PRI Principles for Responsible Investment

RESPONSIBLE INVESTMENT AND BLOCKCHAIN

A PRIMER FOR PRI SIGNATORIES

UNEP FINANCE INITIATIVE | United Nations Global Compact

An investor initiative in partnership with UNEP Finance Initiative and UN Global Compact

THE SIX PRINCIPLES

PREAMBLE TO THE PRINCIPLES

As institutional investors, we have a duty to act in the best long-term interests of our beneficiaries. In this fiduciary role, we believe that environmental, social, and governance (ESG) issues can affect the performance of investment portfolios (to varying degrees across companies, sectors, regions, asset classes and through time). We also recognise that applying these Principles may better align investors with broader objectives of society. Therefore, where consistent with our fiduciary responsibilities, we commit to the following:

1 **We will incorporate ESG issues into investment analysis and decision-making processes.**

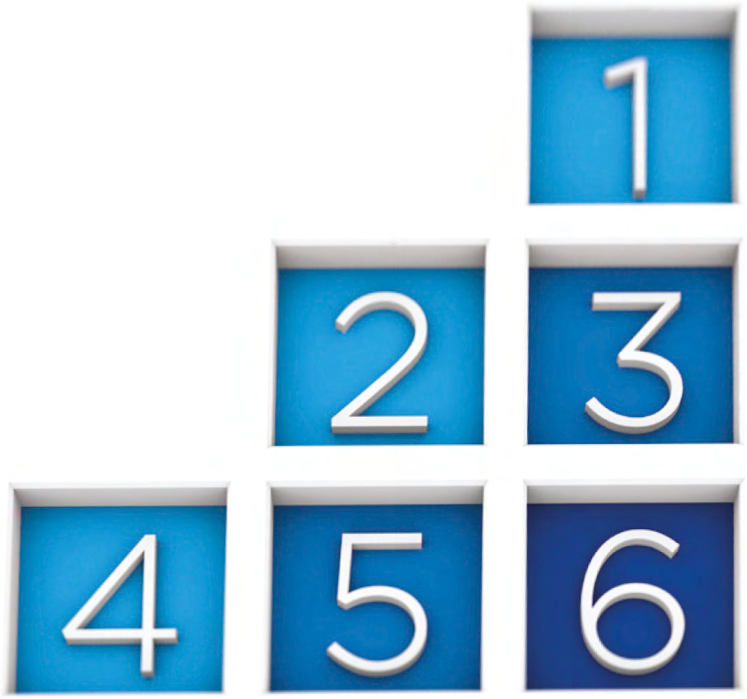
2 **We will be active owners and incorporate ESG issues into our ownership policies and practices.**

3 **We will seek appropriate disclosure on ESG issues by the entities in which we invest.**

4 **We will promote acceptance and implementation of the Principles within the investment industry.**

5 **We will work together to enhance our effectiveness in implementing the Principles.**

6 **We will each report on our activities and progress towards implementing the Principles.**



PRI's MISSION

We believe that an economically efficient, sustainable global financial system is a necessity for long-term value creation. Such a system will reward long-term, responsible investment and benefit the environment and society as a whole.

The PRI will work to achieve this sustainable global financial system by encouraging adoption of the Principles and collaboration on their implementation; by fostering good governance, integrity and accountability; and by addressing obstacles to a sustainable financial system that lie within market practices, structures and regulation.

INTRODUCTION

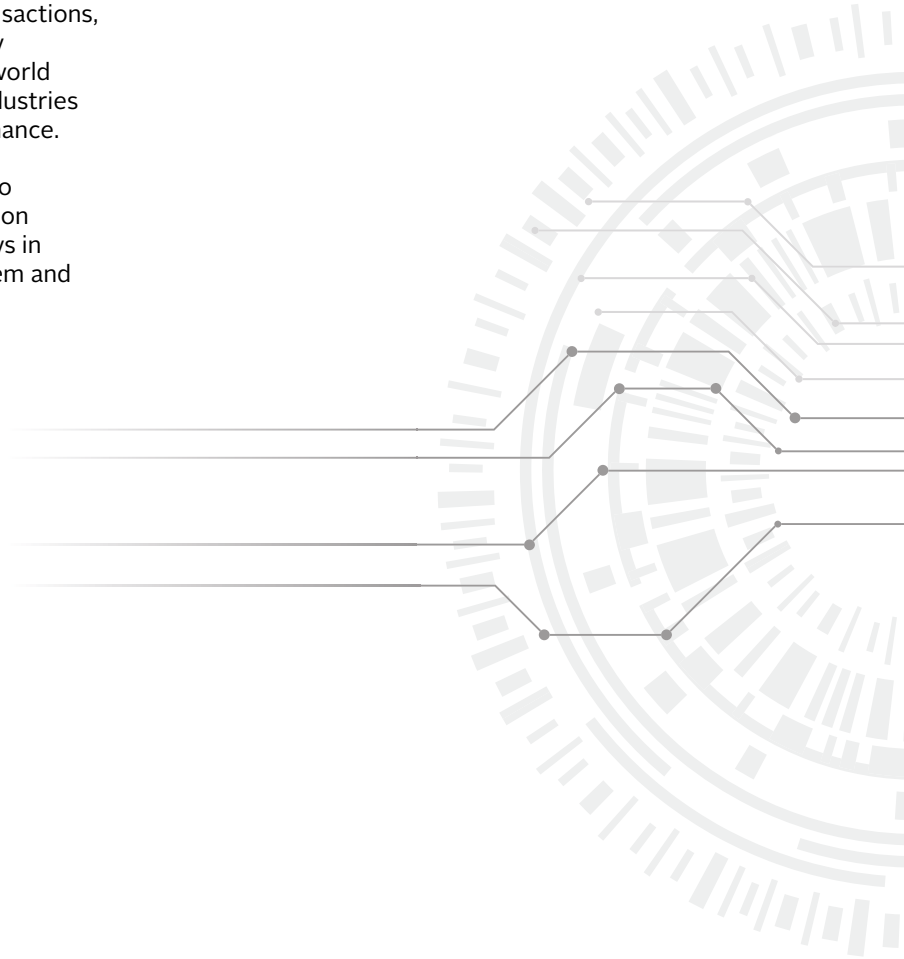
Technology matters for institutional investors – it disrupts and transforms the economy, society and the environment. Digitisation, automation, AI and new fintech have the potential to significantly impact and alter the financial system and investment industry in which investors operate – something institutional investors are acutely aware of.

Indeed, the PRI's recent megatrends survey with Willis Towers Watson found that institutional investors rated technology advances as having an "extremely significant impact". Respondents also expected technology to have the most disruptive impact on the financial system[1].

One of these disruptors is the emergence of blockchain technology, which has generated substantial hype though the proliferation of cryptocurrencies, notably Bitcoin and Ethereum. However, amid the speculative frenzy, much discussion has focused on cryptocurrencies, rather than the underlying blockchain technology which has the potential to reshape the investment industry, offering significant opportunities as well as generate potential risks to system stability.

Blockchain could facilitate secure decentralised transactions, reduce incidents of fraud, and increase transparency and efficiency in multi-party transactions. The real-world applications span a cross-section of markets and industries including travel, energy and real estate, as well as finance.

This paper introduces blockchain and its relevance to responsible investors. Part one is a technical primer on blockchain, while part two explores some of the ways in which blockchain could transform the financial system and the implications this may have for investors.



1 https://www.willistowerswatson.com/en/insights/2017/12/2017-investment-institutions-trend-index

PART ONE: A PRIMER ON BLOCKCHAIN

EARLY OPEN PUBLIC BLOCKCHAIN

Broadly speaking, an open public blockchain is a means for 1) an open network of strangers to 2) keep track of their positions – or states – relative to each other 3) without a (clearly identifiable) central intermediary being present to mediate between them and 4) with all players in the network (theoretically) possessing equal rights and capabilities in the system.

Bitcoin is the first example of this. It is a system that allows an open network of strangers to track who has control over tokens (balances), and to record changes in the ownership of these tokens (transfers). The system essentially allows people to hold and pass tokens between themselves. The term "trustless" is sometimes used in cryptocurrency circles to refer to the property of being able to interact with people you do not know without requiring a third party to mediate.

THE CONCEPT OF THE TOKEN

A token is a digital object that can be transferred. A bitcoin token is a digital entity that can be seen via a computer and moved around. In the Bitcoin network, there is no central issuer of the token. Rather, new tokens are recorded into existence by a subset of network players called miners as a reward to themselves for facilitating transfers of older tokens. This is an elegant design in that new tokens are granted as incentives to those who validate the transfer of old tokens.

Bitcoin tokens are blank; they have nothing that they entitle the holder to. They are not vouchers, shares, legal tender or anything particular. They are the digital equivalent to a blank piece of paper. Much discussion has thus occurred about what their legal, tax and regulatory treatment should be. Many monetary scholars are sceptical about whether the tokens are money, and the cryptocurrency community vacillates between calling them money, assets and investments.

KEY CONCEPT: PROTOCOL

Bitcoin is a protocol. This means it is a set of rules. The system only exists if a network of people agree to follow these rules; if they deviate from those rules they are not using the system. Similarly, the current global internet is a set of protocols that enable interconnected computers to speak a common language. The Bitcoin protocol is built on top of the underlying protocol infrastructure of the internet. The protocol rules are encoded in wallets and other pieces of downloadable software that enable people to connect into and interact with the Bitcoin network.

Protocols can be changed. Bitcoin, though, has no clearly identifiable central party that can authorise changes. Rather, it can only change if certain key players in the system – such as the core developers and major miners – agree to change it. This is a political process and in recent years there has been much in-fighting between Bitcoin factions over making changes to the protocol.

THE ALTCOINS

While Bitcoin was the original blockchain-enabled cryptocurrency, the protocol code is open source, which means others can take it, alter it (or fork it) and attempt to convince a network of people to start running new software that embeds a new protocol. The first wave of this innovation was the altcoins, which include, for example, Litecoin, Dogecoin and Peercoin.

CONCEPT: CONSENSUS PROTOCOL

Bitcoin combines existing elements from cryptography. Firstly, there is a way to transmit messages into the network stating that you wish to move tokens, which is achieved through public key cryptography and digital signatures. Secondly, there is a way for the network to collectively agree that the transfer has happened and that it cannot therefore happen again (preventing double-spending). This is achieved through a consensus protocol, which in Bitcoin's case is the proof-of-work process. As this method is energy intensive, new consensus methods such as proof-of-stake have come into play. Peercoin was the first to implement a proof-of-stake method.

OPEN PUBLIC BLOCKCHAIN 2.0

Cryptocurrencies were the first wave of open blockchain innovation. The second major phase was the emergence of systems with a wider range of functionality. At a broad level, these systems are 1) a means for an open network of strangers to 2) keep track of their positions – or states – relative to each other and 3) to automate certain interactions with each other (smart contracts) 4) without a (clearly identifiable) central intermediary 5) with all players (theoretically) possessing equal rights and capabilities in the system.

Leading the way in this Blockchain 2.0 innovation was Ethereum. Bitcoin is essentially a narrow, or single-use, protocol that only enables a limited set of interactions between players – or nodes – on the network. The two main things you can do in the Bitcoin system are 1) receive a single type of token and 2) transfer a single type of token. The creators of Ethereum wanted to enable a wider range of token types as well as automated interaction methods.

KEY CONCEPT: SMART CONTRACTS

Smart contracts are an important new feature introduced within the Ethereum system, although a very misleading term. The closest physical-world analogy for a smart contract is a vending machine, an automated agent that acts on behalf of a seller and behaves deterministically: if you put a coin in a vending machine it is forced to give you something. It thus only enacts a contract when you interact with it. Smart contracts are – roughly speaking – conceptually similar to digital vending machines. Unlike human players on the network, they are automated agents (or robots) that behave deterministically when you interact with them. For example, you can deploy a smart contract programmed to automatically issue share tokens to people upon receiving money tokens from them. We can also imagine linking smart contracts, with one digital robot interacting with another, creating decentralised autonomous organisations – more complex automated systems.

TOKEN CATEGORIES

At a high level, a blockchain system is a digital information recording, coordination and contracting architecture, but the main mode of interacting within the system involves the transfer of digital tokens that are accounted for on the system. These can be separated into different categories:

- The first wave involved tokens that were solely useful in the digital realm. Cryptocurrencies, for example, do not reference anything in the physical world.
- The concept of a utility token has emerged. It is used ambiguously, but tends to mean "a token that enables you to interact with our digital infrastructure". For example, with Ethereum, you must use Ether tokens to activate smart contracts.
- There are also tokens that represent financial contracts. Crypto-equity tokens aim to be the blockchain equivalent of share certificates.
- Other initiatives attempt to link a token to a real-world asset. For example, Digix Global creates tokens representing physical gold. Creating tokens that reference real-world physical objects or assets is sometimes called tokenisation.
- A similar tokenisation process can be seen in the attempt to link tokens to digital or informational goods, such as digital art, licensing rights or IDs.

One key problems is how to fuse a digital token with something that exists outside of the blockchain network. Gold might exist in a warehouse in Singapore, so what would it mean to have a gold-backed token issued on Ethereum? Achieving this requires legal recognition of the blockchain recording within existing law systems. Alternatively, it requires integration with Internet of Things (IoT) infrastructure, such that things in the real world are rendered unusable unless you possess digital keys. For example, one might imagine a car rental service in which the car could only start if you activated it online through a digital access token.

The potential to completely automate processes using smart contracts, though, is limited. Many would require external experts to feed in the information upon which they act. For example, if you wished to programme a weather insurance smart contract, you still need a weather agency to give an official account of what the weather was. These third parties are sometimes referred to as oracles within the blockchain community.

CLOSED PRIVATE PERMISSIONED BLOCKCHAIN

Much of the current hype around blockchain relates to the corporate or governmental use of elements of the original blockchain protocols within more controlled or closed settings. This is the realm of permissioned blockchain or consortium blockchain, which occasionally blends into the more generic category of distributed ledger technology.

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The conceptual outlines of these systems could be summarised as follows. They are 1) a means for a closed network of (loosely) associated parties 2) to keep track of their positions – or states – relative to each other 3) and to automate certain interactions with each other (smart contracts) 3) by coming together under a mutually-agreed shared infrastructure rather than relying on finding ways to make their separate infrastructures interact 5) whilst introducing the potential for different or unequal rights and capabilities in the system.

These private blockchain systems thus reintroduce many concepts from centralised IT management, such as a system administrator that might grant different parties access to the system with different levels of control. You might only gain access if you can authenticate yourself, and you must be authorised to gain different levels of access and functionality.

Major commercial banks were early leaders in this regard. Consortiums like R3 have been designing systems for inter-bank interaction to automate co-ordination and reconciliation processes, which has historically required back-office staff to ensure that banks with different IT systems maintain the same accounts of what has happened. If the banks collectively agree to share infrastructure, they will be able to continue doing what they already do, but more efficiently and with a potentially clearer audit trail.

PART TWO: THE IMPLICATIONS OF BLOCKCHAIN FOR RESPONSIBLE INVESTMENT

CENTRAL SHARE DEPOSITORIES

Modern shares are often not directly held by shareholders, but in bulk by specialist depositories (such as the DTC in the US), which then assign shares to their individual owners by keeping a central ownership register. This has drawn attention from blockchain reformers who claim that the depositories days are over, with two ways to decentralise or distribute a central share register:

1. A single register of share ownership that is held by multiple bodies, rather than one.
2. Fragment the single digital register into thousands of individual digital tokens that are directly held by the people who own them, and use a blockchain to maintain a record of the tokens' existence and movements between the holders.

The first option is more akin to the concept of distributed file storage (i.e. we have a single file that is stored in a distributed fashion), but which raises questions around how the file is edited. The latter option is the concept of crypto-equity: the company initially issues its shares as crypto tokens that are transferred using a blockchain protocol. A shareholder holds a token that represents a share, and then uses a blockchain system to initiate the transfer of it to someone else. This is akin to a digital bearer instrument.

Hypothetically, if these systems were to become widespread, central share depositories might be rendered redundant, in that shareholders could directly hold digital shares (although whether they would want to be responsible for that is another question).

The state of Delaware has taken the lead in allowing companies to use blockchain technology to issue shares. NASDAQ has worked on making that right a technical possibility by developing its Linq system for private market crypto-equity issuance. In the near-term, however, this type of action only seems likely to be taken up by new companies that do not have legacy shares on existing systems.

SHAREHOLDER E-VOTING PLATFORMS

Of more immediate relevance to institutional shareholders are innovations in proxy voting. Several financial institutions and central share depositories (CSDs) have been investigating the use of private blockchain systems to implement shareholder e-voting infrastructure. An early-mover was NASDAQ, which launched a pilot project in Estonia in February 2016 to reduce the time, complexity and cost of shareholder voting. Various national share depositories have been experimenting, including Russia, Abu Dhabi, South Africa and the CSD Consortium Working Group (formed by Russian, South African, Swiss, Swedish, Chilean, Argentinian and UAE central depositories).

These systems use private blockchains and retain control for CSDs. As an example, the NASDAQ system essentially piggybacks on the CSD registers to assign voting rights and voting tokens to identified shareholders, who can then spend those voting tokens on agenda items. Another example is Broadridge, the major investor services firm that runs electronic proxy voting infrastructure. Broadridge completed a pilot project with JP Morgan, Northern Trust and Banco Santander using a private Ethereum-derived blockchain, seeking to "provide an example for how a client could use a distributed ledger to gain daily insight into vote progress" (see the original press release).

Others are campaigning for a more radical use. An Oxford University report from August 2017 by Christoph Van der Elst and Anne Lafarre issued "a plea for the modernization of the AGM with the use of blockchain technology and smart contracting." They argue that AGMs have become dull rubber-stamping affairs, that investors are provided with inadequate information, very limited forum time, and limited decision-making capabilities. They advocate for a private blockchain system with smart contracting systems in which shareholders can place proposals and upon which other shareholders "are *immediately* notified and can exercise their voting rights during a short period".

Proxymity is a digital voting system that enables investors to vote in real time, potentially removing multiple inefficiencies in the proxy voting chain, including traditional deadlines for submitting votes days ahead of company AGMs. It will be rolled out in the UK market for the 2018 Proxy season with plans for additional market expansion later in the year[2].

2 See press release: https://www.businesswire.com/news/home/20171113006102/en/Citi-Successfully-Pilots-New-Digital-Platform-Transform

GIVING VOICE TO BENEFICIARY ESG PREFERENCES

London-based CAPITALusM is building a system to provide a direct conduit for individual beneficiaries of funds to express their voting wishes to fund managers, who will in turn split their total votes to reflect the preferences of their clients (assuming that fund managers commit to honouring client wishes). They are also aiming to implement a liquid democracy feature in which people can delegate their votes to NGOs, as well as a process for proposing resolutions.

REAL-TIME TRACKING OF ESG DATA

There are many generic claims about blockchain technology's ability to make data more transparent and visible, and yet it is not immediately obvious that blockchain technology specifically is suited to this. Lack of data is either a data acquisition (producing accurate data) or data reporting (making that accurate data visible) problem, neither of which require blockchain technology. The first is the realm of data capture (via, for example, Internet-of-Things sensors, monitoring and big data infrastructures), and the latter is often a political or legal issue, rather than a technical one.

In June 2017 the UNFCCC claimed that blockchain could provide "better tracking and reporting of greenhouse gas emissions reduction and avoidance of double counting", but did not specify exactly how this would be achieved. It launched a climate chain coalition and issued a call-out for collaborations, partnering with groups such as HackForClimate (associated with the Climate Ledger Initiative) to come up with solutions. The tracking use case appears to echo much of what Provenance and other groups are already working on, seeking to verify products being bought by scanning and checking them against a (distributed) database of sustainability information, "to track, certify and transfer sustainability attributes of commodities, like the carbon footprint of a litre of milk". Much of this remains at the pilot project stage, and not much can be done with blockchain technology alone.

AUTOMATING INTER-BANK COORDINATION

Banks have been interested in experimenting with the possibility of using private blockchain – or distributed ledger – systems to automate the coordination processes between themselves using technology like R3's Corda system or Hyperledger's Fabric system. The state aim of experimenting with this is to update the collective infrastructure between banks and other financial institutions, and to increasingly automate the behind-the-scenes co-ordination.

Distributed ledger technology potentially offers benefits whenever there is need for a group of related parties to coordinate an activity. These areas include clearing and settlement, derivatives clearing, syndicated loans, trade finance, core banking systems, international payments and interest in central bank cryptocurrencies – a somewhat misleading way to describe central bank-controlled digital currencies that use elements of crypto systems.

A major issue with commercial banks, though, is getting all the partners to agree on a common infrastructure design and then motivating them to change their legacy systems, which is costly and requires significant resources (in time and training, for example). There is thus emphasis on designing systems that enable banks to continue running their existing infrastructure whilst being able to plug in to a blockchain system, rather than replacing their entire infrastructure.

CRYPTOCURRENCIES AS AN INVESTMENT ASSET CLASS[3]

A range of financial institutions have begun offering funds, ETFs and structured products to allow either long or short exposure. There have been a range of diversified crypto venture capital funds (investing in crypto businesses) and cryptocurrency funds (that hold tokens). Greyscale launched the Bitcoin Investment Trust; XBT Provider AB Sweden launched Bitcoin and Ethereum trackers in July 2017; and Swiss structured product providers Vontobel and Leonteq have both released Bitcoin tracker certificates, including Bitcoin shorting products. The design and legal structure of these products is beyond the scope of this paper, but most appear to be backed by holdings of cryptocurrency, rather than synthetic exposure via derivatives. The market for crypto derivatives (e.g. forward contracts, options, swaps) remains small, but the launch of Bitcoin futures by CME Group could assist with the future development of structured products.

3 Here we are commenting on developments in technology. The PRI does not have a view on the value of cryptocurrencies as an asset class.

However, it is important for investors to consider the energy implications. The "proof-of-work" concept is energy intensive, with miners competing to process the transaction with more and more processing power.

Bitcoin has also been associated with criminal activity. The concept of an online wallet "that holds bitcoin" is not regulated, and so, bitcoin (assuming bitcoin can be 'cashed' into "real" currencies by both sender and receiver) can be used to money launder or for fraud. From 2011 to 2013, Bitcoin was notable for its use on Silk Road – an online market place that combined bitcoin technology and Tor for, among other things, selling drugs.

ALTERNATIVE CAPITAL RAISING

One of the major blockchain buzzwords that has risen into the public imagination is the ICO, or initial coin offering, presented as an alternative method of raising money for start-ups or enterprises. Originally, most of the businesses raising money using ICOs were attempting to build blockchain-based or decentralised services, but, more recently, "ordinary" businesses have also been drawn to ICOs. This is in part due to the speculative frenzy that has accompanied many of these ICOs, with enterprises able to raise sizable amounts with very little track record or clear business plan. The process is quite simple: a company solicits money from people and gives them tokens in exchange, and the tokens – in theory – represent some claim upon the future success of the company. In this sense, ICOs are similar to share issuance or IPOs, but they are unregulated and the legal status of the tokens issued is far more questionable.

Many ICOs have been criticised as being scams, or at the very least, akin to Dot Com Bubble shares issued by teams without robust propositions. Unsurprisingly, a major debate that has sprung up concerns whether ICOs should be regulated, partly hinging on the legal characterisation of the tokens being issued. Many instigators of ICOs have been at pains to prevent the tokens being characterised as securities, whilst simultaneously marketing them to people as an investment opportunity. The main loophole to address this is to characterise the tokens not as shares but as utility tokens that will enable the holders to interact with the future platform or product once it is built.

In this sense, the process is somewhat analogous to a management team of a non-existent gym selling gym memberships that promise access to a future gym as a way to raise money to actually build that gym, which in turn will accept the memberships. To many regulators, such a process looks very similar to issuing shares to obtain money to build an enterprise that will later benefit the shareholders. The tokens, however, often do not carry any of the legal rights that shares would (such as rights to dividends and voting), so they appear to be neither shares nor, for that matter, utility tokens, given that the platforms that would give them utility do not yet exist. Many appear to be a form of quasi-equity that are sold on the promise that they will later convert into utility tokens when the enterprise builds something that will have utility. To some extent, they are similar to crowdfunding projects that raise money by promising people products in future, but differ in that the tokens can be traded on secondary markets.

The ICO markets are currently too small to be of major interest to institutional investors, who also dislike the legal ambiguity of the tokens. That said, and despite widespread market fraud and abuse, they are important test beds of hypothetical future hybrid financial instruments. The sophistication of tokens issued is increasing, and authentic shares and bond instruments could one day be modelled in crypto token form.

BLOCKCHAIN FOR GOOD: BLOCKCHAIN FOR ENVIRONMENTAL, HUMANITARIAN AND SOCIAL SERVICES

Much activity in the blockchain space is motivated by people speculating for profit, or cutting business costs to optimise profit. Nevertheless, there is an emergent "blockchain for good" or "blockchain for impact" community, attempting to use it for non-commercial purposes. Individual humanitarian organisations, UN agencies and social enterprises have launched private initiatives, and coalitions are emerging. These include the Blockchain for Impact Coalition, set up as a conduit for UN agencies to engage with private blockchain technology vendors, the Blockchain for Social Impact project run by ConsenSys (a major for-profit Ethereum application developer), and the Blockchain for Good think tank. Meanwhile, the EU Commission has put out "blockchain for social good" calls.

The major categories that tend to be focused on include:

- Financial inclusion: Remittances, microinsurance (Stellar)
- Ethical or transparent supply chains: Tracking the origins of raw materials (Provenance) or conflict-free diamonds (Everledger)
- Open government: Finding ways to promote greater visibility of public spending
- National e-voting systems for tamper-proof election results
- Direct democracy systems: Enabling people to participate in democratic decision making
- Securing property rights: Land registry systems
- Humanitarian aid distribution systems
- Charity donation systems
- Identity systems: Self-sovereign identity or the ability to control one's own identity
- Sustainability and climate change
- Distributed renewable energy: For example, energy trading systems
- Education: Secure recording of educational certificates, for example
- Healthcare: Storing and access to medical data, for example
- Decentralised platforms for a collaborative economy

It is important to note that many projects within these areas are, firstly, aspirational in that they are not widely deployed; secondly, address problem areas that do not necessarily require blockchain technology; and, thirdly, do not necessarily address the problems they claim to solve. A healthy dose of scepticism is advised when assessing them.

CONCLUSION

It is important to note that many blockchain technology projects are not claiming that "this cannot be done without blockchain". Rather they are normally saying "we can do this previously centralised function in a decentralised way".

As Provenance notes, "Until now centralised data systems were the only way to power a traceability system for materials to ensure data was trustworthy... We believe [blockchain] can disrupt how we track the attributes and journey of every material thing - powering a system everyone in the supply chain can be part of."

The value proposition is either phrased in terms of 1) efficiency – "this will work better" or else 2) participatory democracy – "this will be more inclusive and responsive to people's needs" – posing questions of ethics and philosophy, which is unique to the application of blockchain and the investor.

Feedback, further resources and suggestions for future work on blockchain can be sent to innovation@unpri.org.

CREDITS

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The Principles for Responsible Investment (PRI)

The PRI works with its international network of signatories to put the six Principles for Responsible Investment into practice. Its goals are to understand the investment implications of environmental, social and governance (ESG) issues and to support signatories in integrating these issues into investment and ownership decisions. The PRI acts in the long-term interests of its signatories, of the financial markets and economies in which they operate and ultimately of the environment and society as a whole.

The six Principles for Responsible Investment are a voluntary and aspirational set of investment principles that offer a menu of possible actions for incorporating ESG issues into investment practice. The Principles were developed by investors, for investors. In implementing them, signatories contribute to developing a more sustainable global financial system.

More information: www.unpri.org

PRI Principles for Responsible Investment

The PRI is an investor initiative in partnership with UNEP Finance Initiative and the UN Global Compact.

United Nations Environment Programme Finance Initiative (UNEP FI)

UNEP FI is a unique partnership between the United Nations Environment Programme (UNEP) and the global financial sector. UNEP FI works closely with over 200 financial institutions that are signatories to the UNEP FI Statement on Sustainable Development, and a range of partner organisations, to develop and promote linkages between sustainability and financial performance. Through peer-to-peer networks, research and training, UNEP FI carries out its mission to identify, promote, and realise the adoption of best environmental and sustainability practice at all levels of financial institution operations.

More information: www.unepfi.org

UNEP FINANCE INITIATIVE

United Nations Global Compact

The United Nations Global Compact is a call to companies everywhere to align their operations and strategies with ten universally accepted principles in the areas of human rights, labour, environment and anti-corruption, and to take action in support of UN goals and issues embodied in the Sustainable Development Goals. The UN Global Compact is a leadership platform for the development, implementation and disclosure of responsible corporate practices. Launched in 2000, it is the largest corporate sustainability initiative in the world, with more than 8,800 companies and 4,000 non-business signatories based in over 160 countries, and more than 80 Local Networks.

More information: www.unglobalcompact.org

United Nations Global Compact