



BLOCKCHAIN FOR SOCIAL IMPACT 2019



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Executive Summary

Use Case Details

Records and Verification

Storing and verifying records simultaneously on multiple computers, reducing risks of data falsification and allowing individual users to access, track, and share their data.

Payments and Money Transfers

Building peer-to-peer networks to transfer money without relying on many intermediaries in the financial system.

Platforms and Marketplaces

Creating platforms for entities to access services and marketplaces.

Supply Chain Management

Capturing information about entities, steps, locations, or other aspects of the supply chain.

Smart Contracting

Facilitating ownership transfer and other transactions between entities.

INTRODUCTION

Over the last five years, the promise of blockchain technology has swept the social impact world, with many innovators experimenting to find use cases for this uniquely secure technology. This has resulted in hundreds of new organizations, ventures, and initiatives (referred to collectively as “organizations” in this report) focused on blockchain.

To understand the ways in which blockchain can most effectively be used for social impact, our team conducted phone interviews with people in upper-level management positions (often CEOs and founders) at 110 organizations. These interviews were augmented through digital surveys. For this report, we focused on organizations in the following key sectors:

- Agriculture and Land Rights
- Climate and the Environment
- Digital Identity
- Financial Inclusion
- Governance and Democracy
- Health

In the following report, we share our conclusions from these interviews, including observations about trends that we discovered among our sample of organizations, as well as specific use cases in different sectors. In all cases, we are reporting on conversations held with a subset of organizations operating in the blockchain space and not extrapolating to the broader industry or sector.

METHODOLOGY

To compile these findings, our team of student researchers divided into sector-oriented subteams. To identify organizations to approach, we used the participants of the 2018 report *Blockchain for Social Impact: Moving Beyond the Hype* as a starting point and added organizations from our own internet searches and personal networks that we knew to use blockchain for social impact. We did not limit by nonprofit status.

Most of our outreach to these organizations was conducted through email, beginning with an explanation of the project and a request for an interview with organizational leadership about their use of blockchain for social impact. These interviews shared a common format based on a questionnaire; in some instances where an interview was not granted, this questionnaire was filled out and returned by company leadership, or by a member of the research team using publicly available information.

The number of participating organizations varies by sector. These numbers are influenced by the organizations cataloged by the research team as possible participants, as well as organizational willingness to participate. This variation in our sampling is not indicative of larger industry trends (e.g., we interviewed fewer organizations using blockchain in the Health sector; this does not mean that there are generally fewer organizations in the Health sector using blockchain).

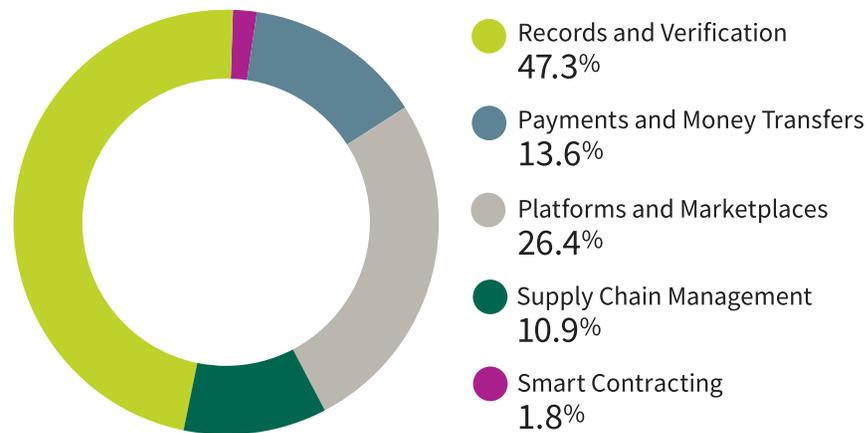
USE CASES

Within the six different sectors, we wanted to understand the specific problems being solved through use of blockchain technology. To bring commonality to the solution to these problems across sectors, we listed five different use cases and then categorized the solutions across these use cases.

Approximately 47% of organizations cataloged in this report use blockchain primarily for records and verification. Other common use cases include platforms and marketplaces (26%) and payments and money transfers (14%). Among the organizations we surveyed, smart contracting is the least prevalent use case.

Among the organizations we surveyed, smart contracting is the least prevalent use case. | N=110

Fig 1 / Primary Use Case for Blockchain



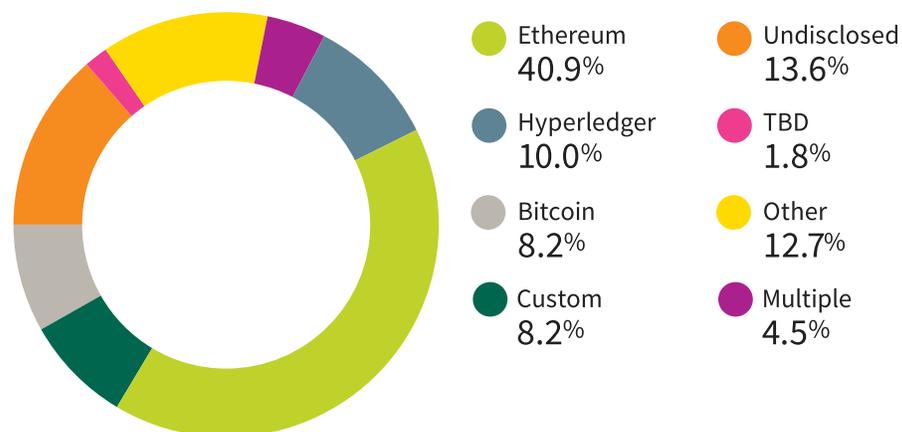
Within each sector, use case varied, although among the Digital Identity sector organizations that we surveyed, records and verification is the use case for the overwhelming majority. This is perhaps because this pain point is the largest among organizations in the space, and they have found that blockchain is a reliable and accurate way to address the challenges of records and verification.

BLOCKCHAIN TYPES

Among organizations that we surveyed, the blockchain technology landscape is fragmented. Some 41% of the 110 organizations interviewed report using Ethereum, while 10% report using Hyperledger, 8% report using Bitcoin, 8% report using their own or a custom-built blockchain, and 5% report using multiple types of blockchain. Another 14% report using a blockchain that is not Ethereum, Hyperledger, or Bitcoin — these other blockchains included Corda, Cosmos, Stellar EOS, Penta Global and Ripple.

Ethereum was most common among our sample, but the landscape is fragmented. | N=110

Fig 2 / Type of Blockchain Used



In three use cases — payments and money transfers, platforms and marketplaces, and records and verification — we encountered organizations that use their own or multiple blockchains. However, none of the organizations with whom we spoke are currently using multiple or proprietary blockchains for smart contracting or supply chain management.

Within individual sectors that we surveyed, the choice of blockchain was similarly fragmented, with only one sector in our sample (Digital Identity) showing a clear preference for a particular type of blockchain (Ethereum, used by more than 50% of the 20 organizations in our study).

When asked about their choices, some organizations reported that they use Ethereum because it is one of the more established blockchain protocols. Many organizations also said they found Ethereum more scalable and developer-friendly and hence chose it over other forms of blockchains.

IMPACT

We asked about the time frame during which organizations hoped to reach customers or end users, which we defined loosely as “impact.” The overwhelming majority of organizations in our survey anticipated reaching customers or end users within six months; a small minority expected to require more than a year.

The majority of the organizations that we surveyed (57%) focused on providing a general social public good. Examples include reducing emissions or improving healthcare services for all. Meanwhile, 43% were designed specifically to benefit a vulnerable or marginalized group — for example, people of lower socioeconomic status or people who do not have access to traditional forms of banking.

Of the organizations surveyed, those operating in the Climate and Environment, Digital Identity, and Health sectors were more likely to report larger-scale impact. We speculate that one reason for this could be the type of clients served in these sectors — a health organization might be serving an insurance provider with a large number of clients, while organizations in sectors such as Financial Inclusion are trying to bank unbanked consumers themselves.

Note that these numbers are self-reported and have not been subjected to independent verification; they include companies impacting the general public through greenhouse gas emissions reduction, improving voter transparency, and similar actions with broad social benefit.

VALUE-ADD OF BLOCKCHAIN

An overwhelming majority of the executives in our survey reported that blockchain had a strong value-add toward achieving their social impact goals: Of 108 who answered this question, a slim majority (51.9%) said that blockchain is a necessity for solving their problem, while 41.7% said it is an improvement over other methods. Only 6.5% said that it is one way to solve the problem but that other, non-blockchain solutions may be better.

CHALLENGES AND SUPPORT

Not all organizations with whom we spoke had launched their blockchain operations, but the majority of those who had reported that launching was more difficult than they anticipated.

Regulatory challenges were reported by nearly half of the organizations in our study. Examples include an unfriendly regulatory environment, unclear regulations that required organizations to navigate a gray area, or a lack of regulations, which makes organizations more nervous. Many also reported that regulators do not understand the technology and its potential impact.

Other reported problems include education of the public and stakeholders, cost or budget issues, lack of infrastructure, general internal challenges, and security or privacy concerns.

When asked what would improve their organization or its ability to expand, many organizations cited increased education of the public, as well as more funding, better networks, and more labor.

CONCLUSION

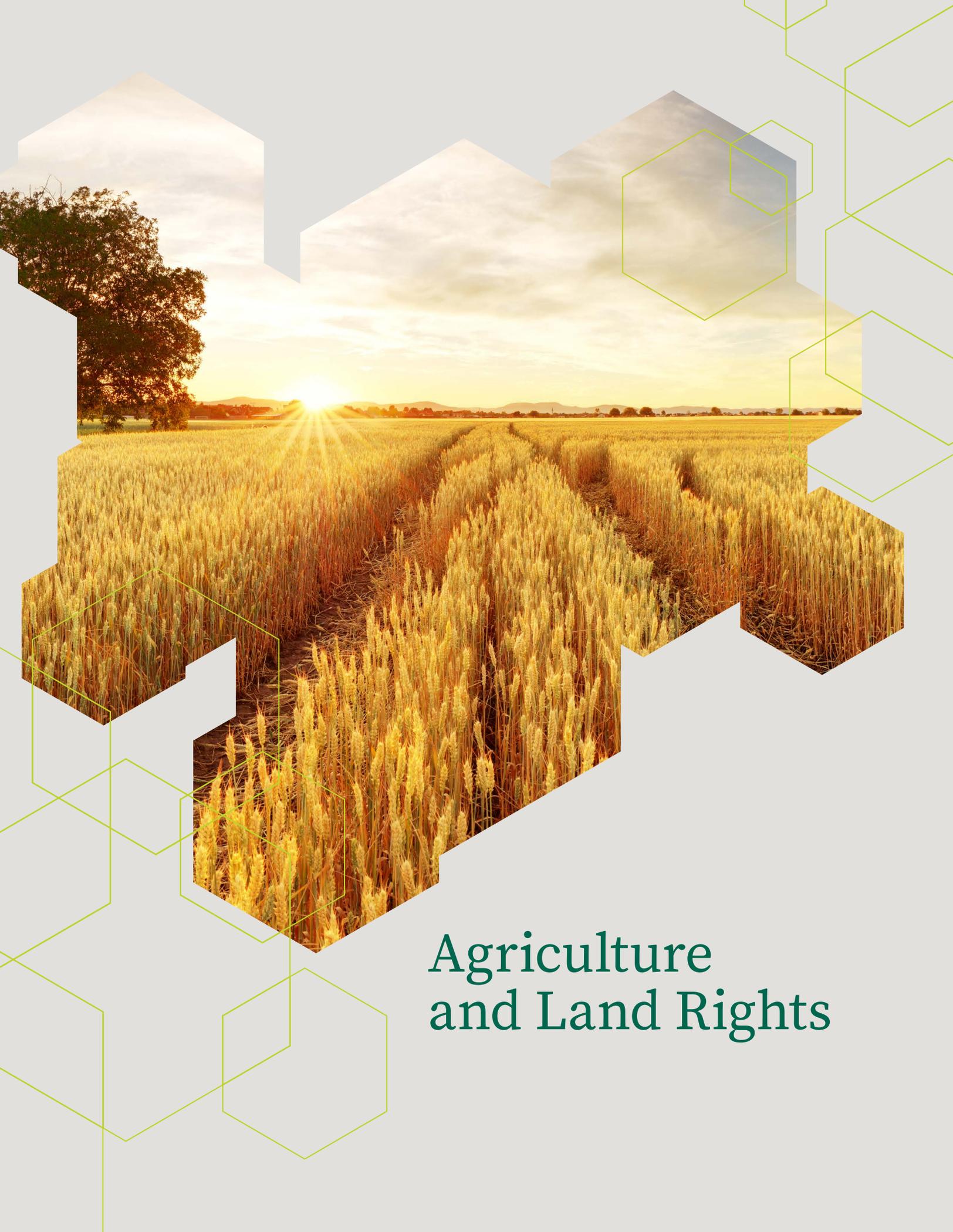
General Trends in the Blockchain-for-Social-Impact Landscape

While blockchain use varies across the sectors that we explored, we identified three overarching trends. First, the most common use case among our sample of organizations is records and verification, indicating that this is a salient problem across sectors. In that use case, we believe blockchain offers improvements in efficiency and implementation.

Meanwhile, the most common challenges cited by interviewees are regulatory. This suggests that government regulations are not adapting quickly enough to properly incentivize and facilitate growth in the blockchain-for-social-impact space. Improving policies and regulations in different sectors to reflect the reality of blockchain's use could catalyze more innovation.

Additionally, most interviewees reported that launching was harder than anticipated; here, again, policy reform could lower the threshold for blockchain-based innovation in the social impact space.

The following report unpacks these trends by sector, examining how they converge or diverge within different industries.



Agriculture and Land Rights

Agriculture and Land Rights

OVERVIEW

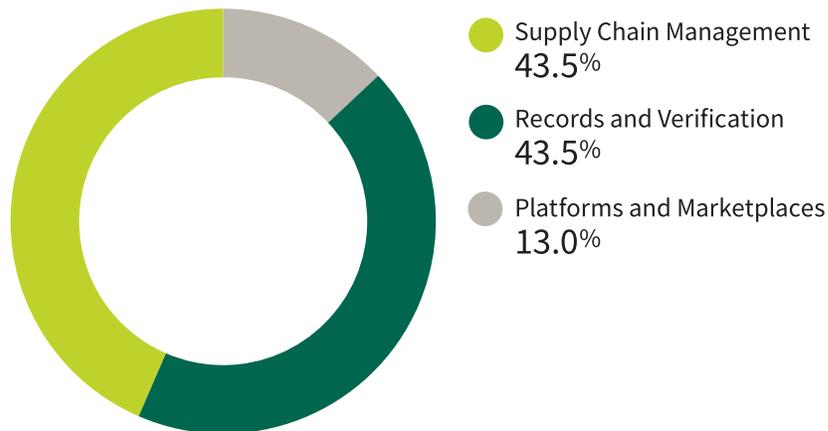
We surveyed 23 organizations that have used blockchain technology to promote social impact in the Agriculture and Land Rights sector. These organizations are using blockchain mainly for supply chain management and for records and verification.

Specifically, in agriculture, surveyed organizations apply blockchain to improve transparency in the food supply chain by enhancing the ability to track food from farming to consumption. In addition, blockchain technology is being used to remove unnecessary intermediaries and to enable farmers to obtain more accurate information and gain better access to agricultural markets.

In land rights, blockchain technology is used to address the lack of land registry or rights in developing countries. Organizations in the sector work to provide underserved populations with better access to real estate markets.

Surveyed organizations are using blockchain mainly for supply chain management and for records and verification. | N=23

Fig 3 / Agriculture and Land Rights Use Cases



Asked about the value-add of using blockchain, 48% of organizations surveyed answered that they see it as an improvement over other methods for solving the problems in the sector, whereas 39% of organizations believe that blockchain technology is a necessary solution for problems they are working on.

Ethereum and Bitcoin are the most popular blockchains among our sample of 23 organizations. Forty-eight percent of organizations are using Ethereum, and 22% are using Bitcoin. Some 13% of organizations in this sector use Hyperledger, and another 13% use their own blockchain platform or multiple blockchains.

According to our survey results, a majority of organizations in this sector are already reaching end users. Fifty-seven percent of interviewed organizations reported that they serve vulnerable populations rather than the general public. Although most organizations from our survey said they have impacted fewer than 1,000 people, several organizations reported reaching more than 100,000 people.

An overwhelming majority of those who had already launched reported that it was harder than they expected. They cited various financial and regulatory hurdles, as well as the need to better educate both the public and their stakeholders about blockchain technology.

Nevertheless, in spite of the difficulties they experienced, only one executive reported becoming pessimistic about the impact of blockchain technology. More than half of organizations in our study sample said that they feel more optimistic about using blockchain to promote social impact in their business.

CASE STUDY: GRAINCHAIN

GrainChain was created in 2013 as an integrated cloud-based commodity storage and management solutions company working primarily in North America and Central America. GrainChain's vision is to create a software ecosystem that empowers farmers in the global grain industry who wouldn't normally have the budget to invest in certain technologies.

GrainChain wants to level the playing field and reduce the number of intermediaries needed to complete a transaction. GrainChain does this by providing a transaction platform for the sale and purchase of grain and other commodities.

Overall, GrainChain helps farmers engage with more buyers and increases trust and transparency throughout the value chain so that all actors can access information on the quality of the seed. In many instances it helps farmers increase profitability.

For GrainChain, this starts in the fields of South Texas, where more than 1,000 farmers use its platform to generate smart contracts for the sale and purchase of grain. The farmers are paid instantly, and buyers receive immediate title to the commodity.

GrainChain runs its platform with the help of blockchain technology. It works with two systems: a logistics system called HarvX and a grain governance system called SiloSys that tracks and maintains movement of a seed from the producer to the farm, including data on the origin of the seed, authentication of the seed, and seed storage.

GrainChain's blockchain solution is designed to collaborate with existing software systems that use its API. Therefore, GrainChain's platform records all of this collected data in an immutable record that is perpetually linked to the commodity and the participants.

When a farmer has a certain quantity of grain to sell, the farmer creates a smart contract sales agreement with all the sales terms defined — including logistics, storage, pest control, quality of the grain, and location — on GrainChain's platform. The buyer can then evaluate the information on the smart contract and add variables to it. By accepting this smart contract, the buyer is effectively accepting the terms that the farmer included.

GrainChain's platform then calculates the net value for the contract and digitally escrows the buyer's funds. Once the grain is delivered to the agreed-upon settlement location, it is verified by the system, and the buyer's funds are automatically put into the farmer's GrainChain wallet and converted to the local currency, which cuts out international banking and transfer fees.

Ultimately, GrainChain’s use of blockchain enhances trust, transparency, and traceability of the supply chain for farmers and buyers through instant payment for farmers upon delivery and reliable quality verification for customers via smart contracts.

Luis Macias, GrainChain’s cofounder and CEO, strongly believes that blockchain is a “beautiful technology,” but not the secret ingredient to meet all the challenges of transparency and security in the agricultural supply chain.

GrainChain emphasizes the importance of guaranteeing that data is correct and accurate, and it points to its collaboration with various data collection systems. As of April 20, 2019, 1,439 participants had completed 84,410 transactions on GrainChain’s platform, processing 5,264,205,815 pounds of commodities.¹

Looking ahead, GrainChain plans to work with the Mexican government to help increase the transparency of the agricultural markets in Mexico. The company is already working in 10 grain facilities and hopes to expand to 41 in the next year. Through this work, GrainChain hopes to increase its impact to between 10,000 and 20,000 more farmers.

¹<https://www.grainchain.io/>



Climate and the Environment

Climate and the Environment

OVERVIEW

The Climate and Environment sector processes millions of transactions to trade and distribute energy and reduce environmental harm each year. In energy initiatives, blockchain can improve the efficiency of existing grids through decentralized platforms that take out the intermediary for energy exchange. It also facilitates micro-optimizations of energy at the facilities level by allowing people to track their energy usage through a transparent and easily accessible platform. More efficient transactions can eliminate intermediaries and speed up the distribution of energy.

Blockchain can also facilitate peer-to-peer energy transmission and support the creation of microgrids. For example, one company in our report, Lition, allows its users to buy and sell electricity and gas from local sources on its platform. Additionally, energy initiatives can be funded with increased transparency through payment systems built on blockchain.

Initiatives related to the environment and climate change benefit from blockchain through the use of tokens and exchange markets to incentivize consumers to reduce carbon emissions. In these marketplaces, users earn redeemable tokens that they can trade by making everyday choices that are energy efficient. For example, decreasing energy usage or driving an electric vehicle would earn consumers tokens, incentivizing emissions-reducing behavior. Tokens can also streamline emissions trading between companies and emitters by providing a transparent carbon credit marketplace, thereby reducing the cost of the offsetting process.

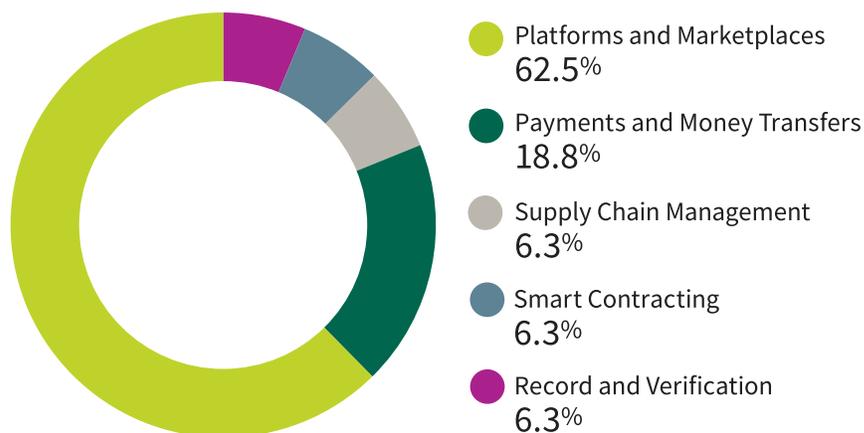
Of the 16 organizations that we interviewed in this sector, 10 use blockchain for platforms or marketplaces. For instance, the Poseidon Foundation plans to partner with retailers to calculate the carbon footprint of their products and offer consumers the chance to buy carbon offsets on its 'reduce' platform.

The second most common use case is payments and money transfers (used by three organizations). One participating organization, Omega Grid, allows users to earn rewards for using clean energy sources.

Finally, the Climate and Environment sector also includes organizations using blockchain in records and verification, smart contracting, and supply chain management.

Of the organizations interviewed in this sector, 10 use blockchain for platforms or marketplaces. | N=16

Fig 4 / Climate and Environment Use Cases



Many organizations that we interviewed in the Climate and Environment sector are still in nascent stages: Fewer than half had already launched, and only six reported already seeing impact. Nevertheless, several organizations reported reaching 1,001–10,000 people so far.

The Climate and Environment sector faces a unique set of challenges due to the nature of the services it provides. Specifically, over half of the organizations interviewed cited regulatory issues as their biggest challenge. This is especially important to many of the energy organizations because they are operating within energy markets, which often have regulations that are not made to facilitate innovative, often disruptive, changes. The second and third most frequently cited challenges are operating costs and the education of the public, respectively.

CASE STUDY: VERV

United Kingdom-based Verv offers users in social housing a smart hub to monitor their energy usage, reduce it accordingly, and sell any renewable-generated excess.

Verv is unusual for its focus on social housing, which is often considered a credit risk. It's difficult for low-income residents to get funding to install solar panels. However, these residents — who often have to prepay for the energy they'll use and, if they exhaust the credit, lose their electricity — could benefit from the cost-saving and potentially income-generating implementation of solar panels.

Verv completed England's first peer-to-peer trade of energy using blockchain in 2018 at a social housing project in London and is working to expand that program. Verv worked with Repowering, a nonprofit organization that facilitates the coproduction of community housing, to install solar panels. Verv also installed hubs in 40 participating flats within the community to enable residents to benefit directly from that green energy as they lower their energy bills.

When the panels generate excess energy, that energy is sold safely and securely through Verv's VLUX token on its peer-to-peer blockchain platform, which uses Ethereum.

The peer-to-peer trading platform both incentivizes using renewable energy and allows participants to benefit from their generated assets. Currently, there are about 1,500 Verv hub users, with more than 150 participating in live peer-to-peer energy trading trials. The number of hub users is projected to reach up to 10,000 in the next year.

Verv encourages both environmental sustainability, by promoting solar power, and social equity, by expanding the benefits of self-generated energy to low-income residents. The blockchain system allows secure, low-cost transactions that further promote the safe and easy transfer of energy from generator to consumer.



Digital Identity

Digital Identity

OVERVIEW

We interviewed 20 companies using blockchain for social impact in the digital identity space. Nineteen of these use blockchain for records and verification. Application of blockchain in digital identity ranges from personal online identification for refugees, to helping college sports teams understand their fan bases, to verifying charity donations, to government-level certification of education credentials.

For example, Malta is the first European country to issue its education certificates and diplomas on blockchain. This ensures tamper-proof education certificates and gives citizens full control over their education records. The Maltese government has partnered with Learning Machine to launch this project using Blockcerts technology.

We interviewed the team at Alice, which aims to make social funding and charity more transparent by using a platform built with blockchain. The London-based company uses Ethereum-based blockchain to incentivize social impact organizations to become more transparent by ensuring that these organizations get paid more when they achieve their stated goals. Their solution allows donors to monitor the execution of projects and identify social impact organizations that work effectively.

SkillZ is a French Ethereum-based blockchain startup that helps workers store their identification, work experience certification, and biometric data on blockchain. Skillz partners with employers who fill out this information on their workers' behalf. This allows workers to have transferable work credentials that can be used by subsequent employers.

Among the 20 companies in our sample, 16 are for-profit, three are nonprofit, and one is a government institution. Fifty-five percent of companies use Ethereum for their digital identity solutions, 15% use IBM's Hyperledger Fabric, 10% use Bitcoin, and the rest reported using multiple blockchain technologies or their own custom solution.

Of the 20 organizations in our sample, 10 reported reaching 100,000 to one million users, and two reported reaching over one million users. Within the scope of our industry exploration — in which fewer than half the companies reported already seeing impact — this was notable.

In our Digital Identity sector cohort, three companies raised \$40 million through an initial coin offering. Two companies received grants, three used internal resources, and 12 opted for traditional venture capital financing. We infer from this that companies and projects in digital identity have grown from the seed level of financing to more advanced stages of financing, which in turn implies trust from institutional and individual investors.

Fifty percent of our respondents said it was harder to launch their startups than they anticipated. Regulatory issues were the most frequently cited challenge (mentioned by 55% of the companies we surveyed). Most countries do not have clear legislation in place to regulate conventional and blockchain-based digital identity. Companies that operate in the European Union have to comply with the General Data Protection Regulation (GDPR), an EU regulation for data protection and privacy. Several startups mentioned GDPR as a benchmark regulation that they strive to comply with even if they are located outside the EU.

The other top three challenges reported by our companies were lack of infrastructure (50%), education of the public (40%), and cost/budget (40%). Since the majority of companies that we interviewed are working with or serving a vulnerable population, lack of infrastructure (e.g. access to internet, smartphones, and computers) is a big hurdle. Due to the complexity of some blockchain solutions, it takes an additional effort to make them user-friendly and educate the general public about their value.

Despite existing challenges, 75% of the 20 companies in our Digital Identity sector survey are more optimistic about blockchain than when they started and plan to continue using this technology. Twenty percent feel the same level of optimism about blockchain as they did when they started, and only one reported less optimism about using blockchain to achieve its business objectives, citing the scalability issue.

CASE STUDY: SPRING LABS

Spring Labs has developed the Spring Protocol, a B2B global information-sharing platform that leverages blockchain technology and an extra layer of cryptography to facilitate the peer-to-peer exchange of information. Spring Labs' mission is to fundamentally change how data is owned, shared, exchanged, valued, and monetized. By separating "data ownership" from "data value," Spring Labs' Spring Protocol will change many industry norms that are contingent on the need to hoard and aggregate data in order to achieve value.

The Spring Protocol enables parties to share interpretations of data with other parties without transferring the underlying data itself or revealing the source of the data. The security, trust, and anonymity of the network will allow the direct, P2P exchange of data that would otherwise be too private, regulated, or sensitive to be shared, especially among network participants.

The first product being built on the Spring Protocol is a decentralized "un-bureau" that facilitates the exchange of identity and fraud data among financial institutions and other parties that have valuable consumer information. The solution should greatly mitigate hacks — like the 2017 Equifax hack — as well as provide better data security, privacy, ownership, and economics than the existing ecosystem.

The product is still in its development stages and is not yet publicly available. However, the company has signed partnerships with more than two dozen prominent financial service institutions that have collectively funded more than \$100 billion in loans across tens of millions of consumers and businesses.



Financial Inclusion

Financial Inclusion

OVERVIEW

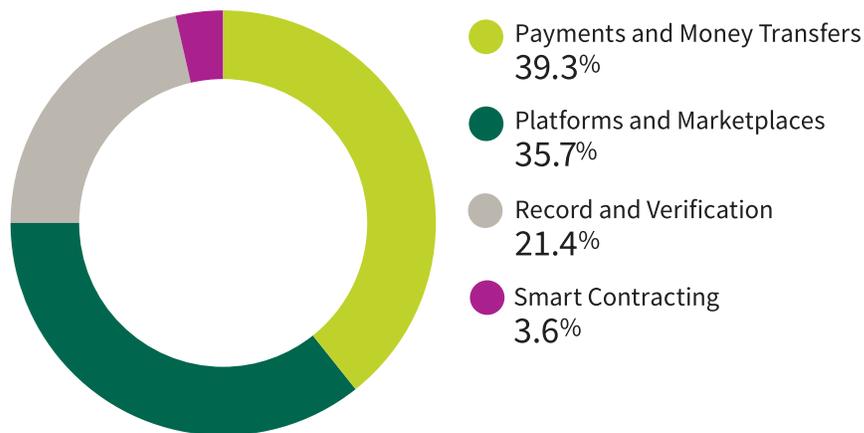
We researched and interviewed 28 organizations across the world committed to using blockchain for financial inclusion. Close to one-third of the world's adults (approximately 1.7 billion people) are still unbanked, and millions more are underbanked. Financial inclusion has been identified as an enabler for seven out of the United Nations' 17 sustainable development goals and thus has become an area of key interest for government and private sector organizations.

We found 39% of cataloged organizations using blockchain for payments and money transfers. Many of them reported that using blockchain lowered the cost of the transaction, especially if it was cross-border. Blockchain either allowed the company to do something that it previously could not or provided a marked improvement to an existing solution. For example, Wala, a fintech company that operates in Uganda, Zimbabwe, and South Africa, has built a mobile platform that functions like a bank account and payment system that is as seamless as WhatsApp or Facebook. The population that Wala targets does not have access to a bank account, and using blockchain allowed Wala to create both a secure method to store and a quick method to transfer funds.

About 36% of organizations in our sample use blockchain for platforms and marketplaces. One of the organizations interviewed, UBDI, recognizes that companies around the world want to better understand their customers' preferences and that collecting this data could compromise an individual's privacy. UBDI has built a platform for individuals to send their personal data to companies and get paid while the platform protects the identity and privacy of the individuals. This helps users earn income, which could be valuable to the poor.

We found 39% of cataloged organizations using blockchain for payments and money transfers. | N=28

Fig 5 / Financial Inclusion Use Cases



While many of the organizations in our survey were in pilot phase and gave incomplete data on impact, a handful reported that they had already reached 100,000 or more people with their product or service.

Organizations interviewed in the Financial Inclusion sector mentioned regulation as a critical challenge. Many executives said that regulation was either not present or unclear in areas where they worked, especially outside the United States. Some executives mentioned

the need to work with regulators early but noted the high cost of the time taken to educate the regulators about their work and influence policy.

In addition to unclear regulation, the lack of infrastructure also emerged as a key challenge in our interviews. Some executives said there are doubts about the extent to which blockchain is scalable, but they remain hopeful that the challenges will be resolved. Internet connectivity was also mentioned as a challenge.

Despite these challenges — and many reported that launching with blockchain was harder than they had anticipated — the executives we interviewed in the Financial Inclusion sector were enthusiastic about blockchain’s potential to provide impact. Eleven of the 28 responded that blockchain technology is necessary for their business; of the rest, all but two mentioned that blockchain is an improvement over other problem-solving methods.

CASE STUDY: BITPESA

Business transactions in and out of frontier markets have historically been slow and expensive, in part because many remain paper-based. Small businesses in Africa need to use international money transfers to pay employees and suppliers and to accept payments from customers.

Traditional banking and financial processes involve converting local currency into U.S. dollars, passing it through multiple banks, and then converting it back into its destination currency. Kenya-based BitPesa uses blockchain and cryptocurrency to transfer money directly across accounts in different countries, cutting out intermediaries and saving on conversion and transfer fees. The founders, Elizabeth Rossiello and Charlene Chen, had two decades of experience in finance and social impact, mostly in developing markets. In 2013, they decided to build a company uniquely suited to the needs of underserved markets rather than extend an existing solution from elsewhere. Today BitPesa works across 85 countries with 26,000 users and has processed over one million transactions.

BitPesa’s BFX can transfer money with a few clicks across seven African countries: Tanzania, Uganda, Nigeria, Democratic Republic of Congo, Senegal, Ghana, and Morocco. BitPesa charges a 1–3% transaction fee on average, compared to about 10% charged by traditional financial institutions. It is 100% digital, partnered with about 60 banks and about six mobile money networks for stable service. The company has also launched a white-label infrastructure solution called TransferZero for enterprises to use in these markets. TransferZero offers money transfer services across banks and mobile wallets, providing a seamless user interface and competitive foreign exchange rates.

One key challenge for BitPesa has been learning to work with regulators who don’t understand blockchain and believe it undermines central banks. BitPesa has been acting as a consulting partner to these central banks to educate them on using this technology to improve trade through increased accessibility and liquidity.



Governance and Democracy

Governance and Democracy

OVERVIEW

Blockchain systems can improve voting processes worldwide by promoting inclusivity, security, and transparency. Once an authoritative body determines voter eligibility, voters receive a token or key that, cast on a blockchain, is instantly countable and verifiable, thus increasing the security of the vote. Some companies are experimenting with open-source voting platforms, allowing any citizen or agency to audit the functionality of the voting system. Blockchain-based voting systems do not require a centralized authority to administer them, reducing the possibility of corruption and increasing trust between citizens and their governments.

Governments also are turning to blockchain beyond the voting process to help them manage various services and encourage data privacy. For example, local, state, and national governments use blockchain-like systems to manage citizens' data and can transmit and/or verify this data without viewing the underlying information (called "zero-knowledge proofs"). Agencies are also using these systems, which are sometimes open source, to publish critical data and certify government operations.

We interviewed 16 companies in this sector. The majority of our interviewees (62.5%) are using blockchain for records and verification. These companies, including Smartmatic, Horizon State, Votem, and Voatz, want to solve the problem of trust in the vote. They are helping to manage voter identification and the integrity of the vote at all levels, ranging from general elections to union voting to shareholder meetings.

Democracy Earth is exploring the idea of "liquid democracy," which promotes a system of representative and direct democracy by allowing voters to delegate a number of votes to a trusted person or delegate multiple votes to a single issue depending on voters' convictions. This type of voting allows communities at all levels to choose their level of involvement in the democratic process, and it allows voters to delegate their votes to experts of their choosing.

Other companies, such as Learning Machine and InCraft, are creating software for actors such as schools, companies, and governments to issue digital records in a manner that is secure and transparent and to automate internal business processes. In particular, this allows documents like academic credentials to be secure and wholly owned by the student — and instantly verifiable all over the world.

Among our sample of organizations in the Governance and Democracy sector, we observed no clear preference for a particular type of blockchain. Eight of the companies in this sector are using Ethereum, Bitcoin, or Hyperledger, but the remaining companies reported using custom, multiple, or unspecified "other" blockchains.

A majority (75%) of the companies in our sample have already seen impact. Several are well-established and have reached millions of people through partnerships with governments.

Companies in Governance and Democracy confront a variety of challenges, including the need for more education, regulatory issues, and security and privacy concerns. Blockchain is touted in this sector as a way for citizens to regain trust in institutions, but

executives we interviewed felt that a lack of public/stakeholder education remains a barrier. Some companies cited recent events — such as the 2016 U.S. election — as leading to greater distrust in emerging technologies and said they are having a difficult time convincing citizens that blockchain is a secure solution.

In addition, some companies cited the lack of regulatory clarity as a key challenge. Many governments do not yet understand how to approach blockchain or cryptocurrency and thus do not know how to regulate these companies and/or design regulatory frameworks that are appropriate.

CASE STUDY: OS CITY

In 2018, only 48% of citizens surveyed in over 20,000 interviews across 18 Latin American countries expressed support for democracy as their preferred type of government, with government corruption noted as a top reason for the public's eroding trust, according to Latinobarómetro, a nonprofit polling company based in Chile. Against this backdrop, OS City, a software company based in San Pedro, Mexico, is focused on improving the transparency and accountability of government operations in cities across Latin America.

Founded with financial support from the Organization of American States' Fellowship on Open Government in the Americas, OS City has integrated blockchain into the software platforms it designs for local, state, and national governments. The use of distributed ledger technology allows for the creation of tamper-proof records that can be used to verify government operations. This has the potential to enable greater public trust in how local governments make decisions as part of their processes for administering public services, such as how they choose to allocate public resources like subsidies.

In November 2017, OS City launched a pilot program with the municipality of Bahía Blanca, within Buenos Aires, that focused on the secure, open issuance of the city's arts and culture subsidy grants to local artists and organizations. The use of blockchain guaranteed that the distribution of subsidies would not be subject to corrupt diversion. During the pilot program, 120 projects were submitted, and subsidy funds were awarded to 47 individuals and organizations, with an average of 25,000 pesos (\$1,500) awarded to each.

OS City is exploring a range of other use cases for blockchain to support the administration of city government operations across Latin America. In April 2018, the company started a pilot program with Chile's National Energy Commission to develop a publicly accessible ledger of data on Chile's national energy market.

OS City uses both the Ethereum and Bitcoin networks and is also exploring the use of Hyperledger. In 2018, OS City received a grant from the UNICEF Innovation Fund to continue to scale up.



Health

Health

OVERVIEW

To shed more light on uses of blockchain in the health industry, we interviewed seven organizations. Four of them were primarily corporate-facing. This could be due to the fact that blockchain applications in the Health sector inevitably involve industry incumbents. Therefore, it makes sense to build applications to empower the incumbents to improve their solutions. Potential uses include creating efficient data exchange between stakeholders, improving the security of sensitive medical records of patients, and offering individuals ownership and management of personal health data.

Five of the organizations we surveyed considered their primary use of blockchain technology in the Health sector to be in records and verification. Electronic health records are usually siloed, rendering information exchanges costly and challenging. The lack of a unique patient identifier makes it more difficult to identify patients' records stored by other practitioners, often resulting in duplicated or inconsistent patient records and increasing the likelihood of patient mistreatment. Health information is highly regulated, and electronic systems in the United States must comply with HIPAA standards for patient privacy and data security.

One of the respondents to our survey, SimplyVital Health, builds blockchain infrastructure to allow healthcare providers to safely share their patients' data under HIPAA standards. One potential use case is to allow healthcare providers to share patients' data with insurance providers in an efficient and secure way, creating a win-win for all parties. Healthcare providers get reimbursed faster and lower their costs. Insurance providers enjoy more timely handling of data, enhanced data analytic prediction, and reduced risk of fraud. Patients could potentially enjoy a lower cost of healthcare.

The Health sector is also vulnerable to cyber attack because it stores valuable personal data. Healthcare organizations had the highest costs associated with a lost or stolen record, at \$408 per record — three times higher than average.² Blockchain uses distributed ledgers to store records, creating a barrier to tampering and theft.

Companies like Factom help healthcare incumbents adopt new data storage structures using blockchain that are also compliant with regulations such as HIPAA and GDPR.

Blockchain has opened up a new opportunity to enable patients to share their data with appropriate parties within healthcare. For instance, data such as personal demographics and medication history are important in drug development and identifying the right targets for clinical trials. Blockchain ledgers can be audited, and an individual can trace the transfer of his or her personal health data along the chain with ease. A blockchain network with a built-in incentive mechanism could encourage individuals to approve the sharing of their data with pharmaceutical companies. Moreover, a blockchain network can facilitate the transfer of healthcare data between healthcare companies and pharmaceutical companies. All of these benefits could potentially lead to more and speedier drug discovery and a reduction of drug development costs.

²Weisbaum, Herb. "The total cost of a data breach—including lost business—keeps growing," NBC News, 30 July, 2018
<https://www.nbcnews.com/business/consumer/total-cost-data-breach-including-lost-business-keeps-growing-n895826>

The largest challenge reported by health organizations in our survey is education of the public and stakeholders. The recent crash of the cryptocurrency market in 2018 has created significant adverse publicity for the blockchain community. Some of the respondents said the cryptocurrency crash has harmed their business development efforts, as the general public associated blockchain with cryptocurrency like Bitcoin and Ether. The organizations we interviewed hope that the general public will become more educated on the distinction between blockchain and cryptocurrency, as well as on the potential benefits blockchain technologies can bring.

CASE STUDY: COVERUS

CoverUS is a for-profit company founded in 2018 that supports transparent and secure third-party auditing of data sharing and financial transactions on a distributed ledger. The company's data brokerage platform aims to be a marketplace for healthcare data in which consumers have control and trust over how and with whom their data is shared, and in which they are compensated for their participation in the data exchange.

Thirty-seven percent of Americans can't afford a \$100 medical bill, and 64% of patients are delaying health treatment until they have the money to pay for it, resulting in poor health outcomes and skyrocketing national healthcare costs. On the other hand, lack of direct patient engagement makes it difficult for the healthcare industry to conduct highly targeted marketing campaigns, to incentivize people to take healthy actions, and to collect real-time, real-world health data from patients at scale. This leads to higher costs for research and development, advertising, and medication non-adherence.

CoverUS is introducing a way for consumers to profit from their direct sharing of healthcare data by choosing which surveys and adherence programs to participate in, thus increasing many Americans' access to good healthcare and reducing national costs. The company also adheres to HIPAA, GDPR, CCPA and other privacy standards, and it supports transparent third-party auditing of data sharing and financial transactions on a distributed ledger. Blockchain allows independent verification that all actors in the marketplace are behaving in a trustworthy manner.

CoverUS was set to launch in Q2 2019 with an online patient community of 1.5 million people suffering from chronic diseases.

If CoverUS and similar solutions can be scaled up, platforms could improve patient outcomes and help save the global healthcare system billions of dollars per year in R&D, advertising, and medical compliance.



Blockchain Comparisons

Blockchain Comparisons

In this section, we explore the four blockchains that are most commonly used among our interviewees: Bitcoin, Ether, Hyperledger, and Ripple.

Bitcoin

ORIGIN

Bitcoin was invented by an unknown person or persons under the pseudonym Satoshi Nakamoto and released as open-source software in 2009. Bitcoins are created as a reward for a process known as “mining” on the Bitcoin blockchain, and they can be exchanged for other currencies, products, and services.

HOW IT WORKS

Transactions contain a unique transaction ID, an input Bitcoin address, the number of Bitcoins to be transferred, and the output Bitcoin address of the recipient. The process involves the initiator of the transaction and a “miner” (i.e., people in the blockchain network that verify transactions and get paid for verification in Bitcoin).

Currently, a Bitcoin blockchain operates on the proof-of-work concept:

1. An expensive computer calculation (“mining”) is done in order to verify a new set of transactions (a “block”).
2. The transaction initiator pays transaction fees to the miner, who will attempt to solve the computational problem.
3. Verification is executed by solving a computational problem.
4. The transactions included in that block are then recorded in the blockchain.

When transactions are recorded, they are encrypted using cryptographic hashing so the information cannot be changed. Creating a new block requires not only the transaction information of the current transaction but also a reference to the last recorded block.³

PROS

- This blockchain allows users to conduct irreversible transactions without having to trust a third party⁴.
- Many currencies have been built on this blockchain, and today Bitcoin is one of the most ubiquitous currencies used and traded in the industry.
- Bitcoin blockchain has recently implemented Segregated Witness, or SegWit, technology, in which the block size limit (1,000,000 bytes) on a blockchain is increased by removing signature data from Bitcoin transactions. When certain parts of a transaction are removed, this frees up space or capacity to add more transactions to the chain.⁵

³⁻⁵ edChain. “A Comparison Between 5 Major Blockchain Protocols.” *Medium*, EdChain, 19 May 2018
medium.com/edchain/a-comparison-between-5-major-blockchain-protocols-b8a6a46f8b1f

CONS

- Mining and verification take much longer on the Bitcoin blockchain (10 minutes or more) than on others (10–20 seconds on Ethereum).⁶
- Despite the implementation of SegWit, there are still some scalability issues with this blockchain, since with every transaction a miner must load the entire chain of information as they participate in the transaction validation process.
- This blockchain does not support smart contracts but rather is focused on cryptocurrencies.

Ethereum

ORIGIN

Vitalik Buterin, cofounder of Ethereum, was also an initial contributor to the Bitcoin codebase, but he became frustrated with its programming limitations and advocated for a more malleable blockchain. Buterin built Ethereum, the second public blockchain, in 2014.

HOW IT WORKS

Unlike Bitcoin, which was built to allow crypto payment transactions over a decentralized network, Ethereum was designed with more objectives in mind. Ethereum provides a blockchain platform, which developers can use to launch their own blockchain projects, in addition to new cryptocurrencies.

The platform, commonly called an Ethereum Virtual Machine, or EVM, has been used to launch over 1,000 DApps.⁷ DApps are open-source, fully automated applications where the backend code runs on a decentralized blockchain. The automation of these applications is conducted through smart contracts, which are coding demands that execute once certain conditions have been met.

Ethereum has several features in common with the Bitcoin blockchain, including the same cryptographic hash function when new data is verified on the blockchain, private- and public-key encryption, a P2P network, and the proof-of-work consensus algorithm.

However, Ethereum will be changing to a new consensus system called “proof of stake” by the end of 2019. Proof of stake has the same goal as proof of work — to validate transactions and achieve consensus in the chain — and it also uses an algorithm to complete blocks and distribute Ethereum, but with a different process. Regular mining on the Bitcoin blockchain requires a great deal of computing power to run different calculations to solve the computation problems. The computing power translates into a high amount of electricity and power needed for the proof of work. The proof of stake seeks to address this issue by attributing mining power to the proportion of coins held by a miner.⁸

⁶Siriwardena, Prabath. “The Mystery Behind Block Time.” FACILELOGIN, 14 Oct. 2017
medium.facilelogin.com/the-mystery-behind-block-time-63351e35603a

⁷edChain. “A Comparison Between 5 Major Blockchain Protocols.” *Medium*, EdChain, 19 May 2018
medium.com/edchain/a-comparison-between-5-major-blockchain-protocols-b8a6a46f8b1f

⁸Frankenfield, Jake. “Proof of Stake (PoS).” Investopedia, Investopedia, 12 Mar. 2019
www.investopedia.com/terms/p/proof-stake-pos.asp

PROS

- Ethereum has made wider adoption of blockchain possible because of EVM, smart contracts, and DApps.
- Ethereum has the second highest market cap, behind only Bitcoin.
- The average block time for Ethereum is significantly less than for Bitcoin: 10–20 seconds versus 10 minutes. This translates into more block confirmations, which allows Ethereum’s miners to complete more blocks and receive more ether.

CONS

- Similar to Bitcoin, Ethereum still has an early-mover disadvantage. Most new startups are learning from the incumbents and are nimble enough to ensure faster development and execution.

Hyperledger

ORIGIN

Hyperledger is an umbrella project of open-source blockchain frameworks and related tools started in December 2015 by the Linux Foundation. Linux has a committee of leaders that consists of multiple executives with decades of experience in open-source products and connections to several industries.

Hyperledger is a hub for open industrial blockchain development. Hyperledger frameworks (such as Hyperledger Fabric and Sawtooth) and tools (such as Hyperledger Composer and Cello) allow developers to develop customized enterprise-level blockchain solutions; Hyperledger does not support Bitcoin or any other cryptocurrency.

Hyperledger’s members include mobility tech giants like Airbus and Daimler; IT companies like IBM, Fujitsu, SAP, Huawei, Nokia, Intel, and Samsung; and financial institutions like Deutsche Börse, American Express, J.P. Morgan, BBVA, BNP Paribas, and Wells Fargo; as well as blockchain startups like Blockstream, Netki, Lykke, Factom, Bloq, and Consen-Sys.⁹

HOW IT WORKS

The network created using Hyperledger protocols is permission-based, meaning that a network owner decides who can join the network and verify blocks. Permission-based blockchains support private and confidential transactions within the network. Hyperledger blockchains are also more scalable than the other public blockchains because they do not require computing-power-intensive consensus.

The commonly used Hyperledger Fabric framework runs distributed applications written in general-purpose programming languages without depending on any native cryptocurrency. This stands in sharp contrast to most other blockchain platforms for running smart contracts, which either require code to be written in a domain-specific language or else rely on a cryptocurrency.

⁹<https://blockgeeks.com/guides/hyperledger/>

Furthermore, Fabric uses a portable notion of membership for the permissioned model, which can be integrated with industry-standard identity management. To support such flexibility, Fabric takes a novel architectural approach and revamps the way blockchains cope with nondeterminism, resource exhaustion, and performance attacks.

Fabric can also create “channels,” which enable a group of participants to create a separate ledger of transactions. This is especially important for networks where some participants might be competitors who don’t want every transaction — such as a special price offered to some but not all — known to every participant in the network. If a group of participants forms a channel, only those participants and no others have copies of the ledger for that channel.¹⁰

PROS

- Hyperledger offers modular architectures and thus flexibility to businesses to adapt blockchain technologies to each of their distinctive needs.
- No cryptocurrency or mining is required for assuring transactions, which means these networks use less computing power and allow for more transactions per second.

CONS

- Blockchain networks developed under the Hyperledger protocol are controlled by a number of selected members.
- It may not be transparent enough to gain trust from the public.

Ripple

ORIGIN

Ripple is a real-time gross settlement system, currency exchange, and remittance blockchain network created by Ripple Labs.¹¹ RippleNet is a network of institutional payment providers that use blockchain solutions developed using Ripple to empower fast and cheap transactions. Ripple is generally used for currency exchange and international payment transactions.

HOW IT WORKS

Ripple is built upon a distributed open-source protocol with features similar to Bitcoin or Ethereum, such as decentralized design, cryptographic hash functions, a P2P network, and private- and public-key encryption.

Transactions are cryptographically signed, and the protocol enables real-time gross settlement, allowing fast global payments. According to Ripple Labs’ consensus white paper, rather than mining, Ripple works by consensus. The Ripple system is a peer-to-peer system in which participating devices all connect to the network. Some nodes make and receive payments for their users, while others operate as validators, carrying out the consensus process. These validators look at the ledger, which is a snapshot of the current state of transactions on the network, and agree upon the current state using the Ripple Protocol Consensus Algorithm.

¹⁰ “An Introduction to Hyperledger.”, Hyperledger, July 2018
https://www.hyperledger.org/wp-content/uploads/2018/07/HL_Whitepaper_IntroductiontoHyperledger.pdf

¹¹ “Ripple (Payment Protocol)”, Wikipedia, 21 Mar. 2019
[https://en.wikipedia.org/wiki/Ripple_\(payment_protocol\)](https://en.wikipedia.org/wiki/Ripple_(payment_protocol))

Prior to verification, validators take all the valid transactions they have seen that have not yet been applied to the current ledger and make them public in a list known as the “candidate set.” Each validator then groups the candidate sets of all validators on its unique node list and votes on the accuracy of all transactions.

Transactions that receive more than a minimum percentage of “yes” votes are passed on to the next round, while transactions that do not receive enough votes will be either discarded or included in the candidate set for the beginning of the consensus process on the next ledger. The final round of consensus requires at least 80% of a validator unique node list to agree on a transaction. All transactions that meet this requirement are applied to the ledger.

PROS

- Ripple has partnerships with some of the most prominent institutions in the financial world, and many central banks have already made amendments to incorporate Ripple into their systems.
- Ripple is built specifically for currency exchange and payment. The infrastructure allows faster and cheaper transactions compared to alternative non-blockchain solutions.

CONS

- The company has concentrated on targeting a majority of Wall Street banks, which is a disadvantage for many early adopters and developers of blockchain technology. Ripple focuses more on the movement of money than on smart contracts or basic developer tools that makes it easy to engage with the platform.
- Since Ripple is pre-mined, it does not offer any mining incentives like Bitcoin does. There exist few incentives for miners to join the network, and the nodes are operated on a more or less voluntary basis. The smaller number of participants results in a less distributed network and a lower level of public support to invest in the system.

Features comparison of four major blockchain protocols

PARAMETERS	Bitcoin	Ethereum	Hyperledger	Ripple
CRYPTOCURRENCY	Bitcoin	Ether	None, but can be implemented when required	XRP
NETWORK	Public	Public	Permissioned	Permissioned
CONSENSUS	Proof of Work	Proof of Work	Practical Byzantine Fault Tolerance	RPCA
SMART CONTRACT	No	Yes	Yes	Yes
PROGRAMMING LANGUAGE	C++	Golang, Python	Golang, Java	C++
TRANSACTION PER SECOND	10	1,500	15	>3,500

Acknowledgments

With thanks to Ken Weber, head of social impact at Ripple, for his support of this project:

While still early in its development, blockchain is an undeniably promising new technology with far reaching consequences across a wide variety of sectors and use cases. In particular, it is exciting to see the progress being made by applications of both blockchain and digital assets as a means to accelerate and expand global financial inclusion — and to realize a more participatory and equitable vision of globalization overall.

We would also like to thank the many organizations listed below for taking the time to speak with us about this project. Without them, this research would not have been possible.

AGRICULTURE AND LAND RIGHTS

<u>AgUnity</u>	<i>AgUnity is trying to build the world's largest network of small farmers and cooperatives and create the framework of trust with integrated services for farmers and co-ops.</i>
<u>Bitland Global</u>	<i>Bitland Global utilizes blockchain to register land titles and records new plots of land with the larger goal of settling land disputes and unlocking land capital in developing countries.</i>
<u>ChromaWay</u>	<i>ChromaWay is a blockchain development company that focuses on smart contracts for land registration powered by its Postchain consortium database.</i>
<u>Connecting Food</u>	<i>Connecting Food is a blockchain-based platform designed to protect and build brand equity, creating value through total transparency toward consumers.</i>
<u>EthicHub</u>	<i>EthicHub is a blockchain-based P2P platform that connects lenders with profitable small farming communities around the globe.</i>
<u>FoodNation</u>	<i>FoodNation is creating an open-source protocol/platform, with lower costs, so that more restaurants can go online.</i>
<u>GrainChain</u>	<i>GrainChain is a platform that creates a secure digital record of commodity data and transactions for the sale and purchase of grain and other commodities.</i>
<u>HARA</u>	<i>HARA started its mission within the food sector and continues toward overall sustainability for the world's most socially impactful sectors.</i>
<u>Land LayBy</u>	<i>Land LayBy records land buying and selling transactions on its listing platform using smart contracts to increase the transparency of land ownership in Africa.</i>
<u>OriginTrail</u>	<i>OriginTrail, launched in 2011, uses blockchain to bring transparency to international supply chains through an open-source protocol and decentralized network. It also started a nonprofit association, Trace Alliance, which now has over 50 members, to connect the private sector, public sector, and academic institutions to create blockchain-based solutions for supply chains.</i>
<u>OwlChain</u>	<i>OwlChain, operating under the umbrella of OwlTing, uses blockchain to trace supply chain data for food manufacturers from farm to table.</i>
<u>Provenance</u>	<i>Provenance uses blockchain technology to document the supply chain of materials, ingredients, and products to provide consumers with greater transparency about their authenticity and origin.</i>
<u>Regen Network</u>	<i>Regen Network is a global marketplace and contracting platform for Earth's ecosystem assets, services, and data — focusing on ecological monitoring and regeneration, especially for agriculture.</i>
<u>Skuchain</u>	<i>Skuchain empowers participants in a global value chain by using blockchain to take the real-world needs of buyers and their supply chains and provide fine-grained control in inventory procurement across all partners.</i>

TE-FOOD	TE-FOOD is a farm-to-table food traceability system that stores all traceability information (assets and events) on a blockchain ledger.
Twiga Foods	Twiga Foods links Kenyan farmers and vendors to fair, trusted, and modern markets. It provides a complete supply chain for a variety of produce.
Ubitquity	Ubitquity offers a platform that allows citizens to securely track real estate, land, and other property on a blockchain ecosystem called unanimity.
CLIMATE AND ENVIRONMENT	
Choose	Choose provides a blockchain-based platform for people and companies to fund the best U.N.-verified CO2-reducing projects in developing countries. Users can sign up with subscriptions or make individual purchases.
Climatecoin	Climatecoin is a cryptographic utility asset designed to work as trading currency for certified carbon credits within the Climate Trade ecosystem.
Electron	Electron is a new platform developed by a group of blockchain and energy experts that will empower and streamline innovation in the energy markets.
EnergiToken	EnergiToken incentivizes consumers to adopt energy-saving and “green” behaviors — such as switching to low-carbon transport or purchasing energy-efficient electric appliances — from its various partners to be rewarded with ETk.
Energy Web Foundation	The Energy Web Foundation is an open-source, scalable blockchain platform specifically designed for the energy sector’s regulatory, operational, and market needs. It serves as a foundational shared digital infrastructure for the energy and blockchain community.
Enzed Share	Enzed Share is a community model enabling the public to participate in deploying a responsible waste plastic management system by Syngas NZ Limited.
GainForest	GainForest offers an application with a platform that connects donors around the world to local farmers in the Amazon, allowing anyone to become a stakeholder in the Amazon via blockchain-powered smart contracts.
HydroCoin (HYC)	HydroCoin (HYC) is a cryptocurrency for the blockchain community that empowers the hydrogen industry and enables the blockchain community to participate in hydrogen technologies.
Lition	Lition simplifies the legal, operational, and economic hurdles for green power producers and allows customers to buy truly green electricity at an affordable price.
Nori	Nori provides a blockchain-based marketplace for carbon removal certificates and a cryptocurrency tied to reversing climate change.
Omega Grid	Omega Grid is a blockchain energy rewards platform, where utilities calculate, deliver, and redeem rewards for using clean, local energy.
Plastic Bank	Plastic Bank creates social and environmental impact in areas with high levels of poverty and plastic pollution by turning plastic waste into a currency.
Poseidon Foundation	The Poseidon Foundation created the platform “reduce,” which creates a financial link between activities in everyday life and projects that rebalance limited resources. Using blockchain technology, the reduce platform processes micro-contributions to address the environmental and social costs of any transaction.
Pylon Network	The Pylon Network is a neutral energy database, supported by open-source blockchain technology designed to play the role of the digital communication infrastructure for the increased participation of distributed assets and stakeholders in the energy markets.
Restart Energy Democracy (RED Platform)	Restart Energy Democracy (RED Platform) is a peer-to-peer energy trading platform that uses real-time energy discounting — an IOT system with smart meters installed at renewable energy producers and consumers.
Somish	Somish is a technology and product development company with expertise in building automation systems using cutting-edge technologies like blockchain.

The Sun Protocol	<i>The Sun Protocol creates a payment system based on distributed technology for rural communities, pegged to the electricity produced and sold by its partners. All its partners produce the electricity through renewable means.</i>
Verv	<i>Verv is a blockchain-based company that offers users a smart hub to monitor their energy usage, reduce it accordingly, and sell any renewable-generated excess. In 2018 it also launched a project at a social housing estate to help bring affordable renewables to residents.</i>
DIGITAL IDENTITY	
Alice	<i>Alice is a blockchain philanthropy platform that helps charities raise more funds by being radically transparent about their impact.</i>
BandWagon	<i>BandWagon tracks qualitative customer data for ticketed events through a proprietary blockchain database that monitors each ticket transaction. Event owners can track the economics of each ticket and stay informed about the end user who ultimately attends the event.</i>
BanQu	<i>BanQu provides benefits to the businesses, organizations, and governments that interact with the world's poorest on a daily basis. Each of these interactions is captured through a secure, immutable, and distributed ledger of financial and personal records using blockchain technology — in turn building the economic identities necessary to connect the unbanked to the global economy, thus helping to lift them out of poverty.</i>
Blockchain Commons	<i>Blockchain Commons seeks to improve the blockchain ecosystem by focusing on infrastructure and solutions that are decentralized, platform- and blockchain-neutral, and vendor-independent.</i>
ConsenSys	<i>ConsenSys is a global blockchain technology company building the infrastructure, applications, and practices that enable a decentralized world.</i>
Crayonic	<i>Crayonic develops technologies for people and things to keep their digital identities secure and easy to use — be it in decentralized IOT networks or in personal high-value transactions.</i>
Credly	<i>Credly is a leading digital credential service provider, helping the world recognize lifelong achievement with the most popular platforms for verifying, sharing, and managing digital credentials and badges.</i>
The Exponent Project	<i>The Exponent Project is a crypto-economic incentive structure for tracking refugees separated from their families.</i>
Identifying.me	<i>Identifying.me is a blockchain-based identity service project.</i>
Indorse	<i>Indorse is a coding assessment platform for recruiting, upskilling, and hackathons.</i>
Learning Machine	<i>Learning Machine is a leader in blockchain-based digital credentials and architect of the Blockcerts open standard with the MIT Media Lab.</i>
Malta Blockcerts Blockchain Credentials for Education and Employment	<i>Malta Blockcerts Blockchain Credentials for Education and Employment is a national blockchain project by the government of Malta. Academic credentials are issued to Maltese students in an internationally portable, instantly verifiable digital format.</i>
OpenLaw	<i>OpenLaw is a blockchain-based protocol for the creation and execution of legal agreements. Using OpenLaw, lawyers can more efficiently engage in transactional work and digitally sign and store legal agreements in a highly secure manner, all while leveraging next-generation blockchain-based smart contracts.</i>
SelfKey	<i>SelfKey is building a blockchain-based identity system that allows identity owners to truly own, control, and manage their digital identity.</i>
ShoCard	<i>ShoCard allows users and enterprises to establish their identities with one another in a secure, verified way so that any transaction — whether it's to log in, share personal information, or complete a financial transaction — can be accomplished quickly, seamlessly, and with peace of mind.</i>

SkillZ	<i>SkillZ is a blockchain-based corporate digital identity platform for employees.</i>
Spring Labs	<i>Spring Labs is building a decentralized network for identity and credit to serve as the foundation for a more transparent, secure, and efficient delivery of financial services. The Spring network will allow users to view all attestations about their credit and identities for free and will enable functionality for open alerts and notifications.</i>
Trusted Key	<i>Trusted Key has built a powerful solution that enables digital ecosystems to improve security, prevent identity fraud, and enhance customer experience with passwordless authentication and transaction authorization. Its solution simplifies user acquisition on digital channels while helping organizations meet business and regulatory requirements.</i>
unCHAINed DIRAS	<i>The unCHAINed DIRAS, or Digital Identity and Resource Allocation System, builds identities for refugees and displaced persons, allowing them to access humanitarian aid resources more quickly and easily.</i>
UPort	<i>UPort is an open identity system that allows users to register their own identity on Ethereum, send and request credentials, sign transactions, and securely manage keys and data.</i>
Woolf University	<i>Woolf University makes it possible for any academic to launch an accredited degree and teach it — online or in person. Woolf has been created by world-class academics and an active advisory team with a record of establishing three international universities.</i>
FINANCIAL INCLUSION	
Abra	<i>Abra is a secure crypto mobile-based app that makes investing in cryptocurrencies — like bitcoin and ether — easy and convenient.</i>
Airfox	<i>Airfox develops inclusive financial services for emerging markets, creating an entirely new financial services model that serves the underbanked with reliable, egalitarian, and democratic access to capital and financial services.</i>
Atlas Money	<i>Atlas Money is a P2P branchless banking platform using blockchain technology.</i>
Binance	<i>Binance is the operator of a blockchain-based platform intended to facilitate cryptocurrency exchange at lower trading costs, offering its users access to some of the latest blockchain technologies and allowing clients to trade across multiple digital currency pairs while maintaining security, liquidity, and high speed.</i>
Binkabi	<i>Binkabi is a platform for issuing, trading, and financing commodities on the blockchain.</i>
BitPesa	<i>BitPesa is a company started in Kenya that is using blockchain and cryptocurrency to transfer money directly across accounts in different countries, cutting out all the middlemen and saving on conversion and transfer fees.</i>
Blockchain Exchange Alliance	<i>The Blockchain Exchange Alliance is the developer of a cryptocurrency trading platform designed to provide comprehensive financial services.</i>
Bloom	<i>Bloom offers decentralized credit scoring powered by blockchain.</i>
Colendi	<i>Colendi is a decentralized protocol providing a democratized credit scoring evaluation method that comes attached to an ID to serve users as a global financial passport.</i>
CoMakery	<i>CoMakery accelerates blockchain protocol adoption with scalable teams of talented makers. It builds communities of high-level, distributed engineers, designers, and community managers and matches them with unique blockchain projects.</i>
Gauntlet	<i>Gauntlet is a developer of a simulation platform intended to understand network activity and the fluctuation of asset values.</i>
ICON	<i>ICON is a decentralized network that allows independent blockchains with different governances to transact with one another without intermediaries.</i>

<u>Inclusivity</u>	<i>Inclusivity pursues the inclusive banking and financial ecosystem based on blockchain and mobile financial solutions.</i>
<u>MonetaGo</u>	<i>MonetaGo works with financial institutions and central banks around the world to provide private permissioned blockchain solutions.</i>
<u>Standard Kepler</u>	<i>Standard Kepler is the provider of a crypto-exchange platform that offers blockchain-based investment banking services, enabling corporations and individuals to avail asset management, token financing, and other customized financial products.</i>
<u>Tiger Trade</u>	<i>Tiger Trade is a full-service platform to buy and sell overstock merchandise worldwide. This is an end-to-end service for verified vendors and has a wide variety of luxury, premium-branded and nonbranded apparel, accessories, footwear, health and beauty products, and toys.</i>
<u>UBDI</u>	<i>UBDI helps people make money from anonymous insights from their data that companies need for market research. Every time a company purchases a study, its users get paid in cash and receive digital currency — also called UBDI — to reflect their stake in the community revenue.</i>
<u>Uulala</u>	<i>Uulala empowers the underbanked communities of the world by providing access to the financial tools they need and the entertainment they desire.</i>
<u>Wala</u>	<i>Wala helps emerging market consumers reach financial prosperity by eliminating barriers to banking. Wala achieves this by closing the gap that exists between consumers and financial service providers, increasing the accessibility of the financial system.</i>
GOVERNANCE AND DEMOCRACY	
<u>BeSpiral</u>	<i>BeSpiral is a blockchain-powered platform to allow communities to organize themselves around “social currencies” that can be used to drive action toward shared positive social and environmental goals.</i>
<u>Blockchain Trust Accelerator</u>	<i>The Blockchain Trust Accelerator from New America is a platform for harnessing blockchain technology to solve social impact and governance challenges.</i>
<u>Coinsence</u>	<i>Coinsence is a decentralized platform that uses blockchain to enable nonprofits, grassroots organizations, and social entrepreneurs to issue tokens for projects aimed at social impact.</i>
<u>Democracy Earth</u>	<i>Democracy Earth is building free, open-source software for blockchain-based decision making and voting within institutions of all sizes, with the ultimate goal of improving democratic governance.</i>
<u>Free & Fair</u>	<i>Free & Fair provides open-source election services and systems with the aim of ushering in a new era of provably secure elections.</i>
<u>Horizon State</u>	<i>Horizon State has built a blockchain voting platform that allows partners — ranging from committees to unions — to deploy products and services to aid in the process of decision making and voting.</i>
<u>InCraft</u>	<i>InCraft is a blockchain-based platform for online application to and placement in public kindergartens and schools.</i>
<u>OS City</u>	<i>OS City is a company based in Mexico that is focused on improving the transparency and accountability of government operations in cities across Latin America.</i>
<u>Publicism</u>	<i>Publicism is a Dutch social enterprise using blockchain technology to create a platform to enable journalists to freely and securely operate, with the broader aim of supporting the free press.</i>
<u>Seeds</u>	<i>Seeds builds social good directly into in-app purchases. Seeds gives a portion of all sales to people in need.</i>
<u>Smartmatic</u>	<i>Smartmatic has designed and implemented secure voting technologies for election commissions designed to safeguard the voting process from start to finish.</i>

Value Instrument	Value Instrument is a platform using distributed ledger technology and smart contracts to create dedicated tokens that can be designed and distributed by communities.
Voatz	Voatz is an elections platform that uses blockchain to make it possible to securely vote from a mobile device.
Votem	Votem is a mobile voting platform designed to securely cast votes in elections across the globe.
WFP Innovation Accelerator	The U.N. World Food Programme Innovation Accelerator is using blockchain technology as a means of making cash transfers more efficient, transparent, and secure. Cash assistance and emerging digital opportunities empower vulnerable households to meet their essential needs according to their priorities.
HEALTH	
BloodChain	BloodChain is an application that tracks blood donations with blockchain technology.
BurstIQ	BurstIQ provides end-to-end enablement of blockchain-based health applications and services through a global, person-centric data exchange that connects these solutions to each other and to the people they serve.
Nebula Genomics	Nebula Genomics liberates genomic big data by making privacy-protected individual records scattered across many systems available on a single network where researchers can access and analyze them, connecting data buyers directly with data owners, who store and control their own data.
CROSS-SECTOR	
Bitfury	Bitfury is a full-service blockchain technology company that develops software and hardware solutions for businesses, governments, organizations, and individuals to securely move assets using blockchain.
Cajutel	Cajutel aims to build the most cost-effective broadband access network and to provide state-of-the-art communications for its customers, thus creating a big boost to the education and economy. It makes it affordable for the general public in West Africa to get access to the internet.
doGood	doGood provides a framework by which the enormous problems facing the world can be defined, dissected, prioritized, and staffed against by anyone. It provides an automated governance system that gives investors greater control over the allocation of funds and in doing so enables projects to raise more money from more people.
Ground X	Ground X formed a consortium inviting 12 nonprofit organizations in Korea to identify potential use cases throughout the whole process of donation. It has been communicating with international organizations to test a few initial ideas using blockchain for sustainable development.
Lucidity	Lucidity is a digital advertising blockchain protocol bringing transparency and trust to digital advertising. The company uses blockchain technology for digital advertisers and publishers to mitigate fraud, transact with trust, and maximize ROI.
Medici Ventures	Medici Ventures manages investments in building solutions servicing blockchain technology, with the goal of bringing security and transparency to financial technology.
Procivis	Procivis provides government-trusted digital identity solutions built around the safeguarding and self-sovereignty of personal data.
Proof of Impact	Proof of Impact is a solution that verifies impact events individually and links outputs to funding on the POI platform governed by the POI protocol. This will bring real-time tracking to impact delivery and will lock impact attribution to specific funding.
World Wide Generation	World Wide Generation leverages the global connectivity, efficiency, effectiveness, and transparency benefits of blockchain to accelerate the financing and delivery of the Sustainable Development Goals in order to preserve humanity.