

Blockchain & the SDGs:

How Decentralisation Can Make a Difference



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How Decentralisation Can Make a Difference

June, 2021

dGen is a non-profit think tank based in Berlin, Germany. We focus on how blockchain technology can contribute to a decentralised future in Europe and what this might mean for people, society, private entities, and the public sector over the coming decades. If you would like to be involved, please get in touch at dgen.org.

PositiveBlockchain is the open database, knowledge platform and community exploring the potential of blockchain technologies for social and environmental impact. The database currently lists more than 1100 projects and startups using blockchain technologies for good. PositiveBlockchain is a contributor-based non-profit association registered in Paris and active globally.

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dGen, 2021

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- Tamanna Khan - Director & Senior Consultant at Technovative Solutions Ltd. & Culture and Adoption Co-Lead at PharmaLedger
- Ricardo Garcia - Head of Partnerships & Blockchain Advisory at Scantrust
- Manu Alzuru - Founder of DoinGud
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Julian Circo, Writer

Blockchain Entrepreneur

Founder, Hyfe & Proof of Impact

Foreword

In the early 2010s, I was running a large public health organization in Mozambique. We had thousands of collaborators across the country who needed to be paid every month. We did this by having people drive around with bags of cash.

Needless to say, this gave me sleepless nights. It also became my gateway into blockchain, and a launchpad into an eventful journey of entrepreneurship at the fringes of this curious technology.

As I was educating myself — mostly on obscure forums in what felt like the underbelly of the Internet — I became convinced of the potential of decentralisation to change the way we deliver impact at scale. Alas, not a lot of blockchain people in those days cared much about impact.

Sure, there was excitement about Bitcoin as financial infrastructure for the unbanked. But, I was talking about building entire impact financing and delivery platforms on top of blockchain technology.

I would talk to anyone who would listen, but my progress was slow. I was trapped between two worlds. The world of blockchain, with a strong individualistic bias, had little interest in social impact; and, the world of impact (my peers at the time), less tech-savvy folks, were also instinctively suspicious of blockchain.

Turns out, I was not the only one trapped between these two worlds. Others were trying to apply blockchain to critical problems: carbon credits, event-triggered insurance, natural capital, and more. Their efforts, like mine, were trapped in a vacuum, though.

We were trying to crack the code on decentralisation, but what we really needed was a community to amplify our learnings, structure our knowledge, and encourage us to reach higher.

Today, things are very different. Blockchain technology evolved enormously, as did our understanding of its potential. The world itself is changing in subtle but important ways; a generation that cares deeply about impact is coming of age. They understand that any acceptable version of the future will need some sort of trustless infrastructure to protect us from monopolies and corruptible authorities.

The gap between the two worlds is closing.

Which brings me to this report. As our community grows, reports such as this become invaluable to increase collective knowledge and inspire change.

The best innovation reaches impact by changing apparently unrelated industries. This report spans several worlds and different, haunting problems that our generation needs to solve.

While blockchain — and decentralisation — will not solve these problems alone, they will unlock and accelerate successive waves of innovation.

Reports, case studies, and documented learnings are hugely important for any impact-driven innovator and entrepreneur. I also hope that a fair share of investors and others at the forefront of impact financing will pursue this report to stay ahead of the curve in supporting innovation that will provide impact ROI.

I wish I had something like this all those years back in Mozambique.

Executive Summary

Introduction

Many believe that emerging technologies can be tools to generate positive impact. This is furthered by the fact that these technologies, especially decentralised technologies, can enable solutions by the people, for the people. This supports global goals, and many projects can be specifically linked to the UN's Sustainable Development Goals (SDGs). This report looks at the potential and challenges of blockchain solutions related to lack of identification, financial exclusion, supply chain management, and climate change by incorporating expert opinions and reviews of existing solutions.

Identity

There is a lack of government recognised and accessible identification for nearly one billion people.²⁰ Although not officially recognised by governments, many entities can provide functional and transactional identities. These solutions allow people to access a variety of necessary services inaccessible without any identification. Digital tools, including blockchain and DLT, improve verifiability, opening these solutions to a wider range of service providers and building infrastructure for vulnerable populations.

Use cases

- **GoodWorker** is a matchmaking platform for seasonal workers and employers, that supports finding jobs and builds employment history using decentralised identifiers.
- **Good Health Pass Interoperability Blueprint** is a benchmark released this year for nations without a defined framework for Covid-19 information, such as test results, vaccination status, and recovery status.

Finance

Payments and Remittances

While cash is still the primary mode of payments globally, digital payments rose in the last decade. This is positive for economic development, as digitalisation brings greater transparency, access to e-commerce, and improves credit scoring systems — and therefore loan access. Although with some challenges, blockchain and cryptocurrencies can enable access for unbanked individuals through identification

solutions, more versatile applications, and lower costs. Further, it has potential to lower remittance friction and fees significantly.

Humanitarian Aid & Development

The humanitarian sector suffers from high management costs, lack of transparency, low beneficiary involvement, and power centralisation. The tech sector can provide solutions to make it more efficient and inclusive. Blockchain specifically can support distribution of funds, control, and management, while lightening bureaucracy. However, first local digital divides must be addressed, as well as industry resistance, lack of technological literacy, and poor interconnection between the tech and humanitarian sectors.

Community Currencies & UBI

Community currencies, although not new, are flourishing again in the era of digitisation.⁷⁰ Digital tools are also opening new possibilities for universal basic income (UBI). There are targeted benefits for local communities and individuals, especially those with low-purchasing power, high levels of unemployment, and poverty. Blockchain-based solutions enable decentralised social security and assistance programmes, which also profit from transparent, cheaper, and user-centric means.

Use Cases

- **Ǧ1 Libre Money** is an economic experiment to build a fairer monetary framework, thanks to a community-based system where money is equally created by members.
- **TruBudget** is a digital solution that provides more accountability and transparency to international aid allocation, improving mutual cooperation, communication, and trust.

Supply Chain

Supply Chain Transparency

Blockchain can be a useful tool for supply chain management and traceability. Modern supply chains are increasingly complex. Existing digital solutions and automation can bring transparency and efficiency for both end-users and businesses. This is especially true for the agri-food sector, given the enormous range and importance to our health.

Modern Slavery & Poor Working Conditions

Deeply connected to global supply chains are unethical working conditions — an issue affecting all industries. Socially centred, blockchain-based solutions can address worker and employer needs to mitigate this issue by providing greater transparency and oversight into employment conditions. However, implementation of any solution for this issue requires extensive knowledge of social factors, human relationships, and a wider social change.

Counterfeit Drugs & Vaccines

Globally, the counterfeit drug trade reached \$4.4 billion in 2016.⁸⁵ This issue is far-reaching, degrading trust in pharmaceutical and health systems, income for stakeholders, and, most importantly, can result in therapeutic failures for patients. With the Covid-19 pandemic, the problem is more pressing than ever, as vaccination efforts rely on high levels of trust and success. Digital solutions, like blockchain, can provide more transparent systems, improving trust between parties and ensuring the integrity of products, data, and supply chains.

Use Cases

- **Scantrust** is a cloud-based software platform that provides transparency solutions along the whole supply chain.
- **DoinGud** is an initiative that facilitates an NFT-based art market with built-in money streams to social impact organisations.

Environment & Climate Change

Climate change is a pressing, global problem. Blockchain, while criticised for high energy consumption, does present some novel solutions for natural resource management and climate accountability. Specifically, CO₂ tracking and trading stand to gain using Carbon Supply Tokens, better data collection, and decentralised models of governance. However, digital solutions still require international cooperation and commitment to the goal of a low-carbon economy.

Use Case

- **Energy Web & Crypto Climate Accord** supports the goal of accelerating the transition to renewable energy. Energy Web co-launched the Crypto Climate Accord to decarbonise the crypto industry.

Blockchain Platforms for Social Good

Technology platforms increasingly play a role in the promotion and deployment of blockchain solutions specifically designed for the SDGs. Ethereum's Next Billion and Cardano's Project Catalyst are two of the largest initiatives in the blockchain space, and provide some insights into interest on the side of tech players.

Conclusion

Current blockchain implementations go beyond business efficiency, entering the social sector and expanding the horizons of both. Although digital solutions, blockchain included, still present application challenges and face industry scepticism, their potential points to a future in the social sector. Deeper understanding of individuals' needs (as well as their active involvement), wider technological literacy and access, and better integration are still required. But, blockchain and related solutions can bring added value if developed with a defined vision, such as those outlined by the SDGs.

Introduction

Introduction

Back in 2015, the United Nations set 17 interconnected global goals, the Sustainable Development Goals (SDGs), intended to be a 'blueprint to achieve a better and more sustainable future for all'.¹

Six years later, action needed to achieve the SDGs by 2030 still presents challenges, highlighted by the effects of Covid-19. The pandemic threatened global stability and development, pushing millions more into poverty. But it also accelerated trends, such as the quest for digitalisation, promotion of local cooperation and economies, and the search for more resilient infrastructure for public institutions, financial services, trade, energy, and healthcare.

In this context, many stakeholders continue the fight to create a better reality, believing in a world of opportunities where emerging technologies can be used as tools to generate a positive impact by the people, for the people. Throughout 2017 and continuing into 2021, decentralisation was heavily experimented with. During this time, the first applications of Decentralised Ledger Technologies (DLTs), such as blockchain, were piloted. This is still a relatively new technology, but certain people see it as the greatest revolution since the advent of the Internet. Thanks to this new technology – in its basic form a shared ledger of data — people and organisations found new ways to create, store, and share value — away from traditional models and intermediaries.

SUSTAINABLE DEVELOPMENT GOALS



Source: ³

Populations under authoritarian regimes created immutable records on the blockchain to document atrocities in Syria² (SDG 16),³ or circumvent capital controls and hyperinflation using cryptocurrencies in Venezuela⁴ (SDG 1,2,8,10).³ There is a whole new financial system — Decentralised Finance (DeFi) applications — with the potential to provide financial inclusion to the two billion unbanked people globally. Remittance fees for the poor are being cut with the use of digital currencies. Community currencies are helping boost local economies from Niger to Hong-Kong, and from Colombia to Tunisia⁵ (SDG 8,10).³ Rainforests in Brazil are being tokenised to trade carbon credits⁶ (SDG 13).³ Fair trade farming, from cocoa and banana plantations in Ecuador,⁷ to tuna fisheries in the Pacific Ocean,⁸ is improved by transparent, secure, and immutable supply chain records (SDG 14,15).³ As is the sourcing of natural minerals used for production of electronics in West Africa,⁹ which helps to protect natural habitats and mitigate child labour (SDG 8,12).³ Land registries are being digitised, secured, and managed from Afghanistan¹⁰ to Georgia¹¹ to Estonia¹² (SDG 9,11).³ Public procurement processes in Peru¹³ and Mexico¹⁴ have been piloted on blockchain to curb corruption (SDG 9).³ Humanitarian cash and voucher assistance is being delivered via blockchain to the most marginalised populations much faster and at the fraction of a cost, from tropical cyclone victims in the Pacific Islands¹⁵ to refugee camps in Jordan¹⁶ and Bangladesh¹⁷ (SDG 1-10).³

What can we learn from these early experiments in 2021? What is today's maturity of decentralisation and blockchain solutions applied to the myriad of Sustainable Development challenges? We look at the current status in the key areas of Digital Identities, Financial Inclusion, Supply Chains, and Climate & Environment.

Blockchain Innovation for the SDGs

The open database of PositiveBlockchain contains close to 1100 projects — some of which are listed above — from startups and corporations, to governments, NGOs, and academia, all using blockchain and decentralised technologies as the tools to create a positive impact and solve social or environmental issues.

Fourteen categories and 57 subcategories help structure the database and organise the projects in the most comprehensive way. The range of categories represents the diversity of fields of activity in blockchain for impact. Subcategories are connected to SDGs, based on PositiveBlockchain's own adaptation of the "Toniic SDG Impact Theme Framework".¹⁸

Figure 1: PositiveBlockchain Database by Categories



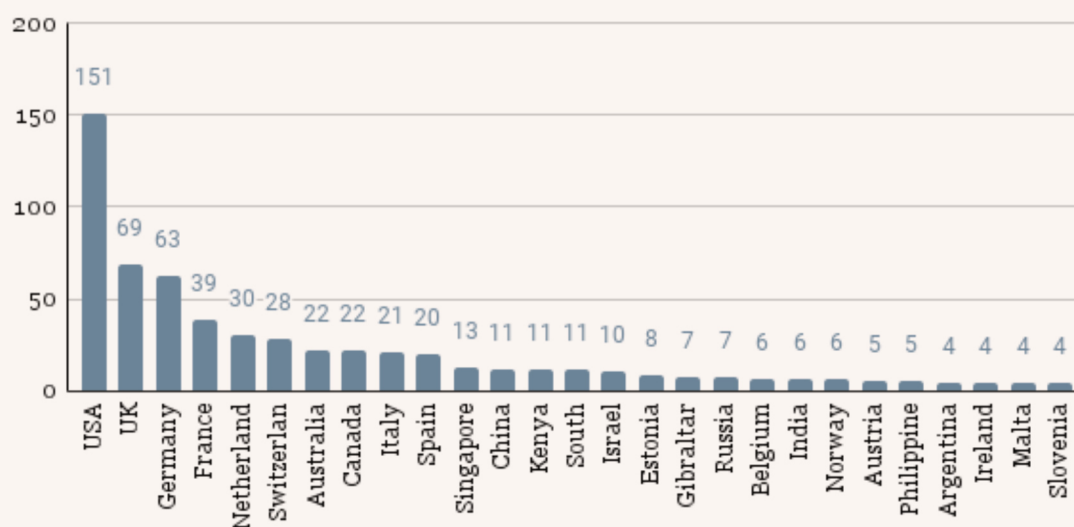
Source: ²¹

Within these, financial and supply chain use cases seem to be gaining stronger maturity, thanks to faster adoption, higher technology maturity, and feasibility. Their attractiveness to investors should also not be overlooked. These sectors are naturally connected to the reality of countries in the global South, many of which are fighting issues related to financial inclusion (financial inclusion, insurance, remittances, and aid delivery), agriculture (agritech, trade facilitation, and food traceability), and general supply chains created by power imbalances and extractive practices in favour of richer nations.

Most database entries, as shown in the chart below, are headquartered in or originate from Western countries, which can be explained by access to capital, investors, and clearer regulations, all of which benefit the ecosystem. A staggering number of projects (151) come from organisations based in the United States.

However, implementation of many of the projects is in countries in the global South (Latin America, Africa, South-East Asia, and the Pacific), which generally experience more critical SDG challenges and may show a greater eagerness for testing and implementing blockchain solutions at the core of public services. Decentralisation, as well as, blockchain technologies, help these regions “leapfrog” — switching rapidly to the latest available technologies, skipping earlier iterations — especially where the infrastructure previously lagged. It is particularly evident in government administration (think of land titling, public procurement, or identity registries), energy, and healthcare.

Figure 2: Number of Database Entries by Location of Headquarters



Source: ²¹

PositiveBlockchain's database is evolving fast, reflective of the market. If many projects come to maturity, many also pivot, fail, or are aborted (16% of projects in the database are identified as 'aborted or inactive'). We intend to continue monitoring the ecosystem and welcome any contributors to make it a collaborative effort.

The database helps identify great projects to learn from. More efforts are needed to recognise local projects representing all regions and use cases around the SDGs. PositiveBlockchain welcomes further contributors to do so in its proposed collaborative open database.

For the core of this report, we selected four key categories: Digital Identity, Financial Inclusion, Supply Chains, and Climate & Environment. We, dGen and PositiveBlockchain, reached out to experts, blockchain entrepreneurs, and impact practitioners to get their insights. Some wrote entire sections related to their work, while others provided information and analysis on the state of impact that shaped our writing. These insights give an overview of their areas of focus, and as such, this is not a comprehensive view. This information was collected independently, without any financial sponsorships from the projects included. We thank all of our contributors warmly and hope you will enjoy and learn from reading this report.

1 Identity



Identity

It is estimated that roughly one billion people suffer from inadequate identity systems or entirely lack access to official identification.²⁰ SDG 16.9 sets clear and ambitious targets related to this, including: 'by 2030, provide legal identity for all, including birth registration'.³ Lack of identity documents results in additional issues, particularly in accessing social protection (SDG 1), combatting epidemics (SDG 3), supporting women's empowerment (SDG 5), and accessing financial services (SDG 10).³

These issues mainly hit the most vulnerable segments of the population, including migrants, women, refugees, and low-income individuals.

These issues mainly hit the most vulnerable segments of the population, including migrants, women, refugees, and low-income individuals. South Asia and Sub-Saharan Africa are the most affected regions.²⁰ To provide the most use, personal identification should be unique and have legal standing at the national level and — given the current status of the global digitalisation — a digital version. As mentioned above, this is recognised as a fundamental right by the UN's SDGs.³

In the blockchain space, digital identity offers unique representation to any subject in any transaction. It is therefore a pivotal component of blockchain applications, with the potential to bring about change in many different sectors that rely on identity, but provide other services. In PositiveBlockchain's category, "Identity & Ownership", 65 projects fall under the subcategory "Digital Identity".²¹

Identity documentation is a widespread and complex issue. The Covid-19 vaccination campaign showed another side of this, and even greater pressure to move to digital solutions. Although not a simple process, digitisation can bring many benefits, making identity more usable, and when paired with decentralisation, even returning greater agency to recipients.



Balázs Némethi, Writer

**Head of Operations, Decentralized
Identity Foundation**

CEO, Taqanu



Sandeep Bajjuri, Writer

**Partnerships & Community Manager,
Affinidi**

Digital Identity

The line between physical and digital is eroding. Particularly, there is a need to link identities to the digital space, which receives growing attention from international communities. Furthermore, while physical services are still more common globally, hybrid systems — which combine physical solutions with digital signatures — are exponentially growing due to wider usability and capabilities.³⁰ However, privacy remains a primary concern and key drawback to digital identity systems.

Even with concerns, the benefits are too great. As such, most countries around the world are already in the process of researching the benefits and issues of government-issued digital identities. Some of these initiatives include:

- India, with a population of over 1.3 billion, has a digital identity system called “Aadhaar”, and has managed to issue identification to almost 90% of its population.³¹
- The European Commission recently announced a framework and guidelines for a European Digital Identity.³²

Identity as a Fundamental Right

We rely on our identities for most actions in day-to-day life, but still this right is too often not available to those who need it most. While it may sound like a simple concept, the requirements can significantly differ between nations, complicating these schemes.

Most international efforts strive to provide foundational

identities to people with no or non-formal identities. Foundational identities are established by the government, such as birth certification or national identity schemes, and allow for legal recognition. Without legal recognition by the state, individuals are cut off from many rights, support programmes, benefits, and even services from private providers.

Organisations working with refugees and stateless people must often invest tremendous resources to help people (re)establish themselves, even in case of loss of proof of their formal foundational identity. While foundational identities are the most widely recognised and enable access to the greatest breadth of services, functional and transaction identities can help to bridge the gap for those without. These forms of identification are generally not government-issued. Rather, they serve specific functions in a given environment. For instance, an international NGO setting up a physical card for access to a refugee camp and weekly stipend is a functional identity. It might not be recognised as a valid government-issued ID, however, in certain places and times it offers functionality and associated trust. This makes it tremendously valuable. Transactional identities, on the other hand, establish a link between multiple service providers. For example, when a local business is willing to accept the card from the first example, this becomes a transactional identity; trust is no longer directly established at the place of interaction, but by a third party.

While these types of identities can be issued in analogue form, there is much higher risk of loss or tampering and greater bureaucratic load to align multiple participating organisations. All of this significantly reduces the utility and feasibility of these solutions.

Decentralised Identity

With the advent of blockchains and DLTs, a new model of identity is emerging — Decentralised Identity.

Decentralised identities establish a trust framework in which identifiers, such as usernames, can be replaced with IDs that are self-owned, independent, and enable data exchange.

Decentralised identities establish a trust framework in which identifiers, such as usernames, can be replaced with IDs that are self-owned, independent, and enable data exchange. In this instance, data exchange relies on decentralised technologies, such as blockchain and distributed ledgers, to protect privacy and secure transactions without intermediaries. In other words, verification of identity can occur without needing a third-party to access and store sensitive information. While decentralised identities have the potential to operate at higher standard of

security and privacy compared to today's systems, some of the challenges that remain include key management, interoperability, and user-experience, particularly around Digital Identity Wallets, among others.

There are a few building blocks for such a framework:

- **Decentralised Identifiers (DIDs)** DIDs are one of the basic building blocks of Decentralised Identity. These are a type of unique identifiers (URI) similar to an ID number or social security number, but usually made up of a string of characters.
- **Verifiable Credentials (VCs)** VCs are machine-readable, tamperproof credentials, issued by a competent authority, such as governments or other trusted institutions, that can be verified.³³ They establish the existence and uniqueness of an entity.
- **Verifiable Data Registries** Blockchains play the role of a global discovery of linked decentralised identities. However, it is important to point out that blockchains are not privacy preserving technologies, and no data should be stored directly on a blockchain.
- **Trust Triangle** Issuers, holders, and verifiers make up the trust triangle. In this system, the issuer provides a credential, the holder is the entity or person to whom the credential is being issued, and the verifier confirms that credentials meets the established criteria of a VC.

Decentralised identity frameworks enable less regulated entities to act as providers by reducing the amount of previously established trust necessary between parties. This is particularly true for functional and transactional identities. While foundational identities should remain a goal, these types of identities play an important role in ensuring faster access to resources.

Decentralised identity systems are capable of distributing power over data due to their inherent design that keeps the user (data owner) always at the centre of decision-making. However, the same systems, if implemented with different intentions, can be turned into a powerful tool of a surveillance economy.

Use Cases

GoodWorker

In India, approximately 400 million workers are considered informal employees,³⁴ lacking access to formal employment contracts or permanent jobs. Of this population, close to 140 million are seasonal/migrant workers,³⁵ who spend part of the year working informal jobs in cities and the rest of the time in their villages tending to farms. Lacking proof of work experience or certificates, they tend to go through the same tedious process every year to find jobs, and are unable to access services like loans, insurance, etc.

GoodWorker, a startup based in India, acts as a matchmaking platform for seasonal workers and employers.³⁶ They also leverage the power of VCs and DIDs to improve seasonal workers' lives.

In an ideal scenario, once a worker signs up, GoodWorker verifies their identity via Aadhaar — India's digital identity service — APIs, and issues a DID. They also facilitate the issuance of VCs for any courses the candidate may take on the platform and for work experience. In this way, people are able to build their reputation, accumulating employment history and gaining access to more services.

While what is described is the ideal scenario, there are multiple hurdles to achieving this vision. First, more than 50% of the Blue Collar Workers (BCWs) earn less than INR 25K per month, which places them at minimum wage in jobs that require low skills levels. Employers also prefer to keep wages low for these entry level jobs. Given the lack of deep career paths in this sector, most employers don't see the value of verification beyond basic identity and almost always assess and train candidates on their own. Similarly, most financial institutions don't have financial products for consumers who earn less than INR 25K per month. GoodWorker is therefore involved in experiments with the employment ecosystems to ensure there is a good match for workers skills and the VCs they provide. While there are challenges, if adopted widely, VCs could revolutionise the way BCWs access and avail jobs and services seamlessly.

Vikram Bhat, Reviewer
Chief Product Officer,
GoodWorker



Covid-19 Credentials

Since the beginning of the Covid-19 pandemic, countries across the world have been trying to implement various measures to curb the spread of the virus and restart their economies. During the course of the pandemic, the need to prove status related to the virus, like proof of vaccination, test results, or proof of recovery, became essential to access airports, educational institutes, sports and event venues, restaurants, and so on. Making this information verifiable and tamper-proof is of the utmost importance, and led many organisations to turn to blockchain.

Providing this information poses the risk of sharing sensitive health-related data, though, raising privacy concerns. On the other hand, existing paper based credentials (WHO yellow card, Impfpass, etc.) can easily be altered or faked. Further, as Lucy Yang, Community Director of the COVID-19 Credentials Initiative (CCI), 'individual[s] are now asked to present COVID health status when crossing borders, but[... there] is a missing trust mechanism among countries'. She continues that centralised approaches are not feasible for the entire world — demanding the use of some sort of decentralised architecture.

Privacy preserving credentials also pose an interoperability challenge when dealing with different country systems, with various frameworks and regulations. However, Yang continues that 'the adoption and success of decentralization require a lot of coordination among key stakeholders,' a slow process. 'For this pandemic, the best we can do is to accelerate the [evolution] of standards and technology'.

That is what the Good Health Pass Interoperability Blueprint was released to facilitate.³⁷ It serves as a benchmark for nations without a defined framework. Some of the countries that published these standards include:

- Digital COVID Certificates by European Union³⁸
- Digital Documentation of COVID-19

Certificates (DDCC) – WHO³⁹

- Vaccination Credential Initiative (VCI) – United States⁴⁰
- Digital Infrastructure for Vaccination Open Credentialing (DIVOC) – India.⁴¹

According to Yang, 'we shouldn't wait for another global pandemic to figure out how decentralized technology can be used to facilitate the responsible and effective use of personal health data'.

Lucy Yang, Contributor

**Community Director,
COVID Credentials Initiative**



2

Finance



Finance

Access to financial services is still an issue for many. On top of limiting individual rights and access to services that can enable wealth growth, this presents a major roadblock for economic development.⁴² Financial inclusion is also recognised as a fundamental enabler to achieve the other development goals by the UN. It is a target in eight SDGs, such as in SDG 1 (eradicating poverty), SDG 9 (supporting industry, innovation, and infrastructure), and SDG 10 (reducing inequalities).³ While digital finance can support more equitable growth by reducing delays and friction, human-centric design and involving affected people at the decision-making level is crucial to open new paths to prosperity.

The blockchain paradigm is shaking up stagnant systems of traditional finance. Twelve years after the launch of the first cryptocurrency, blockchain both became more entangled in speculation for some, and began to disengage and spread beyond that use. Over the past five years, its adoption demonstrated the potential to decentralise systems in sectors that were once totally dependent on traditional financial institutions. This brought more inclusive options.

In PositiveBlockchain's database, 231 projects are related to the category "Finance & Insurance".²¹ Out of these, 69 are tagged with the subcategory "Payments & Cross-border Transactions", 57 with "Financial Inclusion", and 24 with "Investing & Impact Investing".²¹ Other applications are related to crowdfunding, lending, and micro-insurance.

Jane Thomason, Founder of Supernova Data & Industry Associate at UCL Centre for Blockchain Technology, has focussed extensively on blockchain for financial inclusion. She comments, 'using blockchain technology to transform payment systems and reduce the cost of remittances will positively impact on investment, economic growth, education, health, financial inclusion, and promote economic development and welfare as countries recover from the economic consequences of the [Covid-19] Pandemic. Many of these solutions are already being used across the developing world. With intentionality and investment, they can be scaled, and enable more funds to reach those in greatest need'.

The potentials of this field are vast, but the ability to enhance the aid and development cooperation field, decentralise monetary control in favour of local communities, provide digital UBI solutions, and improve the remittance and payment

systems for migrants stand out, in terms of social impact.



Will Le, Writer

Research & Innovations Lead, Celo Foundation

Payments & Remittances

Payments

Cash is still the primary mode of payment globally, with an estimated 69% of global transaction volume in cash in 2019.⁴³ However, non-cash transactions rose dramatically over the last decade, particularly in mature markets and China. Yet, cash-based transactions remain the norm in most emerging market countries.

Figure 3: Proportion of Transaction Volume in Cash by Country



The overall trend toward digitalisation is positive for economic development. A growing body of research shows that shifting toward digital payments creates benefits at the individual, community, and national level, including:

- **Increasing access to digital commerce and new business models.** Pay-as-you-go solar companies, many of which leverage mobile payment infrastructure, brought electricity to eight million households around the world that otherwise may not have been able to afford the upfront cost of a home solar kit.⁴⁴
- **Enabling credit building for individuals.** Digital payments help individuals build a history of transactions, which can be used for more accurate credit scoring. This helps lenders build a clearer risk profile and, in turn, lowers the cost of capital for borrowers.
- **Increased transparency and reduced fraud.** Shifting to digitisation in cash-heavy industries can reduce fraud. In Tanzania, just two years after going fully cashless for national park fees, park revenues increased by 40% for the same volume of tourists.⁴⁵

A 2016 study by MIT showed that M-Pesa, a mobile money solution used by over 90% of adults in Kenya, lifted 2% of Kenyan households out of extreme poverty.

The macroeconomic impact of payments digitisation is significant. A 2016 study by MIT showed that M-Pesa, a mobile money solution used by over 90% of adults in Kenya, lifted 2% of Kenyan households out of extreme poverty.⁴⁶

Why Distributed Ledger Technology (DLT)?

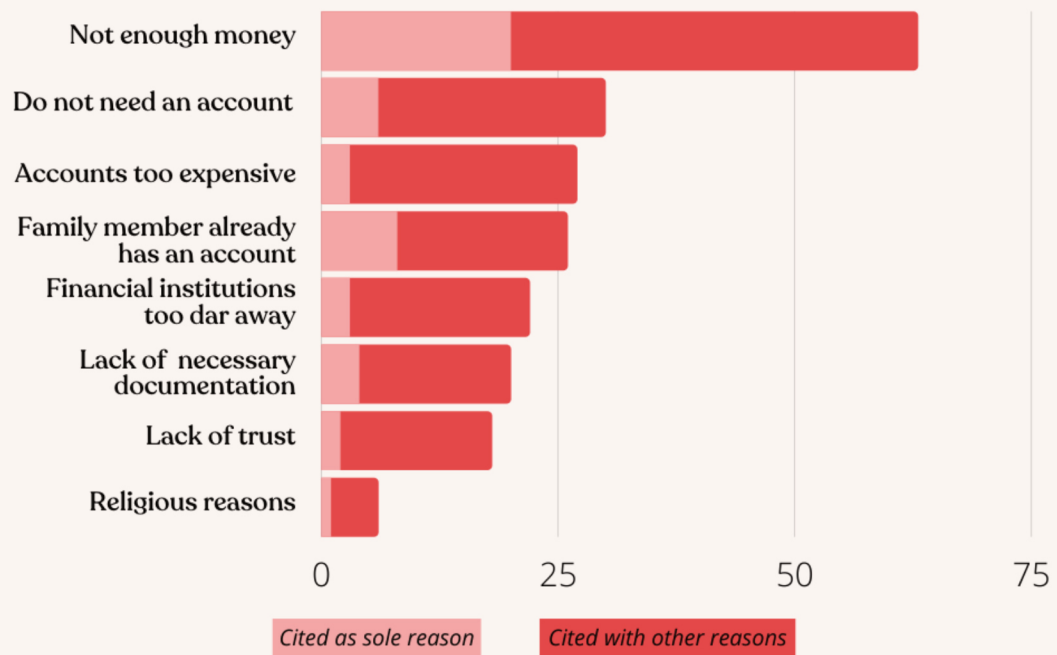
Promoting blockchains and cryptocurrencies for financial inclusion might seem premature when the majority of transactions are still analogue. While it is true that many blockchain-based payment solutions are too difficult and inaccessible for someone accustomed to dealing in cash, there are several opportunities for these solutions to bridge the gap. They can leap-frog older innovations, bringing more agile infrastructure and financial access to a portion of the 1.7 billion unbanked people around the world.⁴⁷

The main issues for unbanked people are:

- **Lack of identifying information.** Access to digital financial services are often controlled by financial institutions that require formal identification. In a global survey of the unbanked, 20% reported that lack of necessary documentation was a reason they lacked access to a bank account.⁴⁸

- **High fees.** Cost is another access barrier for many around the world. In the same survey, 26% of respondents cited high fees as a reason for lack of bank account access.⁴⁸

Figure 4: Reported Barriers (%) for Adults Without a Financial Institution Account, 2017



Source: ⁴⁸

DLT and cryptocurrencies might address several of these concerns, offering an alternative pathway to participate in digital financial ecosystems while circumventing costly gatekeepers. Applying for a bank account or mobile money operator is no longer mandatory; to start transacting in cryptocurrency, all one needs is a digital wallet and access to the Internet.

Challenges

Despite their promise, cryptocurrencies have a long way to go to achieve mainstream adoption for payments. Much interest in cryptocurrencies is centred around speculation and investment. Several drawbacks to use cryptocurrencies for payments remain, although distinctions can be made between different cryptocurrencies.

- **Volatility.** The price of cryptocurrencies is extremely

volatile, reducing its usefulness as a unit of account. Prices for goods and services would have to be updated frequently.

- **High transaction fees.** In periods of high network traffic, transaction fees for cryptocurrencies, like Ethereum and Bitcoin, can skyrocket, making them unreliable for merchant transactions.
- **Slow settlement times.** Transaction throughput of some of the most popular blockchains is still low. For example, Ethereum can process approximately 15 transactions per second,⁴⁹ while the Visa network can process about 2,000 transactions per second.
- **Poor user experience.** Unbanked and underbanked communities may struggle with cryptocurrency wallets, many of which contain features difficult for the layperson to use. For instance, many crypto wallets are self-custodial, which means that the user is responsible for maintaining their own private key. If this private key is lost, there is no recourse for account recovery.
- **Reliance on internet infrastructure.** Blockchains typically require users to maintain an internet connection to sync transactions. This poses a challenge for communities with poor or spotty internet and telecom infrastructure.

It's important to note that DLT is still in its infancy, whereas other forms of digital payments have existed for decades. It will likely see many advancements as it matures. The blockchain industry is working to improve the usability and accessibility of cryptocurrencies for a mainstream audience. Stablecoins, cryptocurrencies pegged to fiat currencies, address the issue of price volatility while preserving many of the benefits of blockchain. Several projects are working on scaling solutions to lower transaction costs, speed, and other general improvements. And, there are projects that seek to provide workarounds for older blockchains, such as Lightning Network.⁵⁰ We believe that as the blockchain industry matures and develops more user-friendly solutions, DLT will become a significant tool, among others, to tackle global financial exclusion.

Remittances

According to the Center for Global Development, '[remittances] are the largest single source of international development finance'.⁵¹ Each year, workers abroad send over

Each year, workers abroad send over \$500 billion in remittances to family and friends back home, over three times global foreign aid.

\$500 billion in remittances to family and friends back home.⁵² That is over three times global foreign aid (estimated to be \$161 billion in 2020).⁵³ For some countries, remittances are the primary driver of economic activity. For instance, they make up over 20% of the GDP in countries such as Nepal, El Salvador, and Haiti.⁵⁴

For many families, remittances serve as a crucial lifeline. About one billion people in the world are involved in remittances — either sending or receiving.⁵⁵ For poorer families, remittances are used for basic necessities, housing, education, and health care.⁵⁶ In richer households, they may provide capital for small businesses and entrepreneurial activities.⁵⁶ Remittances' impact on poverty reduction is significant. The World Bank suggests that receiving international remittances helped lower poverty (measured by the proportion of the population below the poverty line) by nearly 11% in Uganda, 6% in Bangladesh, and 5% in Ghana.⁵⁶

The average cost of sending remittances is roughly 7% globally — meaning approximately \$35 billion of money remitted is lost each year to fees.

Unfortunately, financial intermediaries and antiquated systems create serious friction and divert a significant portion of funds away from intended beneficiaries. Personal cross border transfers typically rely on Money Transfer Organisations (MTOs), such as Western Union, Moneygram, or correspondent banks, all of which charge high fees and can take days to settle. The average cost of sending remittances is roughly 7% globally — meaning approximately \$35 billion of money remitted is lost each year to fees.⁵⁷ That cost can rise to 20% or higher for less common remittance corridors and smaller transfer amounts, which disproportionately affects lower income communities.⁵⁷

The potential positive impact of reducing remittances is widely recognised, and the UN has set an SDG of 'by 2030, to reduce to less than 3 per cent the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5 per cent'.⁵⁸ Cutting the cost of sending money anywhere in the world by more than half in a decade is an ambitious goal, and will require new technologies and ideas to replace the inefficient status quo.

More than any other recent innovation, blockchain technology has the potential to disrupt this industry. By removing financial intermediaries and correspondent banks from the remittance flow, blockchains can offer instantaneous settlements and lower transaction costs.

The blockchain industry is tackling the remittance problem from all angles, aiming to lower costs and improve individual experience. Informal networks of remittance agents, who rely

on platforms like LocalBitcoins and messaging apps, such as WhatsApp and Telegram, are on the rise.⁵⁹ This is particularly apparent in countries such as Venezuela, where unfavourable market conditions caused traditional actors to pull back.⁴ Projects like Ripple are working with banks and traditional money transfer organisations to help modernise back-end processes,⁶⁰ while other initiatives, such as Stellar⁶¹ and Celo,⁶² are taking a more consumer-focussed approach. As these technologies mature, we expect blockchain-based remittance solutions to grow and contribute to lowering remittance friction globally.



Sandra Uwantege Hart, Writer

CEO & Advisory Services, Emerging Impact

Humanitarian Aid & Development

The humanitarian sector faces a growing challenge, compounded by the Covid-19 pandemic: while need and the number of short- and long-term crises have increased drastically — affecting over a billion people each year across all continents⁶³ — funding for humanitarian assistance is declining, at least in part due to heavy scepticism about the use of funds and achieved impact. The Grand Bargain, a series of commitments by aid agencies and donors in 2016,⁶⁴ highlighted the need to prioritise how assistance is delivered. Specifically, improving humanitarian financing models is needed to incentivise faster progress across many of the issues the sector faces.

Overhead costs are high, particularly in multinational agencies, which are consistently criticised for top-heavy structures.

The core challenges are familiar. Humanitarian agencies receive large donations, yet many ask how funds are spent. Overhead costs are high, particularly in multinational agencies, which are consistently criticised for top-heavy structures. These organisations are often overly centralised, concentrating power and expertise in the hands of international aid workers. Local groups struggle to access financing and face significant capacity barriers to match extensive reporting requirements and other “best practice” delivery systems. These systems are designed for, and often by, multinational institutions, and

maladapted to operation in emerging economies. This creates a schema where communities and local people are almost always the first responders, but the last to be formally involved in the delivery process.

There is a need for more and better “localisation” to bring small organisations and communities into the heart of humanitarian efforts, restructure power dynamics, and decolonise aid.

These chronic shortcomings reflect the need for more and better “localisation” to bring small organisations and communities into the heart of humanitarian efforts, restructure power dynamics, and decolonise aid.

The Digital Divide

Potential applications of blockchain technology in humanitarian action align closely with the major weaknesses of the sector. The tech sector now actively seeks out collaborations to assist humanitarian agencies in adapting and integrating these solutions. In recent years, efforts grew to finance and support blockchain for social impact initiatives. Organisations like the Ethereum Foundation,⁶⁵ major donors, such as the European Investment Commission,⁶⁶ USAID, the Danish Ministry of Foreign Affairs (DANIDA), and even large tech firms, such as Binance Charities, continue to invest heavily in the development of blockchain applications within these sectors.

Nonetheless, there is a major rift between the humanitarian and tech sectors. Different operating languages, private vs. public institutional structure, and very different zones of influence all pose barriers. These must be bridged to match desire to invest with current needs on the humanitarian side. Further, management, staff, and country teams in humanitarian organisations are rarely aware of, and do not typically seek out, opportunities to explore emerging technology. Finally, they are often based in locations where emerging technologies are seen as inaccessible or irrelevant.

More efforts to increase partnership between the two sectors are required, though there is a growing precedent for cross-sectoral collaboration. For example, UNICEF Innovations has been a leader,⁶⁷ exploring how to leverage its global role to forge stronger connections between technology solutions and local problems. And, companies and advisory services, such as Emerging Impact, are available to support humanitarian actors in the pathway to adoption.

Decentralised Solutions for Localisation

The humanitarian sector’s most critical pain points are the need to a) shift power, decision-making, and funding to local organisations, away from the global level; and b) create a

“participatory revolution” to explore new delivery models that actively centre local communities.⁶⁸ This is a rich area of work for blockchain, but the core questions are whether the nature of the technology itself can engage and empower local communities and organisations in a way that existing systems have not, and who is best placed to engage in this.

The decentralised and distributed infrastructure of blockchain make it stand out for the opportunity to re-distribute power, ownership, and decision-making.

While the answers to the questions remain to be seen, the decentralised and distributed infrastructure of blockchain make it stand out for the opportunity to re-distribute power, ownership, and decision-making. This is particularly needed, and promising, in the case of communities that may otherwise be isolated, marginalised, or excluded from these processes.

Developing these solutions could benefit both the blockchain and humanitarian sectors. Currently, blockchain seeks mass adoption, but has a limited footprint in emerging economies and developing nations, while the humanitarian community has a massive footprint in these places, but has historically been slow to innovate, especially at the last mile of delivery.

The opportunity to engage with emerging technology early in development gives humanitarians the chance to play a role in how it evolves. This chance should be exploited to rebuild existing delivery infrastructure in a digital space and with the necessary improvements. As major stakeholders, humanitarian agencies can provide significant access to regions otherwise unreachable or neglected by blockchain developers. There is significant value-added by bringing local and community voices into new product development. This would yield more robust operating systems, more accessible interface design and platforms, and more inclusive product and application design.

The inefficient complexity and centralisation of current delivery models is particularly well-suited to blockchain solutions. These systems are generally capacity barriers to local organisations on the front lines. Rebuilding this as lightweight infrastructure running on mobile networks and devices presents an amazing opportunity. It would enable an extremely rapid way to provide tools to local teams and organisations and automate processes in an unprecedented way. This is essential to drastically lower capacity and entry barriers while ensuring the same quality and speed of delivery that a multi-million dollar humanitarian operation can achieve. This will open up the humanitarian space to more diversity, competition, and quality, while also potentially levelling the playing field between large international and small local stakeholders.

According to a recent policy paper, Digital Cash Assistance

Digital Cash Assistance (DCA) is the largest growing area of blockchain development by and with the humanitarian sector.

(DCA) is the largest growing area of blockchain development by and with the humanitarian sector.⁶⁹ The use of the technology to expedite and simplify global, direct financial transactions was in fact the original use case. To further broaden the potential of these solutions, considering how to leverage advances in this area to deliver financial inclusion and access in addition to cash will leapfrog development for some regions. For instance, what if we can deliver cash to millions and provide banking services, all in the same click?

Multiple applications in Decentralised Finance (DeFi) are being developed to open up and digitise banking and money transfer services. These applications aim to make them more accessible via lightweight, low-cost mobile devices. The integration of transparency in transactions, faster payment services using digital channels, and full-suite banking options on the same platform is highly relevant. These solutions offer options to the sector, which has not only struggled with finding more efficient systems to deliver payments, but has also grappled with the challenge of ensuring financial inclusion.

Early Adoption Challenges & Opportunity

Only the process of engaging these voices through co-iteration will allow the humanitarian sector to play a leading role in developing solutions, apps, and interfaces

Using localisation as a starting point and blockchain as a springboard to boost digital innovation, presents a window of opportunity. Giving communities the opportunity to co-develop solutions and stress test digital tools, can only make those solutions more robust and relevant. The perspective of someone who has never used a smartphone, struggles to access electricity and internet, and may also struggle with literacy, is significantly different from that of a software developer. It is only in engaging these voices through co-iteration that the humanitarian sector can play a leading role in developing solutions, apps, and interfaces. These services and platforms will be able to work for the complex reality that local and national responders and assisted communities live in.

It is no coincidence that the decentralised nature of blockchain holds both promise and threat. As it can be used to erode the concentration of power at the top and centre of the current humanitarian system, it entails a loss of power for some, and a threat to legacy systems. It will require new competences and technical skills, especially for local communities. Further, restructuring the current financial and administrative systems will be necessary. The possibilities presented by a technology that has the capability to “disintermediate”, transfer funds directly, remove middlemen and their costs, and execute high-value financial transactions within seconds and for a fraction of the cost, threaten intermediary institutions. This means that

institutional adoption also risks downsizing the humanitarian sector itself – and so remains relatively low, slow, and difficult.

Finally, although more significant for the private sector, there are other multiple areas that have been identified as relevant and likely for the humanitarian sector. These include numerous possibilities, including: humanitarian financing and donations to reduce financial intermediaries, with less overhead and more transparency in funding use and impact; traceability and tracking of humanitarian logistics and sustainable and local agriculture; digital identities for both humanitarian workers and stateless persons and refugees; and accelerating delivery of cash and vouchers while improving cost efficiency for crisis-affected communities.



Will Le, Contributor

Research & Innovations Lead, Celo Foundation

Community Currencies & UBI

Community Currencies

Community currencies are not a new concept, but are flourishing again in the era of digitisation.⁷⁰ Although they do not replace national currencies and are geographically-limited, they can benefit local communities with low purchasing power or high levels of unemployment.

Community currencies can foster adoption of fairer monetary policies, as 'setting monetary policy at a national level is a blunt instrument'.

- Will Le, Research & Innovations Lead, Celo Foundation

Specifically, community currencies can foster adoption of fairer monetary policies. In fact, according to Will Le, Research & Innovation Lead at Celo Foundation, 'setting monetary policy at a national level is a blunt instrument. One area may be suffering from a downturn with high unemployment, whereas the economy of another region in the same country could be overheating'. When used to pay salaries, these currencies increase consumption of local products and services.⁷¹ They also allow community members to collectively prevent extractive consumption. This is important for small economies, as these types of industries pour profits and taxes elsewhere.

Community currencies stirred up increased interest in the last

30 years, linked to the digital revolution.⁷² Digital community currencies, especially blockchain-based solutions, have certain advantages over analogue counterparts. They are generally more secure and counterfeit-resistant, offering features such as real-time monitoring and tracking. This, in turn, fosters more accurate and reactive policymaking. On the other hand, many features of local currencies are difficult to implement in analogue versions. Le explains that throughout history, some local currencies required stamps to denote negative interest and promote circulation. Stamps are undesirable because of extra administrative costs, but easily enabled through smart contracts, which are also more secure.

While these currencies still require research and tests, 'in theory, communities with stronger cohesion and less transience could be better fits. Like an isolated town or an island', Le suggests. This is because one of the greatest challenges is incentivising adoption. Strong local government and business support can help as well, as demonstrated by the Bristol Pound — 'one of the best known examples of a successful local currency', according to Le.

Universal Basic Income (UBI)

'Economists estimate the cost to eliminate global poverty is between \$175 and \$267 billion per year for the next 20 years.⁷³ This sounds high, but it amounts to less than 0.5% of global GDP.[...] UBI can eliminate poverty by ensuring that every person in the world has enough to meet basic needs', according to Le.

UBI, or Universal Basic Income, is a proposed policy to provide everyone with a constant and unstipulated wage. While debates remain about who should receive UBI, how much should be provided, and if it should be a governmental or private programme, it is still one of the most comprehensive proposals to tackle poverty.

A truly Universal Basic Income encompasses three features:

- **Universal** Every (adult) person in a population is entitled to receive the benefit. Unlike other social safety net programmes (like unemployment benefits), UBI is not means-tested or conditional. This limits the impact of distorted incentives — for example, there is no disincentive to earn more since benefits will not disappear.
- **Basic** UBI payment should meet thresholds such that an individual can meet all of their basic needs, like food, water,

and shelter. This may vary by geography — the cost to meet basic needs in the US is much higher than in Sub Saharan Africa, for example.

- **Income** UBI should be distributed over time, as income rather than a one-time or lump sum payment. Studies show that the modality of cash transfers have large impact on what they are spent on. Grants given as income streams over time tend to be spent more on 'basic needs' items such as food security.⁷⁴

Blockchain allows for the development of various UBI solutions, with new capabilities.

Blockchain allows for the development of various UBI solutions, with new capabilities. While governments can fund and scale these initiatives, private or non-governmental entities can iterate them with more flexibility, using different funding models. Moreover, the fact that it is universal and decentralised, makes it feel 'much more like a natural right', Le adds. Nearly all aid programmes today rely on a central administrator, such as a government or NGO. Blockchain-based universal basic incomes introduces innovative decentralised models, where a person's entitlement cannot be unilaterally revoked.

Decentralised Solutions

The combination of features that UBI and Community Currency blockchain-based solutions have, would decentralise power over social security and assistance programmes.

The combination of features that UBI and Community Currency blockchain-based solutions have, would decentralise power over social security and assistance programmes. This moves control away from the national or regional levels to the local community level — directly to the hands of citizens.

Furthermore, generally speaking, blockchain-based designs facilitate transparency, user-centred projects, and decrease administrative costs, while enabling all the necessary features of a UBI or a community currency.

However, there are some aspects to consider, such as identity verification,⁷⁵ voting, and social trust, to make both types of initiatives sustainable and successful.⁷⁶ As money is essentially a social contract, and these two initiatives are designed to empower individuals, prioritising community support and participation is key.

Use Cases

Ĝ1 Libre Money

The Ĝ1 project launched in 2017 to rethink the current monetary system. It runs on the independent blockchain Duniter and was developed by volunteers. It was inspired by the Relative Theory of Money of Stéphane Laborde, which views money as expressed equally in time and space, positioning human beings at the centre of the economy. This theory is built on four fundamental freedoms. The freedom to:

- Choose your currency system
- Access resources
- Estimate and produce value
- Trade with money.

The Ĝ1 community, though still small due to the certification method, is a concrete economic experiment. It is based on solid and transparent community relations that grow organically. In fact, as a common currency, Ĝ1 is mostly used to exchange second-hand goods and food, unlike other cryptocurrencies which are more speculative. The variety of goods and services exchanged is ensured by community diversity.

The Ĝ1 Libre Currency is created through a "Universal Dividend" by any member of the community. This is then continuously delivered according to life expectancy of the population. The universal dividend is not only the 'core of the money creation', as Martin Batiste, Volunteer at the Ĝ1 project, put it, but also unconditional and universal, delivered as an UBI. Batiste continues that in a so-called Libre Money economy, any member 'creates the same relative part of money during [their] lifetime'. This means that 'the economic weight of each generation is relatively the same, creating a more equal and fair society, both between individuals and generations'.

The Ĝ1 initiative has great potential to restructure the current economic system. According to Batiste, 'larger adoption cannot occur just by convincing people about the

strength of the concept or, [in the case of Ĝ1], just by explaining the theory. We have to show concrete examples of exchange happening using this new money system, showing that the implementation of the idea works'.

**Martin Batiste,
Contributor**

**Volunteer, Ĝ1 Libre Money,
Duniter**



TruBudget

As demonstrated above, the international system of development and cooperation is not wholly efficient. One issue is providing accountability of aid allocation. This poses fiduciary risks between partner countries and discourages donors from using national streams. According to Piet Kleffmann, Digital Promoter & Director of Department at KfW, 'donors' approach to mitigate fiduciary risks is [one of] the main reason[s] for having not succeeded in donor harmonization and the use of partner systems'. The TruBudget blockchain-based initiative allows donor aid to be included in partner country budgets that makes it traceable and verifiable. All of this promotes effectiveness and sustainability.

The project launched a collaborative, open source platform, where data is shown in real-time. This fosters mutual accountability, communication, and cooperation. As Kleffmann points out, 'the software is based on a private blockchain, which provides an inviolable database (distributed ledger), [and is] a flexible and easy [tool] to operate. It has been designed in a way that it can interface (using APIs) with existing IT systems of the involved partner institutions'. This simple system benefits all parties — recipient countries, donor organisations, and local populations — as it enables:

- Transparency and control over external financial flows in the public sector
- Allocation accountability and lower transaction costs
- Improved efficiency and effectiveness of development funds.

The platform was successfully implemented by the government of Burkina Faso, while the Brazilian Development Bank uses TruBudget to control financial transactions in the Amazon Fund. Ethiopia and Georgia also implemented the platform to help manage KfW funded projects.

Despite some challenges, such as lack of commitment, knowledge about IT/blockchain

systems, political interference, and lacking regulation, the project has potential to be applied in other countries and sectors. According to Kleffmann, 'in all settings where data integrity is of crucial importance within a group of business partners, TruBudget might represent a solution to facilitate operations'.

**Piet Kleffmann,
Contributor**

**Digital Promoter & Director
of Department, KfW**



3 Supply Chain



Supply Chain

Due to their international, complex, and multi-stakeholders characteristics, global supply chains generate sizable environmental and social impacts, especially those related agriculture, which employs 28% of the world's population.⁷⁷

Given this incredible size and complexity, supply chains have historically been opaque. The situation is slowly changing with shifting demand and regulations. Consumers are requesting more transparency about the origin of their products, companies have come to realise the need for sustainability and responsible procurement practices, and governments are imposing new compliance standards, taking into account factors such as human rights in the case of large importers of international resources and workers.⁷⁸ These demands are related to SDG 8.a (Increase Aid for Trade), SDG 9.3 (integration into value chains and markets), SDG 12 (responsible consumption and production), and SDG 17.11 (Increase significantly the exports of developing countries).³

In this context, technology emerges to support supply chain transparency and traceability. Blockchain is viewed as one of the key technologies available. PositiveBlockchain tagged 144 projects using blockchain in the "Supply Chain Transparency" category.²¹ Many of these are developing solutions specific to the traceability of food (63), minerals & raw materials (24), textiles (10), or drug products (6).²¹

There is great potential to apply blockchain in tackling supply chain issues related to transparency, but this can extend beyond to help mitigate inhumane labour practices and promote safe and verifiable access to medicines and vaccines.



Nathan Williams, Contributor

Founder & CEO, Minespider

Supply Chain Transparency

Incentives & Disincentives

Supply chains are becoming more and more complex. The

management of all components — end-to-end information flows, money, services, and products — are crucial, as they affect market position. Automation and blockchain technology can improve efficiency and transparency. However, it is important to note that more transparency does not necessarily mean end-consumers will know the person who realised the product in the beginning. Rather, these systems enable awareness of who operates in the supply chain, policies, and practices.

Emissions reporting is not new, but by linking this data along the supply chain, companies can see their true footprint and make better supplier choices.

Greater transparency can strengthen marketing, proving the quality, safety, and sustainability of products. This also demonstrates compliance with production requirements, including legal. Further, a better relationship between end-users and producers paints a clearer picture of consumer behaviour and the real value of products. Enhanced transparency and traceability can also support tracking carbon footprint, encouraging more responsible and green practices. As Nathan Williams, CEO of Minespider, notes, emissions reporting is not new, but by linking this data along the supply chain, companies can see their true footprint and make better supplier choices.

However, improving transparency in supply chains is a complicated process. As Williams explains, extra visibility appears disadvantageous to some. While some businesses are reluctant to change as they are used to old, centralised systems, others lack trust in new technologies. Moreover, these methods might expose illegal or unfair practices that will damage a company's reputation and credibility. In addition, greater investments and proper infrastructure are needed to integrate new technologies.

Digitising Physical Assets

Tracking physical goods along the supply chain can be done in a few ways. Williams explains that Minespider conducted two types of traceability projects in the mining industry. One uses digital twins of physical materials, which follow materials flows down the supply chain. The other links blockchain records of transactions that did not change ownership, such as the transformation of a product as it moves through the supply chain.

In the digital twin model, a Non-Fungible Token (NFT) — a unique and limited supply digital token — is associated with the physical asset, representing it in digital environments. As the physical asset is bought and sold, the digital asset is exchanged as well. This approach is most useful for tracking

physical assets that exchange ownership frequently, but are not transformed, such as collectibles, coins, or gold bars.

The other method creates digital certificates at every stage of the supply chain, uploading important material data and linking them. Unlike digital twins, the certificates do not change ownership and are not a limited supply digital asset, like an NFT. This means the certificates represent transactions, not the materials themselves. This approach is best for tracing assets that undergo transformations, such as metals and minerals.

Decentralisation

Blockchain enables the introduction of new data in a decentralised manner, allowing tracking and reporting across all participants or beyond, depending on the permissions of the blockchain. This increases assurance about product authenticity and quality.⁷⁹

Blockchain will likely benefit international supply networks the most. Both up- and down-stream actors could benefit from lightened administrative costs and barriers.

Blockchain will likely benefit international supply networks the most. Both up- and down-stream actors could benefit from lightened administrative costs and barriers.

Automated, decentralised systems reduce the need for middle men. However, in digitising physical products, there are two main challenges: ensuring the individuality of goods and preserving the integrity of the data. While third-parties exist to certify data for specific supply chains, there are often issues with information asymmetry (between the company of origin and the consumer) and lack of transparency. Moreover, data is generally hosted on a centralised server, with higher chances of being altered or hacked.⁸⁰

Through the combination of IoT technologies, such as Radio Frequency Identities (RFID), and blockchain, verification, ownership, origin, and transaction data collection can be fully automated,⁸¹ and thus less prone to errors and requiring few actors. These digitised, decentralised systems give greater confidence to both businesses and consumers. This allows for more oversight and control.⁷⁹ For automation, smart contracts — self-executing computer codes — are generally used. However, the use of smart contracts is still highly debated. Their worth depends on the type of the agreement, and not all the supply sectors see a fit.

As Williams demonstrated, different supply chains require different blockchain solutions to match various levels of complexity. Although this technology has great potential, there are economic, sustainability, and supply chain specificities to

consider before implementation.



Peter Johnson, Contributor

**Founder , Ayadee Foundation &
Ayadee Holding Corp**

Advisor at FinTech4Good



Johannes Pulsfort, Contributor

Blockchain & DLT Researcher

'Tokenization potentially aligns the entire agri-food supply chain by providing transparency, data verification, and incentives across several participants'.

*- Johannes Pulsfort,
Blockchain & DLT Researcher*

Agri-Food Supply Chain

There are compelling reasons to apply these solutions in the agri-food industry, specifically. Johannes Pulsfort, Blockchain & DLT Researcher, affirms that '[t]okenization potentially aligns the entire agri-food supply chain by providing transparency, data verification, and incentives across several participants'.

Transparency and traceability are particularly essential for the food industry. Peter Johnson, Founder of the Ayadee Foundation & the Ayadee Holding Corp and Advisor at FinTech4Good, explains that more information about sources would namely:

- Strengthen consumers' trust in the supply chain thanks to more awareness about food quality and safety.
- Reduce food waste thanks to the ability to recall 'only targeted batches of a harvest if there is contamination in a specific agricultural product'.
- Reduce costs by cutting inefficiencies and wasteful practices. In fact, '[it] is estimated that a properly implemented blockchain could save an estimated \$150 billion annually⁸² by reducing food waste alone'.

- Expand access to new markets and finance streams, as matching global buyers and local growers directly would reduce need for intermediaries, and digital records to prove solvency might help farmers access financing.

However, the sector also faces the following challenges, according to Pulsfort.

- Upfront initial capital investments to digitise the supply chain is the main barrier.
- '[T]raining and education of the agri-food supply chain stakeholders' and 'adjustments of the workflow' to switch from a centralised to a decentralised solution require time and capital.
- There is a lack of interoperability between systems and digital divide affecting certain areas. '[The] existing infrastructure needs to be created or upgraded in order to provide good and viable internet connections for the entire agri-food supply chain'.
- Finally, Johnson adds, '[to] capture the full efficiency gains from a fully digital blockchain-based system, certification agencies and government regulators would also have to agree to become part of such a system'.

Collecting more data to train algorithms to catch outliers — which are more likely false entries — can solve some of these issues. Additionally, enabling local, offline data collection, will address issues around connectivity. This data must then be uploaded once the device is back online. All of this will improve efficiency in food safety tracking and reporting, and reduce waste.



Leanne Melnyk, Writer

Head of Global Supply Chains,
Diginex



Phoebe Ewen, Writer

Programme Director, The Mekong
Club

Modern Slavery & Poor Working Conditions

It's estimated that over 40 million people across the world live under modern slavery.⁸⁴ Virtually no industry is untouched, although companies are increasingly held accountable – if and where such issues are found in their operations or supply chain. One of the most common forms of modern slavery is linked to cross-border recruitment of migrant workers. Unscrupulous labour recruiters charge fees to workers to “secure” jobs. This is coupled with illegitimate employment contracts and unfair terms. Larger fees can easily push workers into situations of debt bondage.

Many of the fundamental drivers of modern slavery are perpetuated by the opaque nature of supply chains. Blockchain technology has the potential to address some of these issues.

Male Bangladeshi migrant workers going to the Gulf Cooperation Council (GCC) can spend almost 21 months of their salary on recruitment fees.⁸⁴ Promises of wages are often not adhered to and retention of workers' identity documents are endemic. Companies responsible for monitoring labour conditions may deal with many layers of suppliers and sub-suppliers. Further, labour providers often feel limited in oversight by heavily paper-based and inefficient audit processes.

Many of the fundamental drivers of modern slavery are perpetuated by the opaque nature of supply chains. Blockchain technology has the potential to address some of these issues. The Mekong Club, a non-governmental organisation committed to ending modern slavery, and Diginex, an impact

technology company, formed a unique partnership, bringing together tech and issue specialists. They worked to develop a blockchain-based solution for greater transparency in the recruitment and employment of migrant workers.

The result was eMin — a mobile-optimised and blockchain-based platform built on the open source and secure Tezos Protocol. Tezos is a self-upgradable blockchain and one of the first projects to incorporate Proof of Stake — a consensus mechanism that aligns the incentives of participants, avoids centralisation, and puts power in the hands of stakeholders.

eMin was first deployed in 2019 across 17 shrimp farms in Thailand's aquaculture industry and has since been deployed in agriculture (rice, rubber, sugar cane), manufacturing (toys and apparel), and the services sectors in the GCC, Malaysia, and Thailand.

Workers registered on the platform are equipped with an immutable copy of their employment information, which can then be shared on a permissioned basis with key stakeholders, such as employers and buying brands within the supply chain. This creates greater trust and transparency, as all parties understand and acknowledge the same employment terms. The system also benefits brands and their suppliers, through the possibility to survey migrant workers and better understand their recruitment experience. This is facilitated via data analytics on a multilingual dashboard. Employers can also validate fees paid by migrant workers, allowing them to better monitor recruitment intermediaries. Similar applications of blockchain can extend beyond employment contracts, improving payment records and grievance reporting.

Implementation across different sectors and locations provided valuable lessons for the wider blockchain community. Particularly important, was how essential it was to understand the demographics of target beneficiaries when designing the intervention. This is especially salient when involving migrant workers and people in societies with limited technological resources and comfort levels with technology. The survey function was also considered valuable, as it helped overcome traditional language barriers and incorporate more communication streams for migrant workers.

Providing a good user journey for workers, particularly migrant workers is often challenging. This is due to lower comfort levels with technology and a wider use of phones with outdated operating systems. Integrating them into solutions therefore requires further adaptations, such as using Facebook

Often, modern slavery is most prevalent in areas where resources are limited, and technological solutions should aim to address, rather than perpetuate, these challenges.

as a login and providing multiple ways to access the app (QR code, APK File, Google Play Store, etc.). On-the-ground facilitators and trainers are also essential to support workers in understanding and using such services. Often, modern slavery is most prevalent in areas where resources are limited, and technological solutions should aim to address, rather than perpetuate, these challenges.

Finally, as information stored on blockchain is immutable, it is fundamental to ensure that only reliable data is shared. To do this, actors joining the blockchain ecosystem must be vetted and validated.

Despite the great potential and need of solutions in this area, it is important to remember that modern slavery is a human issue; there are limitations and considerations when applying technology. Technology should not be considered a silver-bullet. Rather, these issues require a combination of technological interventions, human relationships, and wider social change.



Anca Petre, Writer

Founder & Consultant, 23 Consulting



Tamanna Khan, Writer

Consultant, Technovative Solutions Ltd.

**Culture & Adoption Co-Lead,
PharmaLedger**

Counterfeit Drugs & Vaccines

In 2016, the total value of counterfeit drugs traded globally reached \$4.4 billion, according to a study by OECD and EUIPO.⁸⁵ This is the consequence of several factors that make

the counterfeit drug market very attractive. Among them are easy access to consumers with the rise of e-commerce and online pharmacies, high margins, and low penalties.

The consequences range from serious side effects and therapeutic failures for patients, to an accentuated lack of trust in pharmaceutical products and the healthcare system, to loss of income for all stakeholders of the pharmaceutical supply chain.

In 2020, Europol published a warning about offline and online scams offering counterfeit Covid-19 vaccines.⁸⁶ The stakes are very high in this case, as the success of vaccination campaigns worldwide rely heavily on the public's trust in the product. Many initiatives were developed using blockchain technology to address these challenges.

As blockchain technology is compatible with different standards and technologies, such as QR codes, NFC, RFID, or GPS, the whole system adaptable to various needs.

PharmaLedger is an Innovative Medicines Initiative (IMI), jointly undertaken by the EU H2020 Research & Innovation Programme and the European Federation of Pharmaceutical Industries and Associations (EFPIA). PharmaLedger's anti-counterfeiting use case was led by Novartis and INCM. It is supported by two other pharma supply chain-related use cases: Electronic Product Information (ePI/eLeaflet) and Finished Good Traceability. As blockchain technology is compatible with different standards and technologies, such as QR codes, NFC, RFID, or GPS, the whole system adaptable to various needs. As an example, PharmaLedger combines blockchain technology with 2D Datamatrix code. When a user or patient scans the Datamatrix code using the PharmaLedger app, the embedded information (such as product number, lot/batch number, expiry date, unique serial number, etc.) is used to perform additional security checks. This feature, known as Multi-Factor Product Authentication (MFPA), permits users to verify their products in real-time. It can provide information on how the product was manufactured, the manufacturer, available eLeaflets, valid serial numbers, and status (such as already released, not released, recalled, or stolen). PharmaLedger also contributes to anti-counterfeiting data collaboration (ACDC), a consolidated data sharing capability within the healthcare ecosystem.

In the UK, two NHS hospitals are using blockchain to track the temperature of Covid-19 vaccines.

Further, blockchain can be used to monitor the conditions of legally made and traded drugs and vaccines. In the UK, two NHS hospitals are using blockchain to track the temperature of Covid-19 vaccines.⁸⁷ Some, such as the one produced by Pfizer and BioNTech, require very low storage temperatures before administration. By keeping an immutable digital record of temperatures, these two NHS hospitals can guarantee storage

conditions of their vaccines.

Other projects focus on the distribution and the administration of Covid-19 vaccines. Recently, Moderna announced a partnership with IBM to explore the use of blockchain and other technologies to track vaccine batches on the supply chain, all the way from the manufacturer to the destination.⁸⁸ In parallel, the World Health Organization is working with the Estonian government to develop tamper-proof vaccination certificates, which will also be powered by DLT.⁸⁹

The Covid-19 pandemic presented both a challenge and an opportunity for the healthcare industry, especially when it comes to technological innovation. Blockchain, as a tool designed to create trust between multiple parties, played a key part in ensuring the integrity of health data, vaccine supply chains, and vaccination certificates.

Use Cases

Scantrust

Scantrust is a cloud-based software platform. They provide transparency solutions along the whole supply chain by generating unique IDs for each physical product. Scantrust's goal is to digitally connect producers with end-users, enabling transparent communication.

As Ricardo Garcia, Head of Partnerships & Blockchain Advisory at Scantrust, explains, during production they attach a unique, digital ID to the packaging; 95% of the time, this is a QR code. It keeps track of the product life cycle, from production until it arrives in user's hands. According to Garcia, this unique ID system is Scantrust's way to connect all types of information to the physical product and represent 'the gateway to the digital world'. Consumers can scan this code with regular QR code readers to access information linked to it, or use the Scantrust app. In that case, the authenticity of the QR code is confirmed thanks to a machine learning algorithm that compares the scanned QR code and the original QR code in the Scantrust system.

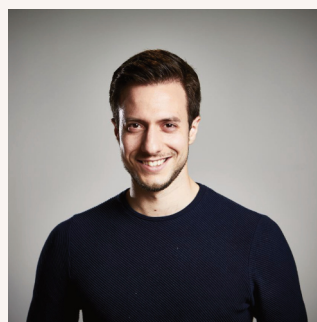
Scantrust mainly sees blockchain use in two areas — upstream traceability of product ingredients (in the case of food, beverage, and cosmetics) and NFTs for luxury goods. While blockchain is already used to support provenance and quality tracking, NFTs are gaining traction in the luxury goods space. Garcia affirms that various brands are looking into them to 'track the product after it has been produced, and enable new use cases like transferring the ownership of that product to [allow] a secondary market. In the case of watches for example, keeping track of the whole life cycle — like when repair jobs [were] done, who was the previous owner and so on'.

These digital solutions have several benefits. According to Garcia, when looking downstream in the supply chain, they improve tackling counterfeiting and grey market activities, policy compliance, fighting illegal practices, and open up a digital communication channel with end-users. Upstream, they facilitate product recalls, provide transparency, and support

sustainability and carbon footprint tracking. However, barriers are still present. Garcia thinks that 'the main challenge is market resistance, because if you're willing to invest enough, you can solve any technological [issue]'. To overcome this, he suggests finding strong metrics to show the benefits of adoption and RoI to facilitate investment.

**Ricardo Garcia,
Contributor**

**Head of Partnerships &
Blockchain Advisory,
Scantrust**



DoinGud

Manu Alzuru, Founder of DoinGud, saw a lack of understanding of human and social capital. Inspired by the growing ecosystem around NFTs at the end of last year, Alzuru and his team decided to create a bridge between 'the creator economy and the giving economy' — DoinGud. This project facilitates an art market with built-in money streams to social impact organisations. This is done by creating a platform where creators, curators, collectors, brands, and social impact organisations can connect using NFTs.

The 'DoinGud Gallery', initially curated by the team, is working towards becoming community managed. It integrates a multi-gallery system, which enables creators to self-manage their creations and partner up with curators and galleries.

The entire business model is then amplified by the commitment to generate social impact. Alzuru explains that 'a minimum of 5% [of profits are allocated] to social impact organisations, [based on] creators' choice, [while] another 5% goes to the [...] the DAO' to run the platform. In addition, as Alzuru continues, 'every time that there is [a] transaction in the platform, we plan to give rewards to those people that are using [it]. And, those rewards can be used for buying user names, unlocking new features and even participate in the governance'.

The allocation of funds is also aligned with the UN's SDGs. Social organisations are categorised based on these goals, ensuring that the contributions don't only go to a single cause, solving one type of issue, but are more equitably distributed to all.

However, building a healthy, successful NFT ecosystem presents some issues. Alzuru explains that the main problem concerns the 'learning curve' — lack of technological understanding making it difficult to build, enter the space, and acquire and hold cryptos. This resistance leads to a shortage of members. Then, there are mental barriers and lack of tax and legal regulation for crypto holding and payments. Finally, the hype

around NFTs also brings 'bad players' or scammers. But, Alzuru affirms that 'NFTs are here to stay.[...] I personally don't think that the standard will disappear, actually, I think it's going to accelerate even more.[...] This is just the very beginning, and we're going to see these new type of [creators] that are doing good for the world using these types of technologies'.

Manu Alzuru,
Contributor
Founder, DoinGud



4

Environment & Climate Change



Environment & Climate Change

Climate change and environmental protection is a priority for the century. This is highlighted by the 2015 Paris Agreement and multiple SDGs — 13 (Climate Action), 14 (Life Below Water), and 15 (Life on Land).³

PositiveBlockchain listed 77 projects related to "Climate and the Environment", and 132 projects related to "Energy".²¹ Blockchain technologies have the potential to provide valuable solutions to better manage natural power, enhance current recycling and waste systems and incentives, improve carbon trading markets, and preserve biodiversity and natural capital. However, the hype around this technology cannot overpower the enormous energy demands and subsequent increase in carbon emissions.

As the carbon footprint of most popular cryptocurrencies (Bitcoin and Ethereum) is extremely incisive,⁹¹ cleaning up energy sources and enhancing energy efficiency are priorities specifically for the blockchain sector. Reckoning with the energy demands of early blockchains remains a substantial challenge to blockchain-enabled environmental solutions, and begs the question whether the positive outcomes of environmental projects built on a Proof of Work (POW) blockchain — the energy heavy blockchains — outweigh their costs?

While this remains an issue for the entire industry to contend with, blockchain does present some novel solutions for environmental preservation and better climate accountability. Regardless of whether first- and second-generation blockchains should remain a part of these solutions, the potential of the underlying technology and growing prominence of more environmentally sustainable consensus mechanisms, make this an area that cannot entirely be discounted.



Tom Baumann, Writer

Founder & Co-Chair, Climate Chain Coalition



Miroslav Polzer, Writer

Strategic Director, Climate Chain Coalition and Founder

CEO, IAAI

Data & Digital Innovation Infrastructure

The atmosphere is a global commons, collectively used by all of humanity. However, the majority of the population currently has very limited rights or obligations with regard to the upkeep. The globally dominant market economy model leads to market failures — unaccounted for negative effects (externalities) and under provisioned public services. In the case of climate, market economic forces depleted greenhouse gas (GHG) absorption capacity. This is recognised as more and more essential for a life-sustaining atmosphere.

The Paris Agreement (2015) established an international consensus to limit average global warming to less than 2°C, and preferably to 1.5°C.⁹¹ These are equivalent to a “Global Carbon Budget”,⁹¹ or a “cap”, and can be expressed quantitatively as a carbon mass balance. For example, remaining within the 1.5°C goal means a finite amount of GHG emissions, equal to approximately 276 billion tonnes.⁹³ Current annual GHG emissions are approximately 43 billion tonnes.⁹⁴ Therefore, it is estimated the total global carbon budget will be used up in less than 7 years. Yet, policy-makers are calling for pledges to reduce emissions by only 50% by 2030.

CO₂ emission trading is highly related to the “carbon cap” set by the Paris Agreement. This is a mechanism introduced by

regulators to put a price on the GHG emissions. It enables regulators to limit the amount emitted by stakeholders (primarily big companies). However, as climate change is global, responses need to be internationally coordinated and encompass all emissions. Unfortunately, this is a distant vision.

Distributed Ledger of Global Carbon Supply Tokens

Rich countries used the atmosphere, benefited from it, and propelled the climate crisis. Poor countries did not create the crisis (although China recently became a major emitter, soon reaching the status of a rich country). Poorer countries will disproportionately experience the negative impacts, though, without a proportionate share of the benefit. And, as they did not benefit from the degradation of the planet, they are without the resources to respond to the impacts. This forces them to rely on resources from richer countries to manage a crisis caused by the same rich countries.

To more equitably divide and improve tracking of the remaining carbon emissions, it is possible to use digital solutions to tokenise the global carbon budget as a finite supply.

To more equitably divide and improve tracking of the remaining carbon emissions, it is possible to use digital solutions to tokenise the global carbon budget as a finite supply. This can then be allocated to individual accounts (or a trust to hold tokens for individuals until their accounts are activated, for future generations).

Per capita allocation of emissions is an imperfect starting point, but addresses some inequalities in how our atmosphere is currently used and protected. 276 billion tonnes divided by 8 billion individuals = 35 tonnes per person (total lifetime, not annual).

This allocation becomes wealth sharing (initial allocation of asset) and transfer (buying and selling), to spread the costs and benefits of using carbon across the global population. This not only makes use of our atmosphere more equitable, but also gives the global population more agency in the future of our atmosphere.

Using blockchain would enable set standards for sustainability and carbon accounting. As data is particularly important, digital sensors, remote sensing, and other technologies would contribute to better and more reliable data. More consistent standards and methodologies to transform raw data into climate metrics are also necessary. For example, in April 2021, scientists reported that countries are underestimating their annual GHG emissions by 5.5 billion tonnes.⁹⁵ This is equivalent to 12% of global GHG emissions. The mismatch was attributed

to inconsistent models and methodologies. However, as new technologies enable the carbon supply and climate actions to be tracked and valued, a carbon currency could be created using DLT, updating and standardising the system.

Smart contracts automate many administrative tasks, and could enable a self-enforcing global carbon market.

The rules for carbon accounting and transactions can further be enforced through a system of smart contracts. Smart contracts automate many administrative tasks, and could enable a self-enforcing global carbon market. Further, this could also be used to modernise governance. Stakeholders could be incentivised and compensated for updating and maintaining a smart contract system. Tokens could enable a portion of the value generated to be shared among a governance and rules community. Combined with international agreements, globally coordinated regulations and incentives, and smart standards, this will help increase transparency, efficiency, and interoperability of the emission trading systems.

Emerging Technologies' Potential

The World Economic Forum estimates that digital solutions can help achieve 15% of the Paris Agreement goals.

In general, digital solutions can be helpful tools to support a low-carbon economy. The World Economic Forum estimates that digital solutions can help achieve 15% of the Paris Agreement goals.⁹⁶ These solutions can be used throughout the entire economy,⁹⁷ creating smart grids and buildings, smart transportation, integrating with digital services, and more. Digital tools could link sustainable production to sustainable consumption in a more efficient and equitable manner, for a fair transition.

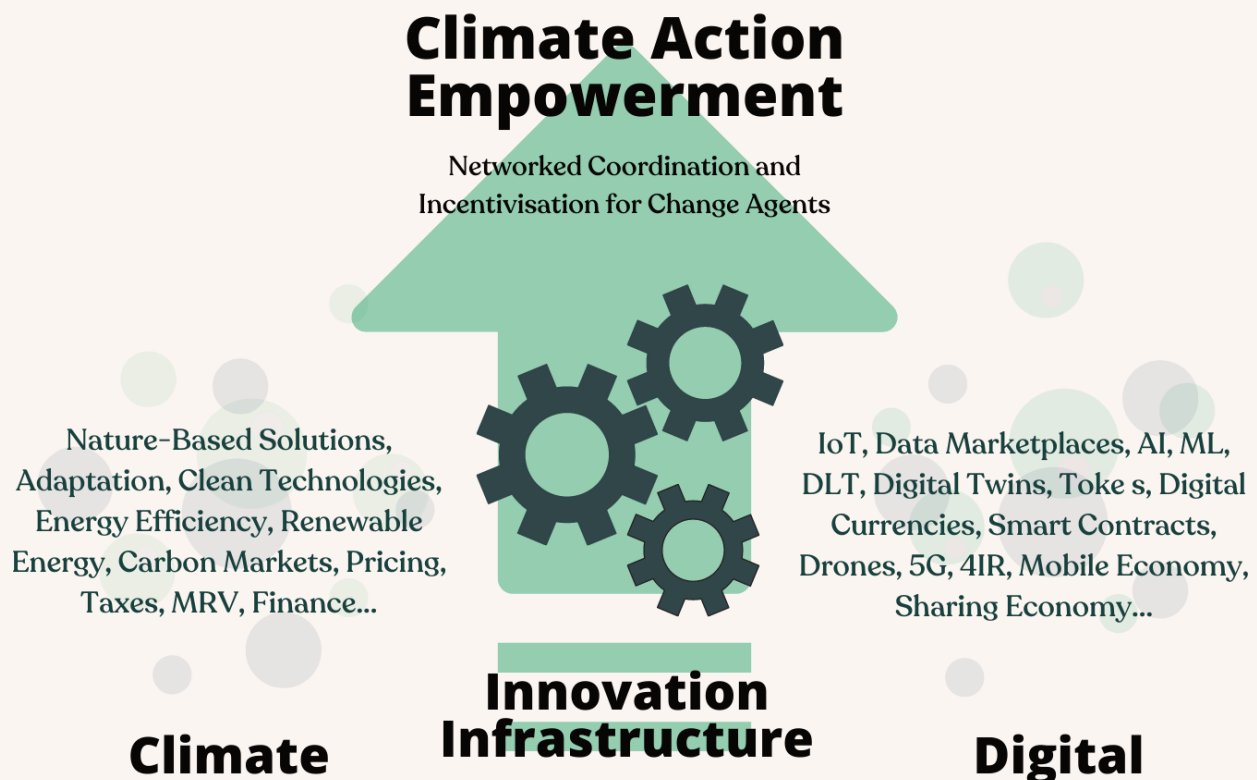
Beyond the described carbon trading market, DLTs, including blockchain, can enhance international and inter-sectoral collaboration. DLTs can be combined with other technologies, like Internet of Things (IoT), to support digital measurement, reporting, and verification (MRV) based climate action tracking and accounting. They can also facilitate innovative natural resource management. This can lessen market failures by recognising and preserving the real value of natural resources, all while considering the rights and interests of present and future generations. In terms of multi-stakeholder empowerment, blockchain has game changing potential. It enables digital identities and asset management to be linked to people, organisations, and businesses in a way that ensures rules are enforced and can make governance a community effort. By employing governance tokens and DAOs, more stakeholders can be brought into decision-making roles.

'Blockchain governance represents a self-contained and autonomous system of formal rules. Instead of relying on

enforcement through the law (as in contractual governance) or through the value of future relationships (as in relational governance), blockchain governance relies on a set of protocols and code-based rules. These rules are developed through formal programming languages, such as Ethereum's Solidity. The rules, embedded in blockchains, are automatically enforced by the underlying blockchain-based network. As observed by De Filippi and Wright (2018, p. 5), blockchains "create order without law and implement what can be thought of as private regulatory frameworks"⁹⁸.

Digital solutions have the potential to change the current system and foster fairer natural wealth management. While implementation of new solutions always comes with challenges, and international solutions even more so due to complex social webs, our climate is in dire need of better ways to manage, track, and limit use of our natural resources and carbon emissions. A participatory smart contract system to define and enforce the rules for valuing, creating, and transacting wealth, the prospects of a rapid, positive transition towards a more sustainable planet seems more achievable than ever.

Figure 5: Climate Action Empowerment



Use Case

Energy Web & Crypto Climate Accord

Energy Web is a non-profit organisation working to accelerate the transition to renewable energy using decentralised technologies. Through Energy Web's decentralised operating system — an open source stack of decentralised software and standards, — the organisation supports energy companies in developing their own solutions. They also work to improve the general understanding of possibilities in the clean energy space. According to Doug Miller, Global Markets Lead at Energy Web, using decentralised solutions enables new approaches to manage the modern, complex energy grids and leverages the flexibility of sources we currently have. However, as with any technological implementation, there are still issues regarding practical adoption.

Energy Web is also one of the founding organisations of the Crypto Climate Accord (CCA) of March 2021 — aiming to decarbonise the crypto industry. The crypto sector is highly criticised for its carbon footprint, but, as Miller put it, 'there's no other sector that is fully decarbonised.[...] We see, essentially, the crypto sector as the first adopters of digital renewable energy solutions because other parts of the economy are slower moving to digitise'. By creating this 'broad tent of supporters', the accord aims to gather organisations and individuals to participate, while exploring some potential future solutions and 'dispel that point of criticism'. The CCA has three main purposes:

1. Identify the state of the industry and promote good practices
2. Build a "technical toolbox" with solutions to make the sector progress
3. Develop new software for better auditing and progress tracking.

This accord aims to lead to a cultural development and information sharing to engage more stakeholders. They further support a technical work stream to build, test, and scale new solutions and host more

business-related work to discuss market opportunities and policy development. The main goals of the CCA is to decarbonise the crypto sector first, then leverage the knowledge and experience from that to build innovative solutions and 'use the momentum to encourage other sectors to also make use of these technologies'.

Doug Miller, Contributor

Global Markets Lead, Energy Web



Blockchain Platforms for Social Good

Actors from civil society, public institutions, and social organisations can gain much from working along with the tech industry to co-design and adapt technologies to local issues.

As demonstrated, the emerging tech and humanitarian sectors — traditionally split audiences — need to be reconciled. Better links and communication will enable both to design impactful blockchain solutions to address the SDGs. Both can have meaningful roles to play in this work, and leverage each other's impact. Actors from civil society, public institutions, and social organisations can gain much from working along with the tech industry to co-design and adapt technologies to local issues. Collaborations such as these enable tools and programmes that account for users' and beneficiaries' needs.

On the technology side, different platforms are meeting a variety of project needs. For instance, Hyperledger is behind major projects, such as Plastic Bank²² or Food Trust.²³ Similarly, The IOTA Tangle is being deployed in various cases which require large numbers of sensors with minimal energy consumption.²⁴

These technology organisations and their foundations are already driving blockchain solutions. Some of them have committed social goals and have even moved several steps towards social impact, endorsing the cause with a holistic approach. Below, we cover two examples among plenty of others.



Taira Ishikura, Contributor

Team Next Billion Member, Ethereum Foundation

Ethereum's Team Next Billion

Ethereum is at the forefront of blockchain platforms seeking impact on a larger scale, in parallel with upgrading to more energy efficient consensus protocols. As the Ethereum Foundation (EF) mentions on its blog, developing countries today account for over 80% of the world's population and more than 360,000 out of the 400,000 babies born every day are born in developing countries.²⁵ This is why the EF has set up its "Team Next Billion" and a dedicated Fellowship Programme,

'[Blockchain might] empower individual participants in a more equitable and accessible manner, tackling some of the core issues behind the global challenges highlighted by the SDGs'.

- Taira Ishikura, Team Next Billion Member



David Taylor, Contributor

Head of Marketing, Cardano Foundation



Alexandre Maaza, Contributor

Trainee, Cardano Foundation

aiming to boost positive applications committed to the SDGs, especially in developing countries.

The EF Fellows, announced in May 2021, gather a range of leaders from impactful projects, which show the different, potential applications of blockchain. Acre Africa aims to design better micro-insurance smart contracts for Kenyan farmers;²⁶ OS.City wants to provide the Argentinean government with a blockchain-based identity platform for citizens;²⁷ BRAC is the world's largest NGO based in Bangladesh, piloting a few use cases and developing a crypto strategy;²⁸ and Giga supports UNICEF's effort to bring internet connectivity to schools.²⁹

Taira Ishikura from Team Next Billion affirms that 'on the one hand, Ethereum and blockchain at large have the ability to improve trust, transparency, efficiency and coordination. [This technology as a tool] can benefit [large and small] teams that are working toward every Sustainable Development Goal. On the other [hand], blockchain and the values of decentralization [serve] as a basis for new organizational and economic models. [It might] empower individual participants in a more equitable and accessible manner, tackling some of the core issues behind the global challenges highlighted by the SDGs'.

Cardano's Project Catalyst

Cardano is also very active in the development of crypto and blockchain solutions to tackle critical development challenges, especially across Africa.

The Cardano blockchain is currently being deployed related to digital identity, renewable energy, and financial inclusion. The Ethiopian government is also exploring the technology to provide digital IDs for 5 million students across 3,500 schools. The project claims to pinpoint and target locations and causes of educational under-achievement. It then supports efficient allocation of resources, while reducing fraudulent university and job applications.

Project Catalyst is an initiative aiming to develop the Cardano ecosystem and create solutions to community challenges.

David Taylor, Head of Marketing at the Cardano Foundation, explains that Project Catalyst is an initiative aiming to develop the Cardano ecosystem and create solutions to community challenges.⁹⁹ He adds 'Project Catalyst[...] was launched to advance on-chain governance and accelerate community-driven innovation to self-determine priorities for the development and growth of Cardano'. The decentralised innovation fund enables the distribution of funds to proposed projects, positioning local initiatives at the same level of international organisations' projects.

According to Taylor, the Cardano Foundation's initiative accepts proposals from both technical and non-technical participants, which fall into the challenges chosen by the Catalyst team or the Catalyst community itself. After proposals are reviewed and voted by a community, they can be funded for up to \$1M in form of the ADA token.

Project Catalyst's grant funding rounds have increased from \$250k worth of ADA to \$2 million in less than a year, thanks to IdeaScale platform. Taylor adds, 'as more come to learn about the potential, continued momentum and further expansion is expected'.

Thanks to their technical know-how, financial resources, and power to incentivise communities, blockchain platforms & tech-focussed companies can be very well placed to help working towards the SDGs. More initiatives, such as the ones from the Ethereum Foundation and Cardano, are required to boost blockchain adoption for the SDGs.

Conclusion



Jane Thomason, Contributor

Founder, Supernova Data

Industry Associate, UCL Centre for
Blockchain Technology

Conclusion

Blockchain technology is one of the most relevant innovations of the 21st century, not only for the financial sector, but also for many other fields in need of more transparent and traceable systems. Jane Thomason, Founder of Supernova Data & Industry Associate at UCL Centre for Blockchain Technology, explains that '[b]ecause blockchain increases efficiency, reduces costs, and promotes transparency, it has the potential to transform systems that enable solutions [were] previously thought to be impossible'.

At the current stage of development, this technology expanded its potential beyond business efficiency, though. As Thomason adds, 'it can help alleviate many challenges faced by the poor and marginalised', providing new horizons for the social sector.

Blockchain-based tools have the opportunity to transform existing systems, making them more accessible and inclusive for unprivileged and unbanked individuals and communities.

Blockchains have now been introduced in different segments of the social field. This work seeks to bring greater social impact and support the achievement of international goals, the UN's SDGs. With regard to the humanitarian and financial sectors, and at a more individual level, these tools have the opportunity to transform existing systems, making them more accessible and inclusive for unprivileged and unbanked individuals and communities. Blockchain-based solutions provide reliable and more direct donations and fundraising, as well as decentralised digital identities and low-cost, mobile payments. Thomason notes that mobile and user-centred digital solutions are extremely relevant nowadays, as most mobile connections occur in emerging markets and 91% of internet-users use smartphones.¹⁰⁰ She continues, '[m]obile technology, at almost 70% of the world's population, is creating an unprecedented opportunity for the bottom billion to connect to the economy'.

Global supply chains also have much to gain, from greater transparency and accountability, better management systems, and data sharing to product integrity and traceability. These improved systems and data points can even be used to

promote fairer working conditions and employment contracts. In this field, gains can be twofold, for both brands and workers. New generations of consumers ask for sustainable and socially responsible products and services,¹⁰¹ while emerging markets require better labour policies to achieve a more equal growth.¹⁰²

Further, digital innovation is promising for global, not just business level, efforts towards sustainability. These solutions are needed more holistically to tackle climate change issues and ensure a more eco-friendly global progress.¹⁰³ Blockchain can support the effort to track and report carbon emissions, improve the carbon asset transactions system, and facilitate the trade of renewable energies while enhancing financial flows. Hopes in this sector are enforced by big actors, like the FAO¹⁰⁴ and UNFCCC.¹⁰⁵

Yet, Thomason adds that while '[b]lockchains have the potential to introduce disruptive forms of innovation that take organisations forward into a new era of connected digitisation', they are not '[...]silver bullet[s] or a panacea. They do not replace well-balanced governance nor considered policy intervention. Blockchains will probably not replace banks or governments – but [it] will force change upon them'.

In fact, as with any innovation, blockchain applications come with challenges. According to Thomason, government, industry, and community scepticism stand at the top of the list. However, deeper understanding of individuals' needs (as well as their active involvement), wider technological literacy and access, and better integration with existing systems are also necessary – as experts highlighted throughout the report.

'[We] are all agents of impact and for the first time, we have ground-breaking technology that will change the way we think, work, and connect'.

- Jane Thomason, Founder, Supernova Data & Industry Associate, UCL Centre for Blockchain Technology

Blockchain has seen numerous new use cases in the last years that demonstrate it will likely continue to proliferate a growing number of sectors in the near future. According to Thomason, the Covid-19 pandemic fostered technology growth, but she sees increasing interest also in the fields of DeFi, cryptocurrencies, gaming, NFTs, and DAOs. With specific regard to the social sector, she believes we need a 'defined vision' and 'accurate and simple information on social impact use cases relevant to the specific regions'. But, as Thomason puts it, 'we are all agents of impact and for the first time, we have ground-breaking technology that will change the way we think, work, and connect. We need to drive progress to scale'.

Appendix A

Glossary

2D Datamatrix Code - Defined by PharmaLedger as a 'standard for serialisation' used in specific countries to provide products (or the packaging) with a unique number. Those codes serve as 'digital keys [to unlock] the connection across the healthcare value chain from the manufacturer, all the way to the patient'.¹⁰⁶ This system is an important step to build up a 'trusted, transparent blockchain-enabled healthcare ecosystem'.¹⁰⁶

Distributed Ledger Technology (DLT) - '[The] technological infrastructure and protocols that allows simultaneous access, validation, and record updating in an immutable manner across a network that's spread across multiple entities or locations', according to Investopedia.¹⁰⁷ Blockchain is a type of DLT.

Decentralised Autonomous Organisations (DAOs) - A self-enforcing system (reliant on blockchain for security and smart contracts for automation) to enable a group of people to collaboratively govern an organisation.¹⁰⁸ Tasks that cannot be automated, such as network upkeep, are incentivised using native tokens that can carry monetary or governance value to align individual behaviour.

Non-Fungible Tokens (NFTs) - Defined as 'cryptographic assets on blockchain with unique identification codes and metadata that distinguish them from each other. Unlike cryptocurrencies, they cannot be traded or exchanged at equivalency. This differs from fungible tokens like cryptocurrencies, which are identical to each other and, therefore, can be used as a medium for commercial transactions'.¹⁰⁹

Smart Contracts - '[A] self-executing contract with the terms of the agreement between the buyer and seller being directly written into lines of [computer] code' contained on a blockchain network, according to Investopedia.¹¹⁰ 'The code controls the execution, and transactions are traceable and irreversible'.¹¹⁰

Universal Basic Income (UBI) - Stanford Basic Income Labs defines it as 'a universal, unconditional, individual, regular and (cash) payment' that aims 'to provide [individuals] with a standard of living above the poverty line'.¹¹¹ It may vary based on the 'funding proposal, the level of payment, the frequency

of payment, and the particular policies proposed around it'.¹¹¹

About dGen

dGen is a non-profit think tank based in Berlin, Germany. We focus on the changes brought about by emerging technologies, and specifically how blockchain can contribute to a decentralised future in Europe. What might this mean for people, society, private entities, and the public sector over the coming decades?

Our insight reports focus on specific topics and industries to drive ideas for adoption in Europe. If you're researching how decentralisation is shaping our future, and would like to get involved, please get in touch at dgen.org. dGen is part of Beyond, a venture studio exploring a new world. For more information, go to beyond.ventures.

About PositiveBlockchain

PositiveBlockchain is the open database, knowledge platform and community exploring the potential of blockchain technologies for social and environmental impact. The association has a mission to build the web of knowledge and support collaboration for technology and social impact enthusiasts willing to leverage blockchain technologies for the U.N. SDGs.

The database currently lists more about 1100 projects and startups using blockchain technologies for good. Projects are either crowd-sourced or identified and qualified by PositiveBlockchain or its alliance partners comprising association, universities or blockchain foundations.

PositiveBlockchain is a contributor-based non-profit association registered in Paris and active globally.



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