTC holders.	Investors, holders of crypto, miners.
Mined since genesis model	Zumo, calculated using data from the Cambridge Bitcoin Electricity Consumption Index	17 MWh/BTC	Reflects energy cost of mining one BTC averaged 2009 - 2021.	Not appropriate for miners, who should be focused on electricity costs today (not averaged).	Investors, holders of crypto. Wallets, exchanges, and payment platforms.
Share of BTC network model	Zumo, calculated using data from the Cambridge Bitcoin Electricity Consumption Index	Variable according to network usage.	Gives a 'snapshot in time' and reflects actual energy use of the BTC network. Includes all energy consumption (no need to split further into transactions, block reward and securing network).	Not suitable for individual investors or holders of crypto. Fluctuates over time.	Wallets, exchanges, and payment platforms.

We welcome comments on these methodologies, in the knowledge that there may also be other methodologies published or in development of which we are unaware. Zumo continues to work to inform the decarbonizing crypto conversation, and will shortly be launching its net zero strategy, which will be publicly viewable on its website, www.zumo.money

This is an extract from a longer 'state of play' paper - Decarbonising crypto: where do we go from here? - authored by Zumo in collaboration with leading sustainability researchers and cryptocurrency experts. The full report will be available to download from the Zumo website shortly. ■

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