BLOCKCHAIN FOR SOCIAL IMPACT

MOVING BEYOND THE HYPE

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Executive Summary

The promise — and potential — of blockchain to drive social impact is massive, but how much of it is hype and how much is reality?

Proponents contend blockchain will touch, if not disrupt, every major industry and will even alter the way that people and societies interact. Technology that increases efficiency, reduces costs, and promotes transparency can have significant implications for sectors that are dedicated to driving social impact. The potential to transform systems and leapfrog infrastructure can enable solutions that previously weren't thought to be possible.

But the question remains: Are we at the pinnacle of a history-altering technology that will drive massive social impact, or is blockchain the latest tech buzzword — more noise than substance?

This report is a result of an analysis of 193 organizations, initiatives, and projects that are leveraging blockchain to drive social impact. By mapping and cataloguing the landscape of such blockchain applications, our research captured which applications have already begun to demonstrate proven social impact, which industries and use cases are more or less advanced, and what we should be learning from the hundreds of test cases, pilots, and experiments that are using blockchain for social impact.

A surge in new projects, organizations, and platforms oriented toward the use of blockchain technology began in 2013.

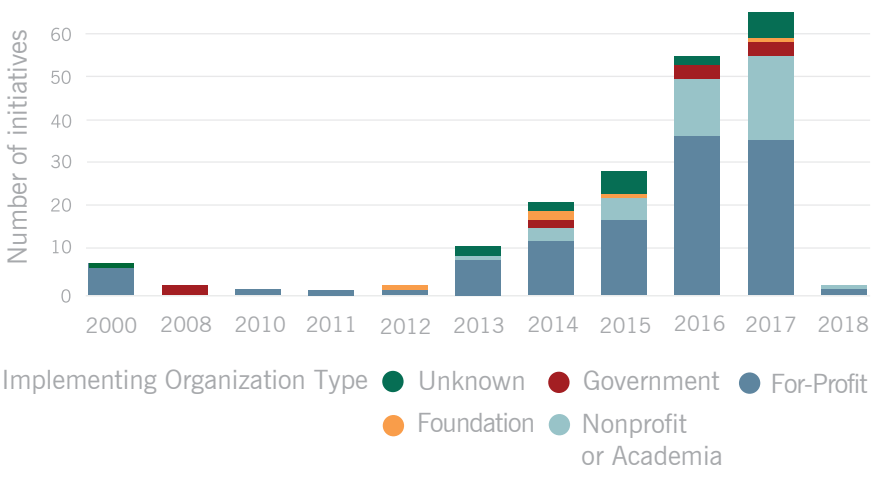


Figure 1: Year Founded by Implementing Organization Type

A steady surge in new projects, organizations, and platforms oriented toward the use of blockchain technology began in 2013 and has grown at an accelerating pace. This research has identified dozens of new ideas for how to use the technology for social impact (54 in 2016, 64 in 2017) — reflecting several new ideas each month, with likely many more currently in stealth mode.

Key Findings

We're still in the early days of blockchain for good, but impact is close. Blockchain initiatives dedicated toward social impact are still in the early days — 34% were started in 2017 or later, and 74% are still in the pilot or idea stage. But, 55% of social-good blockchain initiatives are estimated to impact their beneficiaries by early 2019.

Fifty-five percent are estimated to have an end impact on their beneficiaries by early 2019.

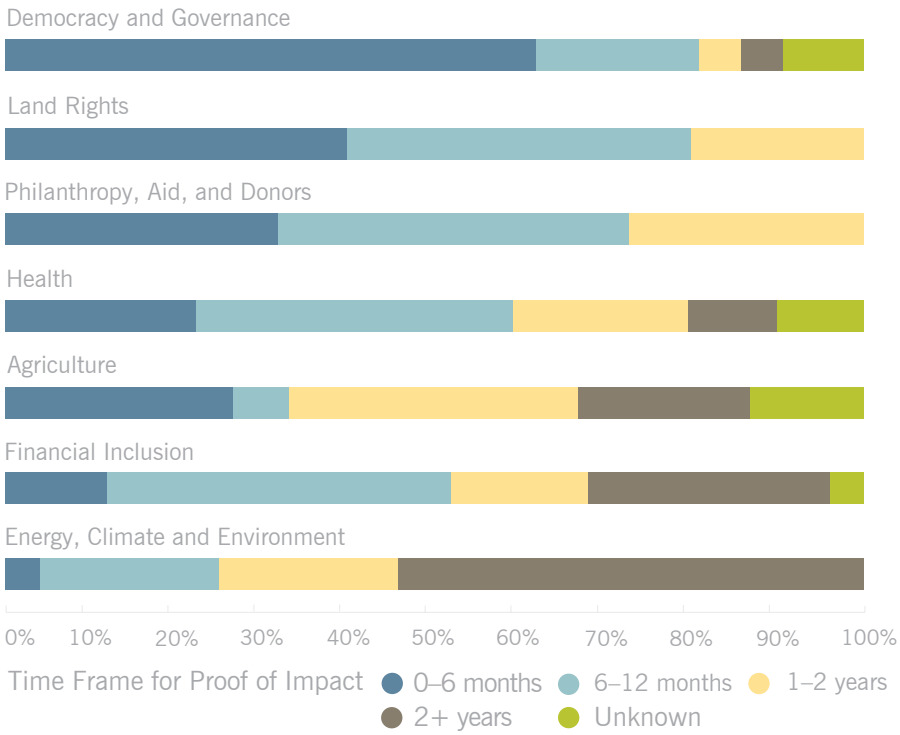


Figure 2:Time Frame for Proof of Impact

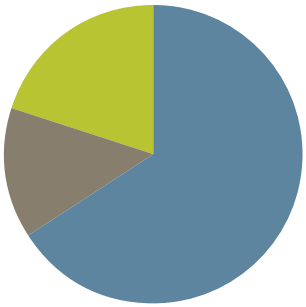
Democracy and Governance initiatives are the furthest along, with 62% of all projects expected to have demonstrated impact in the next six months. On the other hand, 63% of Energy initiatives are not expected to see demonstrated impact within the next two years.

The Estonian government's early adoption (in 2008) is the most advanced example of a government leveraging blockchain technology to enhance government services, with 99% of the country's government services available as e-services through e-Estonia. These services leverage distributed ledger databases to lead to increased security, efficiency, and accessibility. (See case study on page 22.)

Blockchain enables solutions not previously possible. Of the blockchain initiatives researched, 20% are providing a solution to a problem that could otherwise not have been solved without blockchain, and 86% are bringing forward solutions that are material improvements.

Blockchain enables solutions not previously possible.

Figure 3: Could the Core Problem Be Solved Without Blockchain?



66% say blockchain is an **improvement** over other methods of solving their problem.

20% say blockchain is a **necessity** for solving their problem.

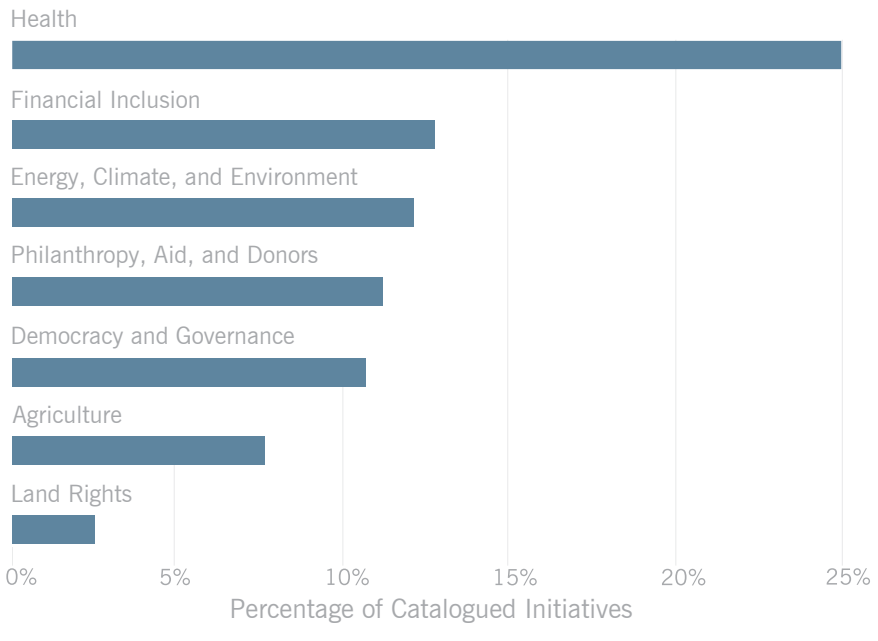
14% say blockchain is **one way** to solve their problem, but others may be better.

BanQu is a U.S.-based company that uses blockchain to provide economic passports to those in need of a digital identity, which include unbanked populations, refugees, and micro-businesses operating in the world's poorest regions. BanQu's secure and accessible blockchain-based platform (accessible via SMS, smart-phone, or web) allows the unbanked and the poor to record their economic and financial transactions, purchase goods, and prove their existance in global supply chains. (See case study on page 29.)

The health sector has attracted more initiatives than any other sector. Of catalogued blockchain initiatives, 25% were focused on health, which is nearly twice as much as the next leading sector, financial inclusion (13%). Energy, Climate, and Environment (12%) and Philanthropy, Aid, and Donors (11%) were the next highest.

The health sector has attracted more initiatives than any other sector.

Figure 4: Initiatives by Share of Total Cataloged

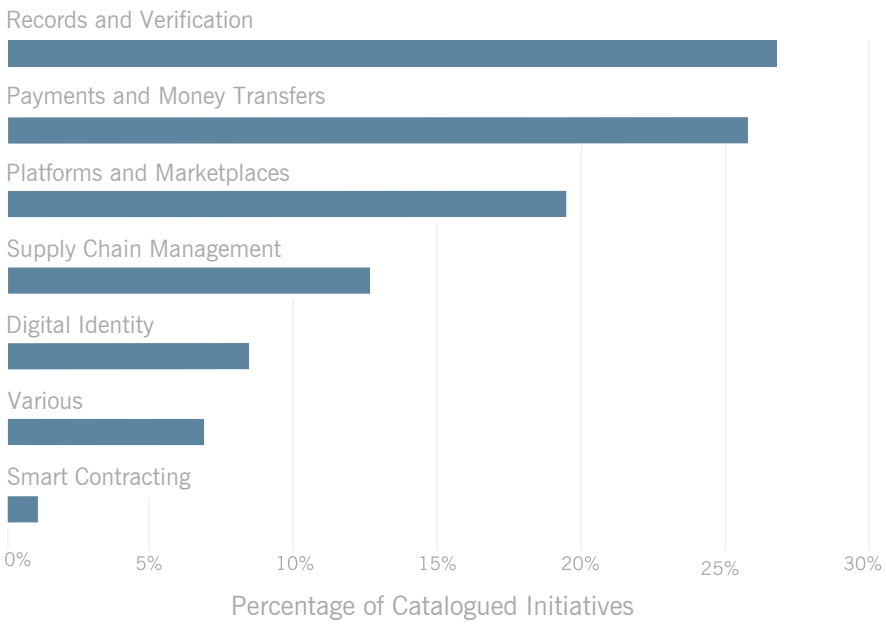


Modum.io is a Zurich-based startup that combines hardware sensors with blockchain technology to track temperatures of medicinal products across the supply chain. Modum.io has completed three pilot projects, and its first-generation sensors are now in mass production, being deployed as part of several new pilots with primarily European-based companies. (See case study on page 51.)

Blockchain is most often used to facilitate payments and verify records. The most common use cases for blockchain initiatives are payments and money transfers (25%) and records and verification (26%). Blockchain's most popular primary benefits are being able to reduce risk and fraud (38%) and increase efficiency (24%)

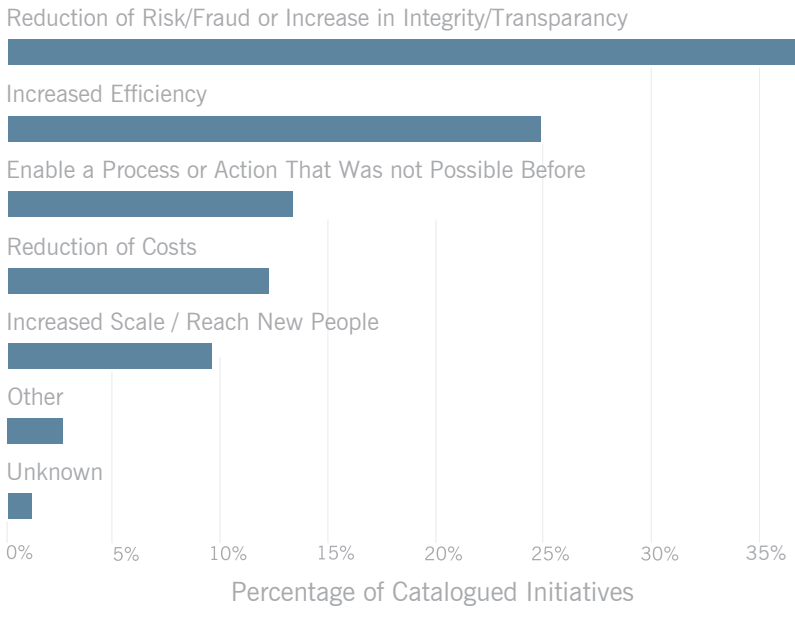
Blockchain is most often used to facilitate payments and verify records.

Figure 5: Primary Ways in Which Blockchain Is Used



Reducing risk and fraud is seen as blockchain's primary benefit.

Figure 6: Primary Benefits of Using Blockchain

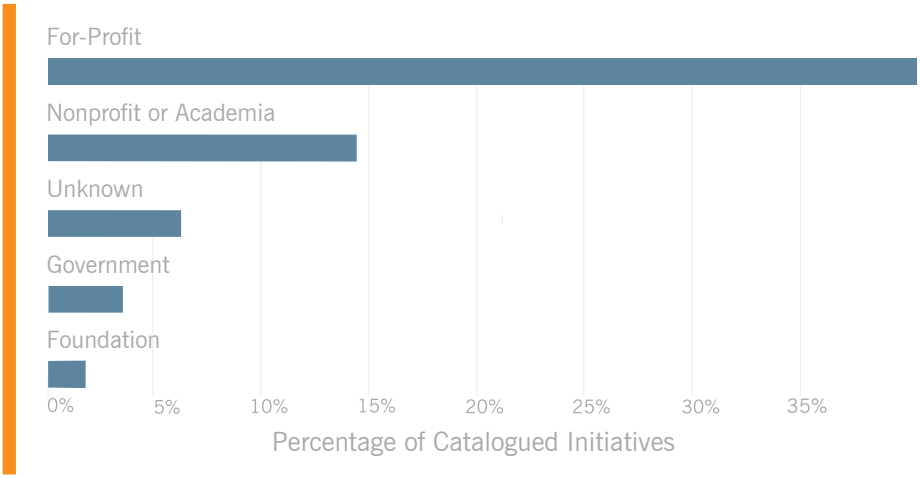


Mojaloop, an open-source payment platform developed by the Level One Project at the Gates Foundation, seeks to link financial institutions and payment providers to facilitate payments and information sharing through blockchain. Mojaloop uses blockchain to enable interoperability between financial institutions, which can speed up transaction times to a matter of milliseconds. The increase in inefficiency can lower costs and expand access to financial services to the unbanked. (See case study on page 43.)

Certain sectors see more for-profit activity than others. Overall, 61% of the initiatives catalogued are for-profit. The sectors with the most for-profit initiatives are those with the greatest commercial opportunity: Energy (94%), Health (87%), and Financial Inclusion (78%). Conversely, the sectors driven by nonprofit or public funding activity are those traditionally rooted in nonprofit or government activity: Philanthropy, Aid, and Donors (76%) and Democracy and Governance (33%).

Certain sectors see more for-profit activity than others.

Figure 7: Implementing Organization Type



Blockchain Primer

To understand blockchain, one needs to first understand the phenomenon that led to its origin: Bitcoin.

Bitcoin and Cryptocurrency

Bitcoin first emerged in the fall of 2008, and the Bitcoin network came into existence in early 2009. Bitcoin became the first decentralized digital currency, which means it is a digital "cash" system that allows people to exchange money instantly, without having to go through intermediaries like banks. Even digital payment platforms like PayPal and Venmo still route transfers through banks, incurring fees and time delays.

Bitcoin was the first cryptocurrency, but its creation has led to over 1,500 cryptocurrencies that get purchased and traded globally: Ether (from Ethereum), XRP (from Ripple), and Litecoin are just a few examples. The "crypto" in cryptocurrency comes from the use of cryptography, which is used to solve several core problems in transferring money over the internet, eliminating the unauthorized creation of new money (referred to as "double-spend"), and giving users a secure way to prove their identities and transact with each other without the need for a trusted intermediary.

Blockchain

It is important to separate cryptocurrencies from blockchain, which is the underlying technology that makes cryptocurrencies possible. A blockchain is a digital, secure, public record book of transactions (a ledger). "Block" describes the way this ledger organizes transactions into blocks of data, which are then organized in a "chain" that links to other blocks of data. The links make it easy to see if anyone has changed any part of the chain, which helps the system protect against illegal transactions.

Blockchain and Fundraising

Over the past few years, blockchain has revolutionized access to capital for new ventures. In 2017 alone, blockchain-based startups raised close to $4 billion through a process known as an "ICO" (initial coin offering) or a Token Generating Event.[1] In this process, a blockchain startup issues its own digital currency, known as "tokens," and sells them to either private or public investors. Tokens have value because the issuer requires that future customers pay for services rendered using these tokens. The types of services vary; this could be computing resources, data storage space, peer-to-peer home sharing, advertisement space, or medical data. Given that the supply of tokens is fixed, this creates a demand for tokens that creates a priceable market. These types of tokens are known as "utility tokens." There are other types of tokens, like security tokens, which can be used to represent equity shares. Another type, called digital collectible tokens, are unique tokens that can represent scarce digital goods like collectible cards, in-game items, or other collectibles.[2]

Blockchains allow users to easily prove their identities, protect ownership of digital assets, and verify transactions without a high-cost intermediary.

The process of issuing tokens became orders of magnitude simpler thanks to the Ethereum network, which made it easy for developers to code their own tokens in twenty minutes or less instead of writing custom code, and it provided a simple way to deploy tokens using a smart contract.[3] A "smart contract" is a piece of software code that gets written into the blockchain, and different applications can reference this code. When an application utilizes a smart contract, it can process counterparty transactions automatically, without human interference; for example, when the application detects that certain conditions are met (e.g. money has been received from someone), an event is triggered (e.g. send money to someone else).

How Blockchain Creates Trust

There are three key elements needed to establish trust: 1) identity, or who's who; 2) ownership, or who owns what; and 3) verification, or what's true. Blockchains allow users to easily prove their identities, protect ownership of digital assets, and verify transactions without a high-cost intermediary.

Who's Who: Blockchains solve the identity problem through the use of digital signatures. Each user is given a set of two digital codes (a "private key," similar to an account number, and a

"public key," similar to a password) that allows them to easily prove an identity and issue authorized transactions.

Who Owns What: Blockchains solve the ownership problem through a technology called "cryptographic hashing." A cryptographic hash is simply a piece of data that has been run through a math function and transformed into a shorter piece of data. In a blockchain, each block contains a hashed representation of the data in the previous block. If you change any previous pieces of data, that change will get reflected throughout the chain, making it easy for the system to see and reject fraudulent attempts to manipulate the data. This allows blockchains to create "immutable" data, otherwise known as tamper-proof records.

What's True: And, finally, blockchains solve the verification problem by making it feasible for a group of people to publicly verify that a transaction is true, without the need for a trusted intermediary. In blockchain terminology, this is called "distributed consensus." The ability for blockchains to verify transactions with fewer intermediaries is a key benefit that can lead to lower costs for many applications in this report.

The Roots of Blockchain's Potential

Blockchain's potential is rooted in enabling four things.

Transparency: Anyone with access to the network can view a history of transactions in real time. Potential impact: The money trail can be tracked and monitored more accurately in areas like aid distribution.

Immutability: Blockchains protect data from tampering; no one entity is able to change past data without alerting the network. Potential impact: Immutability protects areas like voter authentication and land title registrations.

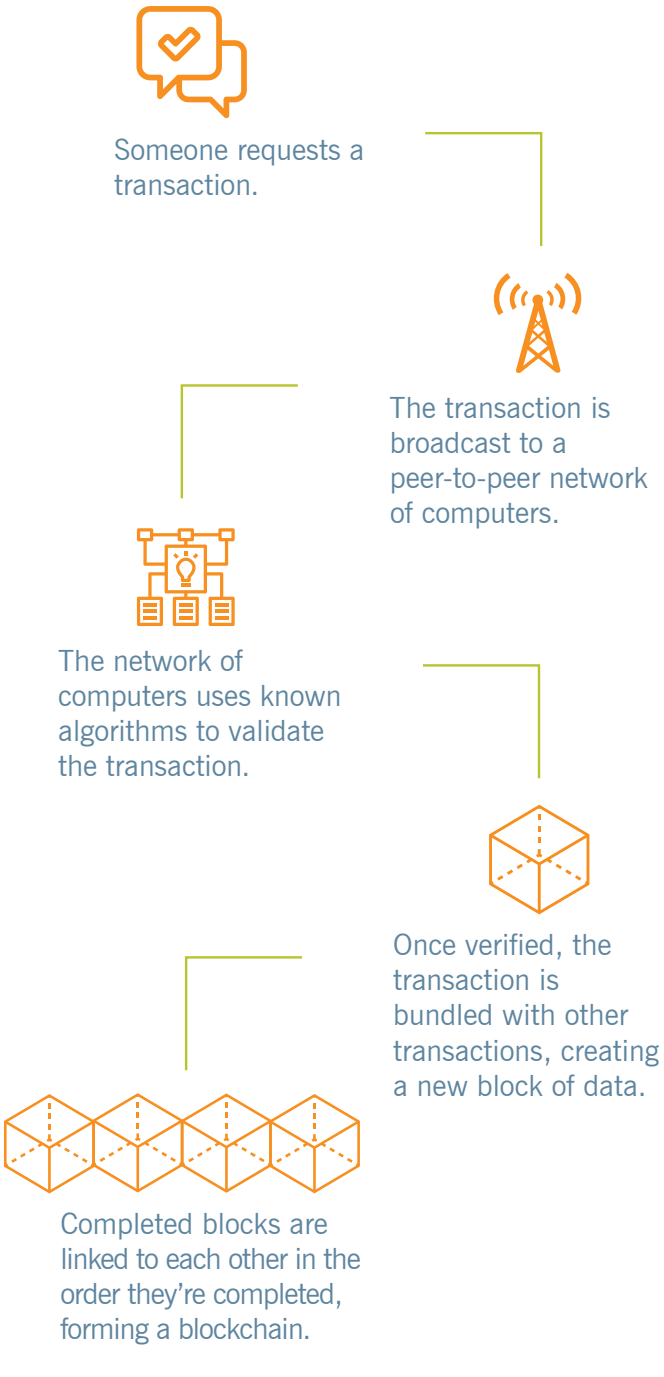
Reduced counterparty risk (and subsequently lower cost payments): Blockchains allow anyone to send money to anyone without an expensive or corrupt intermediary. Potential impact: Money sent across borders or into natural disaster zones will move quickly. In addition, many critical elements of our economy allow people to trade with each other without fear that the other party will back out. Banks perform this function, but often add high administration costs and slow processing times into the system. Blockchain's smart contracts guarantee that a contract

will be fulfilled when a specific action is completed. Potential impact: Eliminating intermediaries reduces counterparty risk, thus reducing costs.

Efficient provisioning of identities. Blockchains can create and manage identities for people in a lower cost, secure way through digital signature technology, which gives people a public key (similar to an account number) and a private key (similar to a password). Potential impact: Underserved populations, like the unbanked, receive access to services never before possible.

Blockchain in Action

Figure 8: Blockchain in Action



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Agriculture

Overview

Investments in blockchain for agriculture are in their early stages, but they have the potential to impact the lives of large numbers of people. Although nearly 90% of Agriculture initiatives are headquartered in Europe, Australia, or the United States, and 50% of implementations are in these same regions, another 30% of the implementations are in sub-Saharan Africa.

The primary uses can improve traceability, transparency, and efficiency for actors across the entire supply chain, from farmers to consumers. To achieve those improvements, Agriculture initiatives must overcome the siloing of actors along the supply chain.

Key Highlights

Most initiatives are less than two years old, and none reach more than 1,000 beneficiaries.

Pilots and small-scale Agriculture programs are occuring in at least 13 countries.

13% of initiatives could reach more than one million beneficiaries.

75% of applications that have moved beyond the idea stage are for-profit.

The Agriculture Context

As agricultural supply chains are structured today, compliance data (such as data on safety, sustainability, and certificate status of food products) is stored on paper or in a proprietary database, which is audited periodically by trusted third parties.[1] This structure results in costly operational management and high potential for fraud, corruption, or error (both human and technology-based).

Food contamination and food fraud affect both consumers and producers. The WHO estimates that one in 10 people fall ill every year from eating contaminated foods.[2] The economic cost is estimated by the Grocery Manufacturers Association to be $10–15 billion per year, with a single food fraud incident costing 2–15% of a company's annual revenue.[3]

Blockchain Solutions in Agriculture

In order to reduce food fraud and contamination and increase transparency and efficiency, for-profit companies are driving 60% of Agriculture applications for blockchain. Blockchain replaces the trusted-yet-fallible third parties involved in collecting, tracking, and managing data within agricultural supply chains with more neutral and efficient systems.

Sixty percent of implementing organizations are for-profit entities.

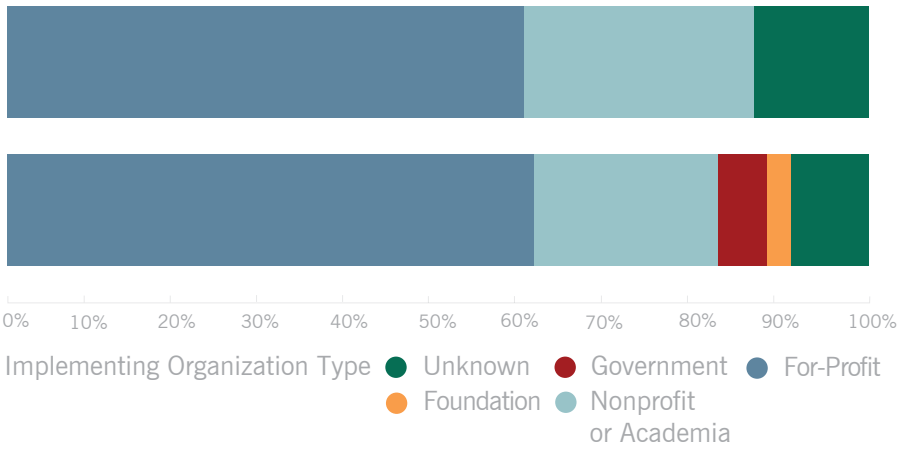
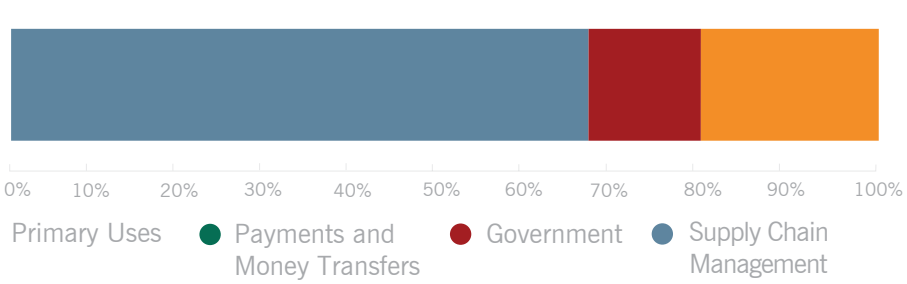


Figure 9: Blockchain for Good Organization by Type, Agriculture vs. other

Farmers benefit as well as distributors. Although the large majority of Agriculture use cases identified in our research focused on supply chain management, 20% focused on payments and money transfers, applications that help ensure that farmers receive timely and complete payments for their crops.

Forty percent of agriculture initiatives are in concept stage.

Figure 10: Primary Use Cases for Blockchain in Agriculture

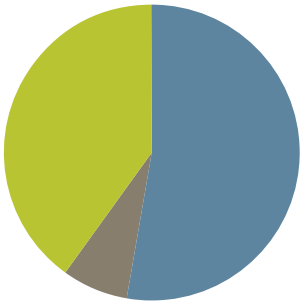


Challenges

Investments in blockchain for Agriculture are early stage. Most initiatives are less than two years old, and none are currently reaching more than 1,000 beneficiaries; 93% are either in concept stage or have started a small pilot.

Ninety-three percent of Agriculture initiatives are either in concept stage or have started a small pilot.

Figure 11: Current Status of Agriculture Initiatives



53% of initiatives are in the **pilot** phase, reaching fewer than 1000 people

40% of initiatives are in the **concept** phase

7% of initiatives **do not have** available information

For blockchain to be implemented in any supply chain, engagement across the full supply chain would be required, meaning each farmer, distributor, packager, and other agricultural supply chain actors must be willing to adopt and use the technology. Blockchain technologies also require internet connections and digital literacy for widespread adoption; this remains a challenge in some emerging markets, as well as in rural areas of developed countries, where many farmers and producers are located.

Significant progress is being made to address connectivity in emerging economies, such as the Alliance for Affordable Internet, a global coalition of private sector, public sector, and civil society actors.

Case Study

AgriDigital

Year Founded
2015

Stage
Pilot

Model
For-Profit

Application
Supply Chain Management

Historically, farmers assume counterparty risk when selling their crops to buyers in agricultural supply chains. After turning over their crops to a buyer, they must wait days or weeks before payment is transmitted.[4] Due to a severe lack of available financing for small-holder farmers (global demand estimates up to $430–440 billion[5]), growers and other agricultural value chain actors struggle to access the financing they need to tide them over. Transparency across agricultural value chains is an additional challenge.

AgriDigital, an Australian company with a cloud-based commodity management platform, connects farmers and value chain actors. By integrating blockchain into their platform, AgriDigital is able to create a programmable asset — a token — to represent a physical commodity (such as a ton of wheat or a head of cattle). When that token is moved between different participants, such as from a farmer to a purchaser, each transaction is immutably tracked on the platform, with a full ecosystem of data (finance data, traceability data, and transactional data) attached to that token and payments occurring in real time via smart contracts. When a farmer delivers his or her goods to a buyer, an "atomic swap" occurs: the digital token representing those goods is transferred from the farmer to the buyer at the exact same time that the money is transferred from the buyer to the farmer.

In December 2016, AgriDigital conducted the first trial of their blockchain-based platform for the trade of a physical commodity — in this case, livestock — for payment. After the transaction, the AgriDigital team interviewed the farmer about his experience in settling trade of a commodity on a blockchain. The farmer told them, "I didn't notice anything. The only difference was that I've already been paid."

AgriDigital's platform is currently being used by 1,000 farmers and buyers of grain in Australia.

The company expects to have its blockchain protocol, built on the Ethereum blockchain, fully active in its platform by the end of 2018 and potentially expandable to the developing world.

Case Study

Grassroots Cooperative

in partnership with Heifer USA

Year Founded
2017

Stage
Pilot

Model
Nonprofit

Application
Supply Chain Management

Consumers of food products, particularly high-end or premium products, demand a certain degree of transparency and trust to justify the higher prices they are paying. Yet due to controversies over GMOs, pesticides, and food fraud, consumer trust in the food system today is low, rated 5.84 (on a scale of 1 to 10, with 10 being the best), according to a survey conducted by the Center for Food Integrity.[6] For producers of high-end food products, finding ways to build trust and transparency into their products, and between themselves and the end-consumers, is critical to maintaining their market position and justifying higher prices for the products.

Grassroots, an agricultural cooperative in Arkansas, has a long-standing commitment to creating as much transparency and traceability as possible, as well as direct connections between producers and consumers. The goal is to give their farmers an edge in the marketplace — increasing sales, and thus, their income — while at the same time giving the consumers who purchase food products from Grassroots the most personalized and transparent experience possible.

After the general manager of Grassroots learned about the application of blockchain technology in supply chains, he founded the technology partner Provenance and, with the backing of Heifer USA (a branch of Heifer International), launched a blockchain-powered app in August 2017 that allows every package of chicken marketed and sold by Grassroots to be traced on the Ethereum blockchain.

Now, when consumers are making their purchasing choices at the grocery store, they can simply scan the barcode with their phones to learn the full journey of the chicken they're buying from Grassroots, with the assurance that nothing has been fabricated or tampered with.

The project is small right now. With about fifteen farmers using the application, around a thousand consumers each month have access to full information about the meat they are buying. Grassroots and Heifer are both committed to learning from the pilot through feedback from both farmers and consumers, adapting it as needed, and scaling it up. Grassroots also hopes to link in smart contracts to facilitate efficient payment streams within the supply chain.

Case Study

Bext360

Year Founded
2015

Stage
Pilot

Model
For-Profit

Application
Supply Chain Management

Twenty-five million smallholder farmers[7] produce 80% of the world's coffee, yet make, on average, less than $2 per day — below the international poverty line.[8,9] These farmers tend to be paid on the basis of quantity, rather than quality, and often do not receive payment right away. Delays in payments for farmers who are living at the base of the pyramid present a myriad of challenges, both farm-specific and personal. At the other end of the agricultural supply chain, there is an increasing desire amongst consumers of agricultural products to better understand where their food products come from.

Bext360 has developed a device that combines machine learning and artificial intelligence with blockchain to create a more efficient and transparent coffee supply chain, ensuring that farmers are paid fairly and immediately, while simultaneously helping consumers better understand where and how their coffee was produced. Bext360's machine weighs, analyzes, and prices coffee directly at the source, offering a price to farmers immediately, based on the quality of their coffee, with digital/mobile payments then made directly to the farmer through a blockchain-enabled smart contract. Once collected by the machine, the coffee is tracked through the washing, export, roasting, and retail process. In the near future, additional tracking technologies will include RFID, GPS, genetic marking, among others. All of the critical data gathered in this process is stored on a blockchain to ensure complete transparency and traceability — for farmers, consumers, and everyone in between.

Currently, bext360 is reaching hundreds of farmers through small projects in Ethiopia, Nicaragua, Colombia, Uganda, and California and anticipates reaching thousands by the end of 2018. Bext360's vision for the future includes expanding to other countries and value chains, such as cocoa, nuts, and seafood, and within coffee, allowing consumers to directly see the origins of their cup of coffee and be able to directly tip the farmer who grew the beans.

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Democracy and Governance

Overview

The investment and innovation in Democracy and Governance applications of blockchain technology speaks to its great potential value to the public sector and citizens. Governments and citizens around the world are implementing a diversity of pilot projects, and throughout 2018, should provide some robust results to analyze different approaches. It will be key for sector actors to publish case studies and results, so that best practices can be identified across projects.

Key Highlights

Twenty-one initiatives make Democracy and Governace one of the biggest sectors.

As early as 2008, government initiatives were exploring block-chain for social impact.

Only 38% of these initia-tives are for-profit — less than half the amount of other sectors.

81% of these initiatives will achieve impact by early 2019.

Distributed ledger technology can address many security and even logistical practices of government data exchange.

The Democracy and Governance Context

The integrity of electoral processes is of increasing global concern even in stable democracies, with Freedom House characterizing 2017 as the "most serious crisis" in decades for democratic governance.[1] As in other blockchain implementations, legitimate voting depends on the ability of governments to verify citizens' identity. Once verified however, votes via tokens on a blockchain can be completely traceable and instantly countable.

Distributed ledger technology can address many security and even logistical practices of government data exchange. Citizens' data is harder to incorrectly or illegally erase or edit when it's stored across blockchain-like networks, and these networks can prevent multiple agencies from having to repeatedly request an individual's information. In the absence of a central system, hackers, or even hostile nation-state actors, lack a main target for attacks. Also, if governments don't need to invest in major data centers, maintenance costs can be greatly reduced.

With new additions to blockchain technology, systems can cross-verify that they contain the same information or correspond to the same individual (like a U.S. Social Security number) without transmitting or viewing the underlying information itself. So-called zero-knowledge proofs offer positive implications for privacy: Sensitive data can be verified without being transmitted, or even seen, by observers or accessed by a government employee.

Crowdfunding and citizen participation efforts could be completely transformed by the blockchain. Blockchain takes the ubiquitous online up-or-down vote to a new level, where reviewers, curators, and implementers of projects build trust over time and follow through on proposed projects. This system of trust allows for verified, public actions to define individuals and groups.

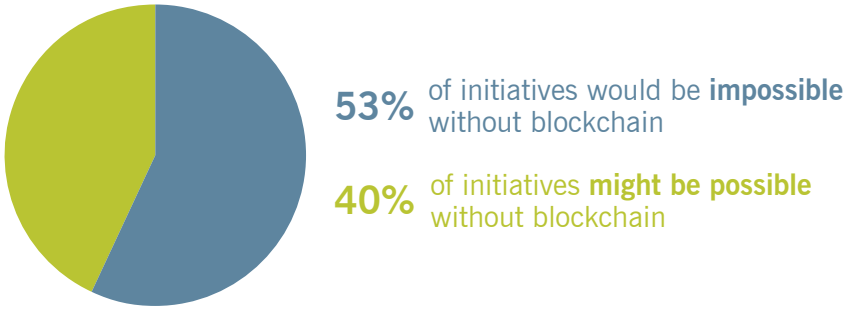
Blockchain Solutions in Government and Democracy

Governments and citizens alike are investing in blockchain solutions. We found 21 use cases for our Democracy and Governance category. They range from voting, citizen participation, and crowdfunding, and our analysis shows that more than half of them (12) would be impossible without decentralized ledger technology. Moreover, the Democracy and Governance sector is closer to real impact than

other sectors: 81% of projects are already achieving impact or are on track to do so in 2018.

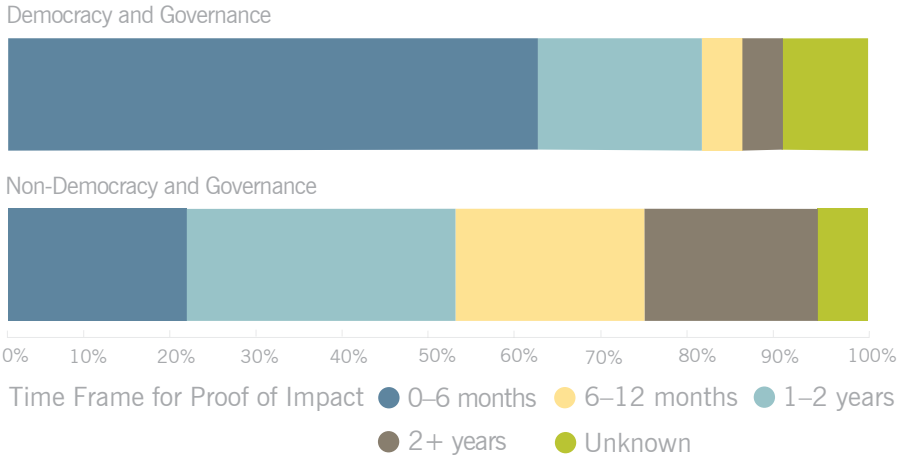
More than half of these initiatives would be impossible without decentralized ledgers.

Figure 12: The Need for Blockchain in Democracy and Governance:



Most organizations are having impact or will by the end of 2018

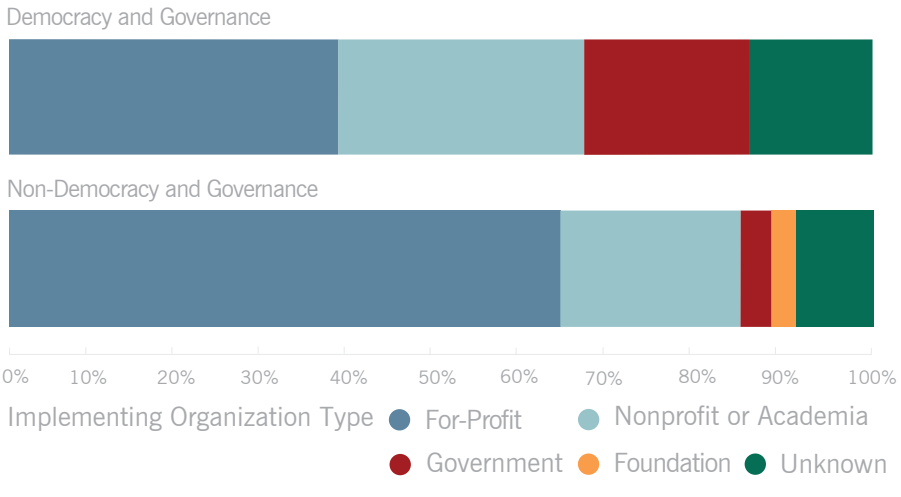
Figure 13: Time to Proof of Impact



There are a higher proportion of nonprofit and government implementers in the Democracy and Governance space. Governments in particular have started programs to consider or adopt blockchain technologies given the technology's added security. Early adopters included Estonia and Canada in 2008, followed later by domestic surplus spenders Singapore (2014) and Dubai (2016).

There are a higher proportion of nonprofit and govern-ment implementers in Democracy and Governance space.

Figure 14: Democracy and Governance Initiatives by Type



Tech providers, of course, are responding to government needs for voting infrastructure, digital identity, e-government services, and recordkeeping of all types. E-Estonia is perhaps the most advanced, with 99% of the country's government services available as e-services.[2] The databases that this system requires to be maintained and shared are supported through distributed ledger technology provided by Estonian digital security firm Guardtime.

Another subcategory of Democracy and Governance includes citizen efforts to hold government accountable to citizen needs, including publicly curated crowdfunding for social movements (ACT Foundation) and direct democratic participation on issues through the blockchain (Democracy.Earth). Similarly principled blockchain initiatives include projects to promote press freedom (Civic, Publicism) and make legal support more widely available (OpenLaw).

Challenges

As a new technology, blockchain is not necessarily understood or trusted by citizens. Though Bitcoin's use of blockchain allows for it to become a "trustless" currency, citizens will need reasons to trust a new framework for interaction with state institutions — particularly on sensitive issues like voting. Many citizens may have difficulty accessing the internet or understanding digital applications of new blockchain systems, so a focus on training and user experience will be key for any implementation.

Finally, private sector actors note the challenges of design, legal, and approval processes when working with governments. This is not necessarily a reason to avoid partnerships with governments on blockchain technologies, but rather a consideration and potential indicator of why non-government blockchain spaces may be quicker to reach fruition.

Case Study

e-Estonia

Year Founded
2008

Stage
At Scale (1M+)

Model
Government

Application
Records and Verification

Estonia has sought to provide government services electronically and over the internet since 2001, when issuance of the first e-ID cards made legal, digital signatures possible for every citizen. These digital signatures now form the basis of verification for almost every government service (like land titles, business registry, healthcare), except some of the most sensitive, like marriage.

There are now more than 1,000 services available through the network known as e-Estonia. As online interaction with the government expanded, it became clear that the country needed to enhance data integrity and security in addition to new methods for auditing and regulatory compliance. So, in 2008, Guardtime was contracted for ensuring the integrity of the digital registries and repositories. Distributed ledger technology allowed for a constant, true situational awareness of government and citizen data and timely detection of any attempts to attack, modify, or otherwise compromise the system. The ability for government agencies to prove they were maintaining the data and provide timely access logs in addition to the data itself helped build public trust in the government. As of 2016, a total of 975 institutions in Estonia provided 1,789 services across the decentralized data exchange platform X-Road, which utilizes distributed ledger technology.[3]

The fully secured system came online in 2012. Citizens can track all government-related transactions that use their personal information in an audit log, accessible through the state portal. For every transaction, there is proof that the transaction was registered on the blockchain, and from that time forward it can't be changed. Citizen data itself is not stored in the chain, rather, the aggregated ledger of registrations shows that the data existed and was certified by the proper entity. There are plans to take it one step further and present the actual blockchain registration directly to citizens.

Efficiency has also been a major benefit of the e-Estonia system. Guardtime says that 99% of citizens don't need to be familiar with its technology to interact with the system. Indeed, Estonia now has a policy known as "once only" — once any branch of the government asks a citizen for information, it must not ask for that same information again. It's still possible for citizens to go in person to government offices, but it's rarely necessary. E-Estonia's website cites savings of 820 years of working time and two percent of GDP with the implementation of its system.[4]

Guardtime makes clear that public trust in the system and the government's ability to maintain and improve it openly and

honestly have been a necessarily gradual process. E-Estonia has continued to exist as government control changes hands among different political parties, and has even survived scandals about how funds are being used. The Estonian citizen interviewed for this research emphasized the openness and transparency with which these types of inquiries were handled by the government and in the press. Still, they say, this may not be a possible solution that can be indiscriminately applied in any environment: Trust in government and willingness to share data among government agencies have been crucial to the success of the system.

Implementing new systems gradually and transparently and being responsive to actual citizen needs have been key to building trust in e-Estonia. Additionally, security is a precondition for trustworthiness, but it is also a process that must be managed, planned, and updated according to evolving situations. Treating security itself as a journey, and communicating about it, also helps to build trust.

Case Study

Votem

Year Founded
2014

Stage
Program

Model
For-Profit

Application
Records and Verification

The potential for fraud and undue influence in the 2016 national elections in the United States has kept the world enthralled. Meanwhile, Cleveland-based Votem worked with Montana's state government to issue and track mobile and online votes cast by absentee voters. Montana needed a way to facilitate voting for those who could not participate in person at the polls. Montanan military officers stationed overseas or in other states, as well as disabled Montanans, could receive, mark, and return their ballots electronically, with votes traced in real time.

Distributed ledger technology, the same technology underlying blockchain, makes votes instantly traceable and impossible to edit. The "audit trail" question is paramount for any voting system, and storing records across a distributed ledger helps to ensure the integrity of the vote as it is happening (and afterward), rather than relying on a centralized database which could be a target for attacks. Furthermore, voters can actually verify that their vote was cast and counted.

In Montana, voters appreciated the ability to cast votes in this way, and perhaps best of all, they didn't need to understand any complicated technology to do it. According to post-election surveys by Votem, 99% of voters who used the new system found it convenient to vote this way and would like to do so again in the future.

The potential for positive social impact in the U.S. is great. There are over 2.6 million U.S. citizens overseas who can vote. However, only 93,000 ballots from overseas citizens were received in 2014 — that's a 4% turnout of eligible voters. Furthermore, without any foreign postal obstacles, there would have been an estimated 15% more ballots recorded from developed countries and approximately 37% more ballots recorded from developing countries in 2014.[5]

If Votem reaches its goal of facilitating 1 billion votes in public elections by 2025 with secure, verifiable and accessible remote voting, the impact on society could be transformative.

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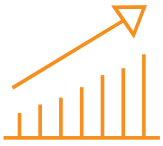
Digital Identity

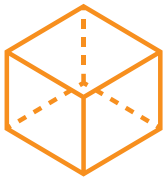
The World Bank estimates that over 1.5 billion people on the planet are unable to prove their identity.[1] Many of these people come from remote, underserved regions. Using blockchain technology to build and deploy digital identity solutions, if applied correctly, holds promise because it can reduce fraud, increase transparency, and increase efficiency. Several organizations, like BanQu and AID:Tech, are already changing digital identity in the developing world with a blockchain solution, making it easier for NGOs, nonprofits, and commercial entities to provision identities, track aid, and enable underserved populations to access a wider range of economic services.

Key Highlights



Blockchain-based Digital Identity is a high-impact, global scale application.

Reconciling data immutability with right-to-be-forgotten laws is a key challenge for the sector.



The top two benefits of blockchain in identity are reduction of fraud/ increase in transparency (31%) and increased efficiency (31%).

Blockchain tracking and security enable more than half of these initiatives to mitigate identity issues in the developing world.

The Digital Identity Context

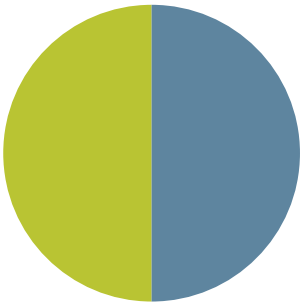
Without a provable identity, people can struggle to access a wide range of critical services. For example, they might be limited from accessing financial services like opening a bank account or obtaining credit; social benefits like vouchers, pensions, or cash transfers may be inaccessible; and healthcare benefits like insurance, vaccinations, and maternal care may be out of reach. In addition, it may be challenging to enroll children in school or apply for scholarships. Political and legal rights, such as voting, filing petitions in court, owning property, or receiving an inheritance are also inaccessible. Gender rights, such as preventing early and child marriage, and migrant rights, such as seeking asylum or crossing borders legally and safely, are also limited.[2]

Blockchain Solutions in Digital Identity

Blockchain technology has several key advantages over current solutions to delivering a digital identity. They include increased efficiency, reduction in cost, and increase in transparency and fraud reduction. Blockchain data is immutable, making it close to impossible to fraudulently change past data. Also, blockchain enables multiple parties to store and interact with the same database in a secure way.

Half of Digital Identity initiatives would be impossible without decentralized ledgers.

Figure 15: Could the Core Digital Identity Problem(s) Be Solved With Blockchain?



Digital Identity initiatives are evenly split between problems that **could** be solved without blockchain and problems that **could not** be solved without blockchain.

This shared access opens up new possibilities for shared KYC (know your customer) identities that can reduce the need for NGOs and other programs to manage separate identities for their recipients, potentially reducing administration costs.

In contrast to existing centralized identity databases, like Aadhaar in India, blockchain-based solutions allow for user-centric databases that give users complete control over who can access their data. Access to records is protected by digital signatures that only the

user controls. This is an important issue considering that Aadhaar identity data has been sold for less $10 in secondary markets in India without user consent.[3]

Blockchain-based digital identity is a high-impact, global scale application. Half of projects documented are expected to impact over one million users.

More than half of these initiatives would be impossible without decentralized ledgers.

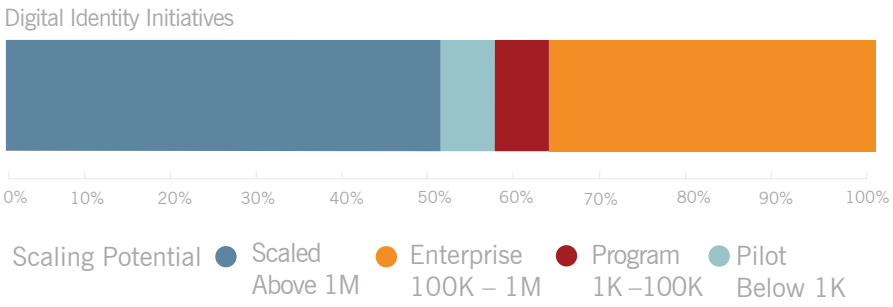


Figure 16: Growth Potential of Digital Identity Initiatives

Challenges

There are still quite a few challenges to adoption. For example, how will blockchain identity data deal with right-to-be-forgotten laws? If data is immutable, but people have the right to delete their data, how do these two issues resolve? One potential solution to this problem is to better anonymize the data so that sensitive data is not publicly viewable.[4] There are also limits to right-to-be-forgotten laws that may reduce their conflict with blockchain immutability.[5]

Additionally, in order for blockchain identity solutions to be valuable, you need actual users in the field to enter transaction data into the blockchain. Many solutions enable users to enter data by scanning QR barcodes or sending SMS texts with their phones, but it is still unknown whether a majority of users will be willing to make the effort. Some initial trials in the field by BanQu and AID:Tech, though, are showing promise.

Our overall assessment is that most projects are in the pilot phase, but several blockchain identity products should be gaining strong traction by the end of 2018. These include products from vendors like BanQu, AID:Tech, Civic, and SecureKey. Companies like AID:Tech are also using digital identity to solve aid distribution problems for disaster-stricken refugees. Overall, these companies have already gained traction with real users.

Case Study

BanQu

Year Founded
2015

Stage
Pilot

Model
For-Profit

Application
Software-as-a-Service

One of the main challenges facing the world's 2 billion unbanked people is the inability to interact with the global economy.[6] Although they can receive money and supplies through aid programs, these programs are temporary in nature.

BanQu, a U.S.-based technology company, seeks to solve this problem by creating a secure, easy-to-use, blockchain-based software-as-a-service that the unbanked that can run on any cell phone. The BanQu platform allows them to record their economic and financial transactions, purchase goods, and prove their existence in global supply chains. This creates an economic passport that enables them to engage with family members, global corporations, development agencies, government organizations, and global financial institutions.

Using blockchain is a unique approach; it enables better data security, faster payments settlement, reduction in administrative overload, and lower costs as a result.

BanQu's app is already being used in six countries by farmers, workers, and micro-businesses in some of the world's poorest regions, as well as by global corporations, financial institutions, and other organizations that want to connect and gain transparency and traceability in their supply chains.

Case Study

AID:Tech

Year Founded
2015

Stage
Program

Model
Nonprofit

Application
Digital Identity

Billions of dollars in foreign aid are lost each year due to corruption.[7] Additionally, money needs to be exchanged between different currencies and transferred across multiple financial institutions, leading to high costs and slow settlement.

AID:Tech, an Irish technology company, seeks to solve these problems by creating a platform that enables NGOs and foreign aid distribution agencies to easily provision digital identities and to transparently track aid distribution worldwide. Their pilot solution successfully delivered and tracked aid distribution to Syrian refugees in 2015.

In this case, they distributed over 500 donor aid cards that were tied to non-forgeable identities. Building the platform on blockchain helped them prevent all attempts to create fraudulent transactions, protecting the underlying aid money. AID:Tech's overall product bundle includes an identity provisioning platform, physical ID cards, and an end-user-facing mobile app.

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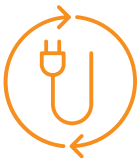
Energy, Climate, and Environment

Overview

The energy, climate, and environment sector, given its characteristic of millions of transactions to trade and distribute energy, has the potential to be transormed by blockchain technology. Blockchain can improve the efficiency of existing grids through a decentralized platform with more data control and micro-optimizations of energy at the facilities level. It can also facilitate peer-to-peer transmission and support the creation of micro-grids.

Key Highlights

The majority (90 percent) of initiatives in the energy sector are for-profit.



ECE initiatives in developed markets focus on optimizing usage, while those in developing markets focus on last-mile energy delivery.

Time-to-impact for more than half of the energy, climate, and environment initiatives is two or more years.

The Energy, Climate, and Environment Context

The energy sector has many known inefficiencies. In most countries, utility companies operate in a highly regulated market,[1] often with significant overhead and energy losses during transmission.[2] Globally, only 85% of the world's population has access to electricity, and it is not always affordable, reliable, or clean.[3]

Blockchain Solutions in Energy, Climate, and Environment

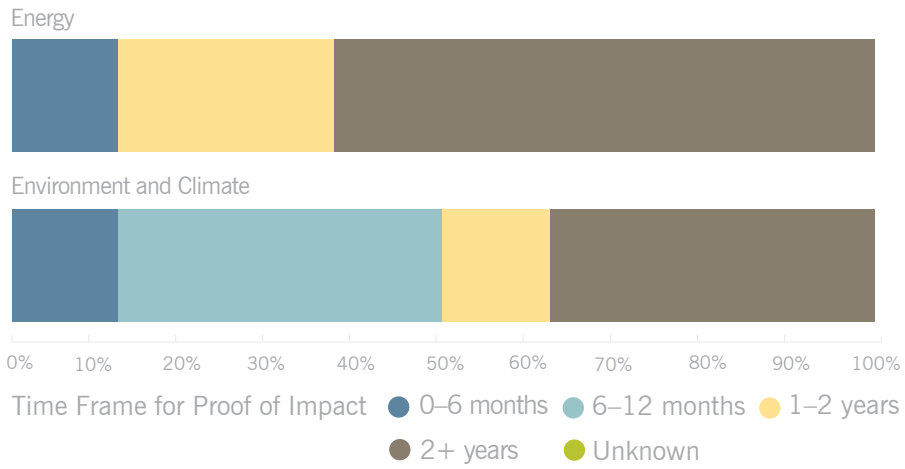
Blockchain technology has several important applications in this market. It can improve the efficiency of existing grids, both for utilities and final consumers. Using a decentralized platform with more data control and micro-optimizations of energy at the facilities level, it can support the creation of micro-grids in deregulated markets, and it can facilitate peer-to-peer transactions of energy and payments. When used as a smart-contract tool, the technology can enable more effective transactions by bypassing banks and credit cards, and allow metering and payment of energy to happen simultaneously. Finally, through trusted payments systems built on blockchain, energy initiatives can be funded with an increased level of transparency and trust, and tokens can be used to reward clean energy producers.

If companies succeed in these implementations, the potential impact could be of massive scale, reaching millions of users who are served by the regular grid and expanding for new users who can be served by new micro-grids.

Companies in the energy sector can have a significant impact on millions of users by improving the electric grid. However, for more than half of Energy, Climate, and Environment blockchain initiatives, the timeframe for impact is two or more years. For companies like Grid Singularity and Power Ledger, this means time to not only develop their product, but also negotiate and partner with utility companies before reaching mass scale. Only a quarter of initiatives are expected to reach proof of concept by the end of 2018.

Only twenty-five percent of ECE projects are expected to reach proof of concept in 2018.

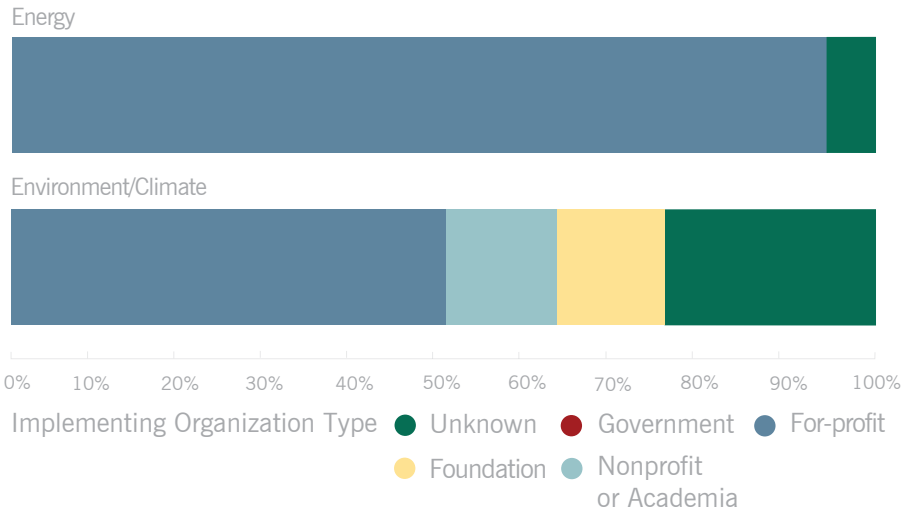
Figure 17: Energy Initiatives Time Frame for Proof of Impact



Since their primary use of blockchain is for platforms and marketplaces, there is a clear path to monetization, for example, by charging a fee per transaction. This revenue model is what companies like M-PAYG, SOLshare, and Grid Singularity successfully adopted. In comparison, only half of environment and climate initiatives are from for-profit companies.

Only half of environment and climate initatives are from for-profit companies.

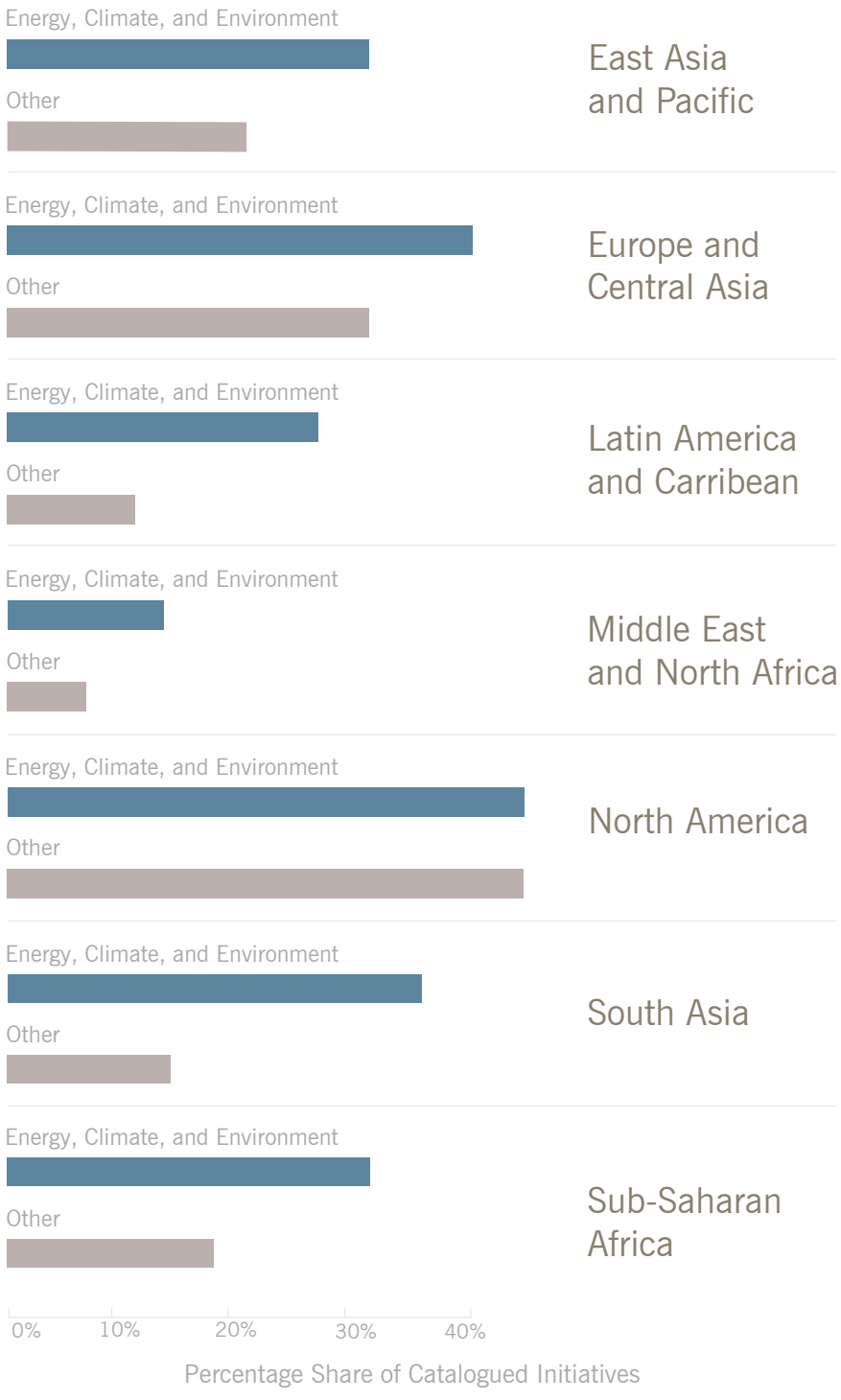
Figure 18: Energy Initatives by Organization Type



Energy initiatives are similarly represented geographically as other sectors, with most operating in North America and Europe and Central Asia (non-exclusively). In this sector, there is a polarization between countries with different levels of development. In developed markets such as Europe, Japan, Australia, and the U.S., the predominant type of initiative is working to serve users who can afford smart meters and smartphones to optimize their energy consumption and trading. In initiatives serving sub-Saharan Africa and Central Asia, the common focus is to provide energy access to last-mile customers.

In developed markets, initiatives work to serve users optimizing their energy consumption.

Figure 19: Regions, Energy vs. Non-Energy Initiatives



Challenges

Despite a promising future, the energy sector faces many challenges. First, from the perspective of utilities, the quality and quantity of consumers' data is still low, as is the proportion of households with the necessary hardware installed to implement smart metering and energy control. Second, from the user's perspective, consumers who

could benefit most from micro-grids and peer-to-peer transactions, such as those living in rural areas in developing economies, still depend on older technologies, such as SMS, for registering the energy consumption and making payments. In many instances, part of the process is still manual and analog. The complete transition to blockchain would depend on smartphone access in these communities and increase in the speed of transactions using this technology.

Overall, companies like Grid Singularity, Power Ledger, and Energo Labs are targeting a long-term solution by creating consortiums with big utility companies and investing in the needed infrastructure for change.

Note on Environment and Climate Change

We documented eight initiatives related to environment and climate change, mostly revolving around the use of tokens to reduce carbon emissions or reward recycling. The main uses of blockchain were to increase transparency and trust in the carbon credit exchange market, and to create rewards for individuals who are recycling or producing clean energy. Blockchain represented an incremental improvement in both of these applications.

Case Study

Grid Singularity

Year Founded
2015

Stage
Pilot

Model
For-Profit

Application
Platforms and Marketplaces

The energy utilities space still operates in an old-fashioned way. Electric grids were built decades ago, companies barely share or analyze data for reducing costs, and customers pay a premium price for unexpected energy peaks — all of that in addition to the high costs charged by utilities companies, which intermediate all the processes. Also, the system was designed in a top-down approach, from big power plants on the transmission network, down to the customer connected to the distribution network.

Grid Singularity is initiating the transition to a new distributed energy utilities system, where energy can be sourced and distributed in a decentralized, more efficient way. The company is creating a blockchain layer where all transactions will be securely stored. This platform will be invisible for end-users, but will allow other companies (including utilities) to develop applications on top of this infrastructure to support, for example, micropayment channels, data analysis and benchmarking, green certificates, smart grid management, and energy trade validation. It's an important step in transforming energy consumers into energy prosumers — meaning that each household will be able to buy and sell energy though this network. In order for the transition to be successful, all stakeholders must agree on market standards and how the technology will grow.

In parallel to its new platform, Grid Singularity cofounded the nonprofit Energy Web Foundation to discuss, finance, and implement these changes.

Case Study

ME SOLshare

Year Founded
2015

Stage
Program

Model
For-Profit

Application
Platforms and Marketplaces

Bangladesh households still rely on biomass fuels, kerosene, candle, and LPG (liquefied petroleum gas) as their primary sources of energy supply.[4] With a high upfront payment, solar panels are not an option for many customers and, for some households, they are not enough for their current energy consumption.

SOLshare's mission is to bring electricity to remote regions of Bangladesh by using clean and reliable solar panels.

More than just selling solar kits to households, SOLshare creates a small local energy grid that allows these households to produce and trade electricity with each other, without having to rely on local utility companies. Their product, SOLBox, is a device that enables homeowners to buy electricity as needed by paying for tokens via mobile phone SMS. Customers can finance this investment through micro-credits, with repayments of 24- to 36-months.

Blockchain technology allows the decentralized trade of energy and payments, shifting power to local households, which are getting affordable access to clean energy, with the increased benefit of becoming micro-producers and potentially having a new source of income.

SOLshare already uses blockchain for distributed ledgers and is in the process of developing a tokenization model for increased transparency and grid management efficiency. The company has set up 10 micro-grids in Bangladesh and envisions setting up 10,000 grids by 2030, reaching over 1 million users.

Useful Resources

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Financial Inclusion

Overview

With over two billion unbanked people around the world, opportunities for financial inclusion are tremendous. Some of the most pressing issues involved in offering access to the unbanked are solvable with the use of blockchain, including lowering transaction settlement time and costs, removing formal infrastructure requirements, and providing digital identity and property rights.

Given the size of the market and blockchain's potential in delivering impact, there have been significant efforts to employ blockchain for financial inclusion. With 25 initiatives identified in our research, financial inclusion is one of the most mature applications of blockchain.

Key Highlights

These initiatives comprise more program-stage projects than any other sector.

For almost half of these projects, reaching more people is a primary benefit of using blockchain.

44 percent of Financial Inclusion initiatives are on track to reach more than a million people each before 2020.

More than half of the for-profit Financial Inclusion projects are reaching more than a thousand people.

The Financial Inclusion Context

Traditional banking/financial systems encounter multiple problems providing access to the currently unbanked. High transaction fees, coupled with limited ability to pay, render the economically disadvantaged unviable customers for existing financial institutions.

A lack of digital identity is another often-cited barrier to financial inclusion. According to a 2014 World Bank survey, 18% of the unbanked lack access to financial services due to their inability to provide proof of identity.[1]

Finally, lack of property registration, especially in the developing world, presents a challenge for the economically disadvantaged to leverage property ownership for access to credit. Land and property are among the most readily available resources to capitalize on, yet clear land boundaries and entitlement are costly to implement and susceptible to corruption on a grand scale.

Blockchain Solutions in Financial Inclusion

Many of the challenges in the Financial Inclusion area align with the strengths of blockchain, giving this sector the potential for widespread reach: 68% of all initiatives aim to reach over a million people.

Sixty-eight percent of Financial Inclusion initiatives aim to reach more than a million people.

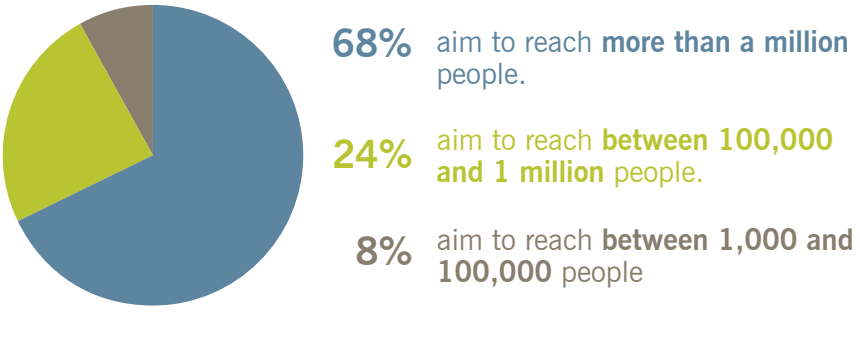


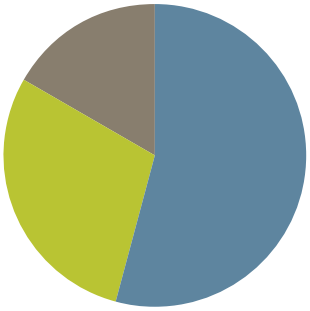
Figure 20: Growth Potential of Financial Inclusion Initiatives

Blockchain has been used for cross-border payments to overcome obstacles associated with traditional banking/financial systems. First, blockchain limits settlement time by eliminating the need for a trusted third-party intermediary. Also, blockchain transactions can settle almost instantaneously, compared to traditional systems in developing countries, which can take up to a few days. Real-time processing helps reduce settlement risks and foreign exchange risk.

Challenges

Despite its benefits, blockchain usage in Financial Inclusion is still in early development. The complexity of the technology makes regulators and incumbents hesitant, and formal regulation frameworks are still lacking, leading to delays in implementation. Furthermore, incumbents in some markets currently benefit fromhigh profitability and thus have little incentive to adopt the technology.

Complexities in financial regulations and fintech present obstacles to blockchain implementation.



52% are in the **program** stage.

28% are in the **concept** stage.

16% are in the **pilot** stage.

Figure 21: Implementation stage of Financial Inclusion Initiatives

While blockchain transaction speed is superior to available options in the developing world, its current speed is still limited compared to settlements in developed countries. Challenges with scaling are therefore present with global-scale implementation being the ultimate goal.

Case Study

Mojaloop

A Gates Foundation Level One Project

Year Founded
2014

Stage
Pilot

Model
Foundation

Application
Payments and Money Transfers

While there is a growing number of digital money solutions for the unbanked, customers can currently transact only with others who use the same service, limiting the reach of mobile money. Mojaloop is an open-source code which makes it easier for financial providers to achieve interoperability, creating one single-payment platform for the end users.

Mojaloop employs Interledger, a protocol for connecting different ledgers, including digital wallets, national payment systems, and blockchains. Mojaloop allows for completely traceable transactions that can be audited by a regulatory body along with satisfying regulatory needs to KYC by financial institutions. Using Interledger, Mojaloop can achieve clearing in milliseconds and deferred net settlements in seconds, as well as lower costs associated with transfers.

The Level One team has carried out discussions in multiple countries (Tanzania, Uganda, West African Economic Union, Myanmar, South Africa), and so far Mojaloop has been well received. The next phase of the project involves discussions with organizations around the world to implement the solution; the first deployment is expected sometime in 2018 or early 2019.

The main challenge remaining is slow regulatory approval, especially on the national level. Political regime changes and lack of a clear regulatory framework may create lags in implementation, which may render the solution obsolete if the commercial market pivots to another direction.

Case Study

WeTrust

Year Founded
2016

Stage
Program

Model
For-Profit

Application
Payments and
Money Transfers

Of an estimated two billion adults around the world who lack a bank account,[2] over one billion participate in rotating savings and credit associations (ROSCAs), a centuries-old system of trusted lending circles that rely on personal reputation and relationships to help people collectively save and lend money.

Inspired by these informal lending groups, WeTrust was founded in 2016 to significantly improve upon the existing financial system by leveraging the efficiency and cost savings potential of blockchain \ technology. Its first product, Trusted Lending Circle, uses the Ethereum blockchain to significantly reduce overhead fees by eliminating the need for a trusted third party, such as a bank, and to improve transparency of transactions within these groups. This makes banking more affordable and accessible, particularly for those with small transactions. The autonomous and decentralized nature of the platform has the potential to improve financial inclusion on a global scale through digitization of what were previously cash transactions, and through enabling the creation of a credit and transaction history.

WeTrust hopes to expand Trusted Lending Circles in 2018 and build additional infrastructure utilities that will push the overall blockchain ecosystem forward.

The company is headquartered in California and has remote team members based in Texas, Vietnam, and Hungary.

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Health

Overview

The largest number of blockchain for good initiatives resides in the Health sector. Applications for blockchain in Health include digital health records exchange and pharmaceutical supply chain management. In many of these areas, blockchain offers a more secure, decentralized, and efficient solution than would otherwise be possible.

Key Highlights

Blockchain initiatives in Health started later than those in other sectors.

The large majority of Health initiatives (82%) are for-profit.

Only a small minority (6%) of Health inititiatives specifically target poor or disadvantaged persons.

94% of Health initiatives could impact more than a million people each—the largest impact of any sector in this report.

The Health Context

The siloed nature of electronic health records is one of the biggest challenges in the sector. While health information exchanges exist, they can be costly and challenging to interoperate, as each system has custom data standards and processes. As a small illustration of the challenge, in the city of Boston alone, more than 26 different electronic medical records systems are used.[1] As a result, patients' records are typically scattered across many different systems, making it difficult for doctors to access a patient's full medical history. It also means that individuals cannot reliably collate and share their own records.

Furthermore, health information is highly regulated, and any electronic system in the U.S. must comply with HIPAA standards for patient privacy and data security.

The safe transport of medicine and vaccines from manufacturer to end user is a concern worldwide. One key challenge is that many items only remain viable within a certain temperature range; if exposed to temperatures too hot or too cold, the medicine no longer works as intended. Being able to track and verify environmental conditions along the supply chain allows medical professionals to discard medicines that are no longer in acceptable condition. In many parts of the world, such as Europe, there are strict regulations around supply chain management for pharmaceuticals.

In other parts of the world, particularly in emerging markets, another significant problem exists: counterfeit drugs. The WHO estimates that 700,000 deaths each year are connected to counterfeit malaria and tuberculosis drugs alone.[2] For patients, knowing whether the drug they have purchased is legitimate can be life-saving.

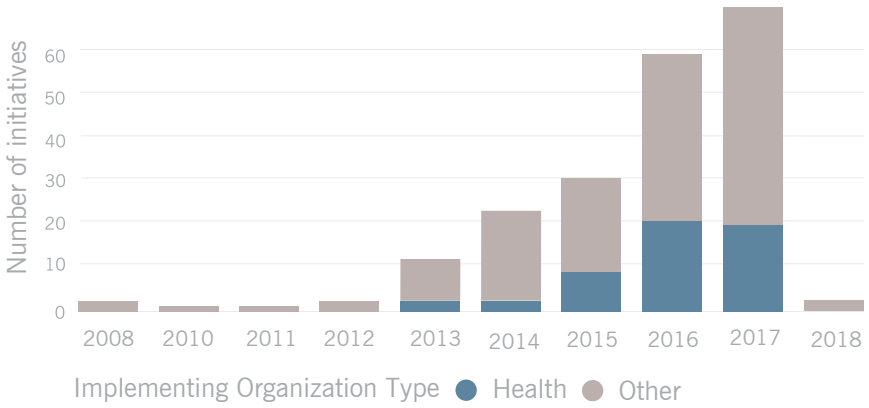
Blockchain Solutions in Health

Blockchain initiatives in Health started later than those in other sectors, and they grew significantly in 2016 and 2017. In an IBM Institute for Business Value survey of 200 healthcare executives in 16 countries, 16% reported expecting to have a commercial blockchain solution at scale in 2017.[3] Because many startups begin in stealth mode, it is likely that the number of initiatives beginning in 2017 is underreported.

The potential impact of a decentralized, patient-centric health records system is substantial. Healthcare providers with a full

Because many startups launch in stealth mode, it is highly likely that initiatives starting in 2017 are underreported.

Figure 22: Health Initiatives by Start Date



view of patients' medical history can provide more personalized treatment and avoid duplicating services. Meanwhile, exchanges could connect patients with research initiatives to monetize their personal data while contributing to medical research. One area of medicine that could particularly benefit from new longitudinal data sets is precision medicine, which seeks to tailor treatment based on individuals' genetics, lifestyle, and environment.[4]

While most efforts around medical records are based in the U.S. and Europe, Factom, a U.S.-based blockchain technology company, received two grants from the Bill and Melinda Gates Foundation for an early-stage project on medical records in developing countries.[5]

Medical records and pharmaceutical supply chain solutions are the most popular applications for blockchain in Health.

Several companies are addressing the challenges of temperature monitoring and counterfeit drug prevention in pharmaceutical supply chains. For example, Modum is building a hardware sensor and using blockchain to securely store sensor data. However, most solutions are not hardware-based. The MediLedger Project, created by a group of companies including Pfizer and Genentech, uses blockchain to track medicines and facilitate information exchange across multiple existing databases in similar fashion to solutions in the medical records context.[6]

While medical records and pharmaceutical supply chain solutions are the most popular applications for blockchain in health, other ideas abound, such as medical equipment asset management[7] and building a secure global exchange for kidney paired donations.[8]

Initiatives in other sectors may also have real health outcomes in the global arena: Digital identity, results-based disbursement of aid and philanthropic funding, universal access to financing,[9] and supply chain transparency for food all have the potential to allow people living in low-resource environments to live healthier lives.

The large majority (82%) of initiatives in the Health sector are for-profit companies headquartered and operating in North America and Europe. Relative to non-Health blockchain for good initiatives, nearly twice as many have operations in North America, and a negligible number target South Asia, sub-Saharan Africa, or the Middle East and North Africa.[10] Headquarter locations show the same trend, with nearly 60% based in the United States.

More than half of Health initiatives would be impossible without decentralized ledgers.

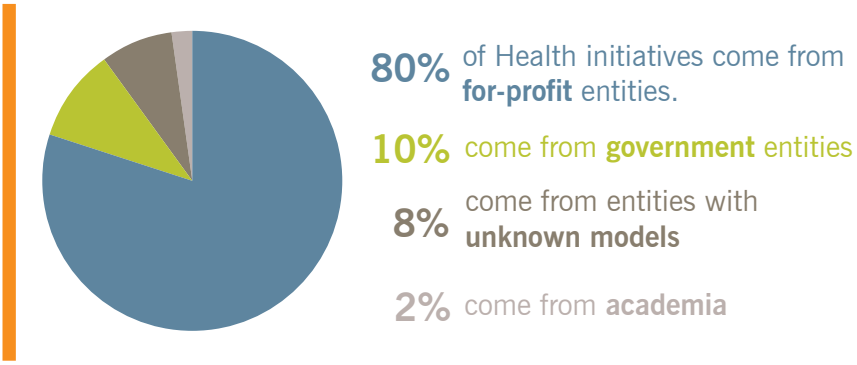


Figure 23: Types of Organizations Implementing Health Blockchain Initiatives

This is likely due to the massive size of the U.S. and global healthcare markets and the suitability of blockchain to technical challenges in the industry. In the U.S., healthcare expenditures top $3 trillion annually, or nearly 20% of GDP, providing ample incentive for innovation and market solutions.

Challenges

While promising, blockchain leaves unsolved many of the underlying problems of the Health sector.

Health-related blockchain initiatives must be aware of and responsive to constantly shifting regulatory landscapes.

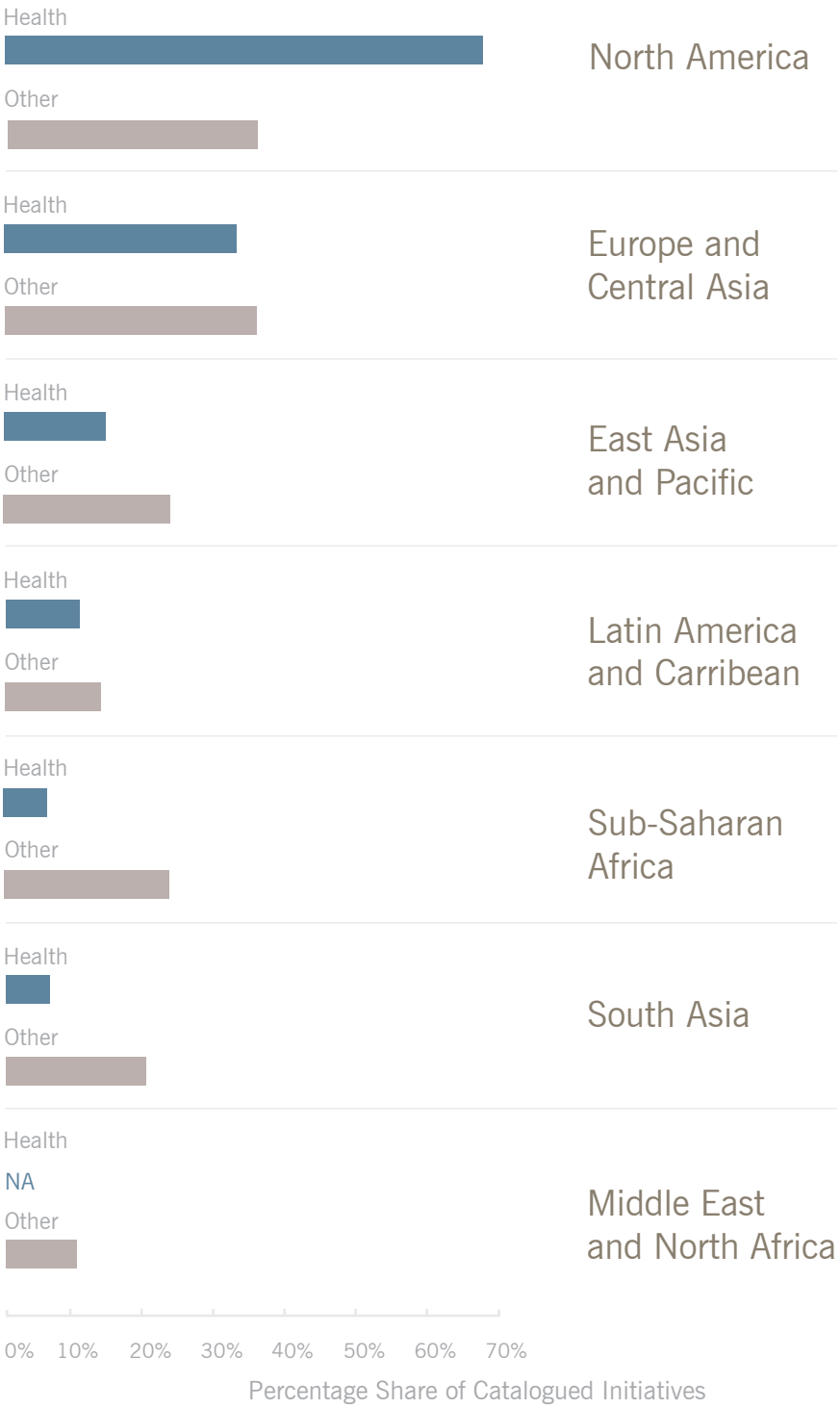
Realizing the full benefits of blockchain will require an unprecedented degree of coordination across players, including agreement on a standardized transaction layer.

Likewise, blockchain does not solve all security and privacy issues. If the solution builds on existing electronic health record systems, these systems may remain vulnerable to hacking. The magnitude of this challenge is enormous: 342 healthcare security breaches were reported in 2017 with tens of millions of records compromised.[12]

Finally, because healthcare is often considered the responsibility of government and is highly regulated, any health blockchain initiatives will need to be cognizant of and responsive to the changing regulatory landscape and heterogeneity across countries.

Eighty-two percent of Health initiatives are headquartered and operating in North America or Europe.

Figure 24: Geographic Operations of Blockchain Health Initiatives



Case Study

Modum.io

Year Founded
2016

Stage
Program

Model
For-Profit

Application
Supply Chain Management

In Europe, an estimated 90% of pharmaceutical shipments are last-mile deliveries occurring between distributors and doctors, hospitals, or pharmacies. For these high-volume, low-value shipments, conventional methods for temperature monitoring and active cooling are expensive. However, companies are required by the European Commission to demonstrate Good Distribution Practice (GDP) compliance with proof of temperature conditions.

Modum.io, founded in Zurich in 2016, offers an alternative passive monitoring system. Its hardware sensors, placed in each package, track temperature conditions of a medicinal product while in transit. The sensors can track packages for weeks at a time and are intended to be reused.

Modum.io uses blockchain to ensure that the data originated from a particular sensor and has not been tampered with along the way. Secure data is important for Modum.io's customers, pharma distributors, to meet GDP requirements. It is also important for pharma distributors' clients, the end users, who have assurance that their medicines will work as intended. Additionally, smart contracts on the blockchain automate notifications to sender and receiver that the products being shipped have met requirements and are ready to be sold to consumers. This market-driven use case is important for the adoption of Modum.io's passive monitoring system in Europe.

Modum.io completed three pilot projects. Its first-generation sensors are now in mass production, being deployed as part of several new pilots with primarily European-based companies. While currently focused on the pharmaceutical sector, Modum.io envisions a multi-sector supply chain solution. Future generations of the sensor will integrate real-time data monitoring and new blockchain back-ends.

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10. Note that geographic analysis may unintentionally incorporate researcher bias due to language limitations and media presence of non-U.S. initiatives.

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Land Rights

Overview

In countries working to clarify or increase titled land area, storing and certifying information via a blockchain can provide greater legal and economic security for inhabitants and landholders. Blockchain's promises of transparency, improved efficiency, and decreased fraud could make a huge difference in countries with poor recordkeeping or frequent instances of land fraud. Still, the social processes that govern land ownership and use cannot, and should not, be replaced by the introduction of new technology.

Key Highlights

Land Rights overlaps with Democracy and Governance, as land registry is often a government service.

Governments partnering with private sector technology providers is the norm for the Land Rights sector.

Results for Land Rights blockchain initiatives are already reaching impact or will do so by the end of 2019.

Impact for transparent and well-recorded land titles could be transformational on a global scale.

The Land Rights Context

Land registries were created as a way to measure economic wealth at a time when land holdings were among the most valuable assets people possessed.[1] Today, having secure land tenure is considered a form of economic empowerment, a safeguard against displacement or exploitation, and even a foundation of cultural identity, especially for local communities and indigenous peoples. Its inclusion in the United Nations Sustainable Development Goal (SDG) 1, regarding poverty alleviation, and SDG 5, on gender equality, shows how land security is a necessary condition for equitable development.[2] Yet, only 30% of the global population has a formal title to their land.[3]

Blockchain Solutions in Land Rights

Though few social impact actors are active in the blockchain land sector, all of the use cases we studied would be an improvement on existing processes or enable previously impossible processes. Blockchain-based land registries attempt to address two critical pieces of information infrastructure needed for land governance: (1) storage and verification of titles and ownership, and (2) more efficient processes and transactions.

More than half of these initiatives would be impossible without decentralized ledgers.

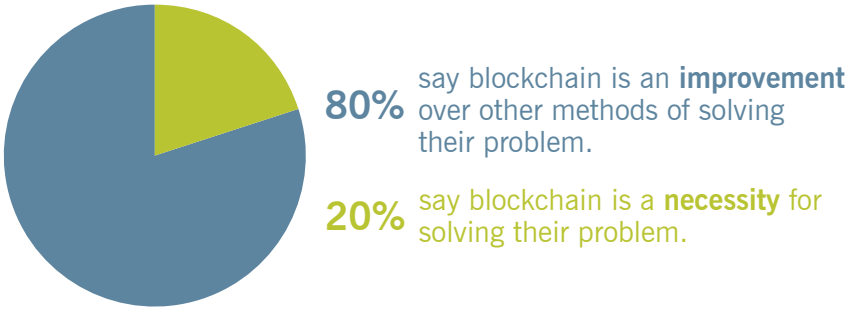

Figure 25: The Need for Blockchain in Land Rights

The transparency blockchain could bring to land registries could be publicly beneficial. If prices, areas, ownership, and overarching trends could be gleaned from land registries, it could benefit buyers, sellers, and government planners. It could certainly be a driver of economic activity. Efficiencies, improved information, and reduced documentation-based fraud would be significant benefits the Land Rights sector. These solutions could be applicable to land registries that already function well, such as Sweden; countries with serious documentation challenges due to political transitions, like the Republic of Georgia; and countries where fraudulent transactions of land create legal challenges and market uncertainty, like India.

Proponents of using blockchain's distributed ledger technology for the land sector say that the use of smart contracts could foster efficiencies in official processes related to registering land, like purchase, sale, subdivision, or inheritance. If all actors who sanction and approve these processes were integrated into a blockchain-like system, time and cost for completing all the necessary steps associated with land registries could be drastically reduced. These are the improvements that velox.RE hopes to bring to places like Chicago, where it completed a successful pilot to transact land titles with the Cook County Register of Deeds and other partners.[4]

Distributed ledger technology for the Land Rights sector creates transparency and efficiencies in registry and documentation and reduces fraud and market uncertainty.

The land sector also illustrates a good implementation of blockchain technology's "double-spending" solution. It could make it more difficult to register one plot of land to multiple owners or over-leverage financing from different sources on the same plot, and it could prevent illicit sale of already-owned land (and some say, any type of property) to new parties.

Challenges

Some of the major drawbacks of using blockchain technology to manage land transactions are infrastructural. Implementing block-chain for land registries requires digitized records and widespread internet connectivity. Maintenance of and access to physical maps is often challenging; digitizing, geo-referencing, and harmonizing maps in remote corners of the world, where maps even exist, would be a colossal task.

The problematic impermanence of paper documents is already well recognized in the developing world — governments in India have proposed land titles that could survive "even if soaked in water for a month"[5] — but paper's ability to be physically owned by an actual, individual human is currently not completely resolved by blockchain technology. Verified digital identities are in many ways a precursor to land transactions on a blockchain.

Another question for blockchain in the Land Rights sector is the quality of the data. Is current information in land registries trustworthy? What if poor quality, incorrect, or fraudulent data is entered in the beginning phase of a blockchain land registry? Proving legitimacy of land claims and occupancy is usually a task for courts. Judicial processes are only as functional as their outcomes, and in many places in the world, these outcomes can

be a result of willingness or capacity to pay for legal help. Blockchain implementations for land must consider how to avoid further concentrating power in the hands of the already powerful.

Mapping is perhaps the biggest challenge to blockchain's implementation in the land sector. Mapping is a social process. Forms of land tenure are as diverse as the legal and traditional frameworks in which they exist, and many legal frameworks do not even take into account all traditional forms of land tenure by indigenous, tribal, or local peoples. These social realities, enshrined in more-or-less functioning legal and political systems around the globe, are at the heart of land conflict and don't have a technical solution.

Case Study

Chromaway

Year Founded
2014

Stage
Pilot

Model
For-Profit

Application
Records and Verification

Who owns what land can be a contentious question. In the bygone days of the approximately 350-year-old Swedish land registry, government officers habitually carried swords to defend themselves in case land disputes got particularly heated.

Today, Swedish-based startup Chromaway is working with governments in Sweden and the Indian state of Andhra Pradesh (among other, not-yet-public locations) to maintain land titles and legal records of property transactions on a blockchain-based system. In places like Sweden, new technology simply brings greater efficiencies to already functioning systems. In India, however, storing land titles on a publicly verifiable and immutable blockchain could greatly reduce fraud and corruption because land titles could be traced over time, amongst various owners, with a record that could not be changed or hidden. Even in the case of disputes, this tracking would produce a notarized workflow that courts could then inspect.

Chromaway's technology leader envisions a future in which land claims can be gradually strengthened through the addition of coordinates, time-stamped photos, and verification by neighbors or other local authorities. The open-source code used by Chromaway to build land registries is crucial for building trust in its solutions, and, characteristic of distributed ledger systems, can operate without a central infrastructure. This creates opportunities for implementation in rural areas with only mobile internet connectivity.

Ultimately, the goal is to empower citizens to interact directly with the government systems that facilitate societal interactions. This empowerment could be measured in terms of increased economic activity, decreased numbers of court disputes over land, or increased trust between citizens and land authorities.

The Swedish land registry system has been piloted domestically and is only awaiting a final legal decision to update a rule that requires paper to be physically signed in the land issuance and transfer process. Delays like these show perhaps one of the biggest challenges to implementing blockchain for social impact are laws and policies that never envisioned a digital future.

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Philanthropy and Aid

Overview

Achieving the Sustainable Development Goals (SDGs) outlined by the UN to address fundamental issues such as poverty, basic human rights, and access to education requires large amounts of capital and innovative approaches to increase effectiveness. Despite significant investments by development organizations, governments, and the private sector, an estimated $2.5 trillion of additional capital is needed. Blockchain offers a promising solution to help increase funding levels and effectiveness by addressing some of the key issues in philanthropy and aid such as transparency, costs and inefficiency, and new vehicles for capital.

Key Highlights

Nearly three-quarters of these initiatives are using blockchain to facilitate payments and money transfers.

All but one of these initiatives are located in western countries, and only 30 percent have a presence outside of their own region.

82% of these initiatives are non-profit or foundation-led.

More than half (59%) of these initiatives are still in the early pilot stage, reaching fewer than 1,000 people

The Philanthropy and Aid Context

Billions of dollars are donated to charity each year, with an estimated $390 billion from the U.S. alone,[1,2] and these numbers are expected to increase in coming decades. Global development aid reached a new peak of $142.6 billion in 2016, according to the OECD. However, despite increasing levels of giving, there is much more needed. The United Nations Conference on Trade and Development (UNCTAD) states that achieving the SDGs will require $5–7 trillion, with an investment gap in developing countries of about $2.5 trillion.[3]

Donors are becoming more results- and impact-focused, and trust in the recipient organization is crucial to their decision-making.

One of the issues hindering giving and aid is a lack of transparency, and, therefore, often a lack of trust that funds will be used effectively. Currently, billions are donated to a recipient organization, agency or government, and once the money leaves the account of the donor, there is limited tracking or transparency available to determine exactly how the funds were used and who ultimately benefited. Donors are also becoming more results- and impact-focused, and trust in the recipient organization is crucial to their giving decision-making.

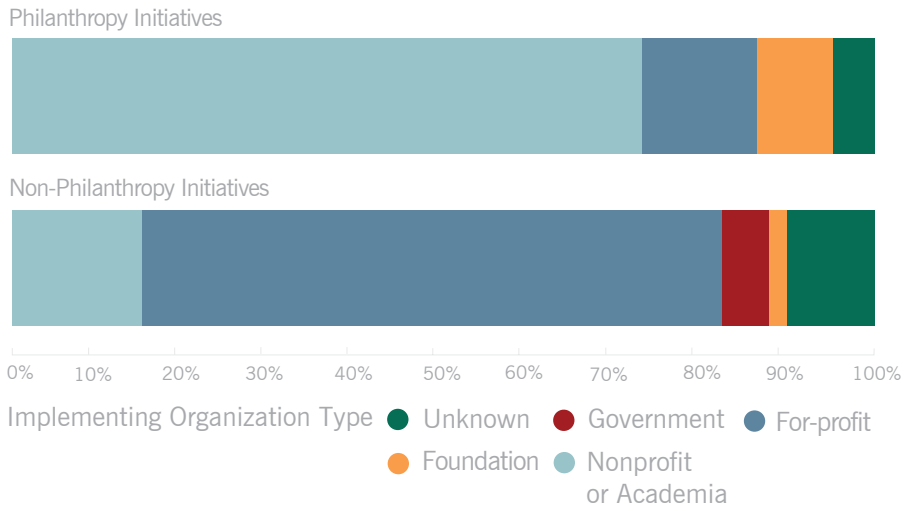
According to a survey by Fidelity Charitable, 41% of donors say they have changed their giving due to increased knowledge about nonprofit effectiveness.[4] Complicating matters, organizations transferring funds internationally may lose from 3% up to 10% of the funds in transaction fees and inefficiencies caused by having to go through multiple intermediaries such as banks, agencies, and governments. This is especially critical for aid organizations dealing with large sums of money and more complex geographies and financial systems.

Blockchain Solutions in Philanthropy and Aid

Nonprofits are leading the way in this sector: 82% of the initiatives in our survey are nonprofit- or foundation-led initiatives or organizations. Blockchain has the potential to transform charitable giving and aid distribution by enhancing transparency, reducing costs through disintermediation, and enabling new mechanisms for monitoring and tracking impact.[5,6] It also is providing emerging models for new sources of revenue and fundraising.

More than half of these initiatives would be impossible without decentralized ledgers.

Figure 26: Philanthropy Initiatives by Organization Type



One of blockchain's primary benefits to philanthropy or aid is that it enables a donation to be traced through every step, from donor to recipient, and record every action and intermediary along the way. Additionally, the use of smart contracts enables the determination of specific conditional milestones that must be reached before funds are disbursed. One example of this is Alice, a platform that incentivizes social organizations to run projects transparently by making sure that they get paid more when they achieve their goals. All donations are held in smart contracts and only disbursed once milestones are reached and verified. Donors can track their donations, and the performance of each project is publicly available, making it easier to identify and help scale projects that are most effective.[7]

Blockchain enables a donation to be traced through every step from donor to recipient, recording every action and intermediary.

For organizations dealing frequently with cross-border money transfers, especially where multiple intermediaries are involved, blockchain can significantly reduce process inefficiencies and save costs. Payments are immediate, fees are lower, and the risk of loss or fraud is mitigated through tracking of the funds. For example, Disberse is a fund management platform using blockchain for development and humanitarian aid. In its pilot project the charity Positive Women used the Disberse platform to reduce its transfer fees to educational projects in Swaziland by two-and-a-half percent.[8] The UN World Food Programme (WFP) has used blockchain for aid distribution in Jordan to directly pay vendors, facilitate cash transfers for over 10,000 Syrian refugees, and audit beneficiary spending.[9] In the initial pilot they were able to reduce costs of bank transfer fees by 98%. If such a pilot could be expanded to the entire organization, which spends $6 billion annually, it would lead to tens of millions in savings that could instead be allocated to aid.[10]

Blockchain is also providing new sources of fundraising and revenue for nonprofits through mechanisms such as crowdfunding and tokenized giving. Cryptocurrency donations are increasing. For example, Fidelity Charitable, the nation's second-largest grantmaker, received nearly $70 million in cryptocurrency donations in 2017, a nearly tenfold increase compared to the previous year.[11] Many nonprofits are beginning to accept donations in cryptocurrency, and platforms such as BitGive enable donors to make Bitcoin donations to specific charities and projects through crowd-fundraising campaigns. Other organizations have created their own charity cryptocurrencies that serve as a donation mechanism while providing a potential return for the donor. One example is Pinkcoin, which is a platform for Bitcoin donations but also allows users to buy and trade Pinkcoin (PINK) on a normal cryptocurrency exchange platform and to generate coins passively by using what is known as "proof-of-stake." Another example is RootProject which has established a unique model for funding nonprofits and directly supporting those in poverty utilizing three mechanisms: a crowd-funding platform, their own cryptocurrency (ROOTS), and a pension fund. RootProject is highlighted in more detail in our case study.

Challenges

The utilization of blockchain in philanthropy and aid benefits nonprofits and aid agencies as well as donors, but ultimately could have the greatest impact on the end beneficiaries. However, most projects are still in pilot or small program stages and, while initial traction is achievable before the end of 2018, getting to significantly larger scale will be a much longer and more complex process. Development organizations, nonprofits, and governments tend to be risk-averse and slow to adopt innovative and disruptive technology. Even in the case of a successful pilot, the process to rollout a new technology or solution at scale across the organization or geography is often complex and fraught with budget constraints, infrastructure complexities, and regulatory challenges.

Another significant barrier to wide-scale adoption is that introducing a new technology does not solve for the local economic and political forces that often impede the effectiveness and transparency of aid or philanthropic initiatives. In order for blockchain to be a transformative solution, collaboration and open dialogue is required across borders and sectors to develop a sustainable and scalable solution.

While blockchain is unlikely to completely disrupt philanthropy and aid in the short term, the potential for it to do so in the long term is very promising.

While Blockchain is unlikely to completely disrupt philanthropy and aid in the short term, the potential for it to do so in the long term is very promising. As the existing organizations and initiatives mature and new pilot projects enter the field, blockchain will continue to help drive innovation and transparency in the sector and open up new possibilities for funding models. Over time this could lead to enhanced trust in nonprofits and new mechanisms for giving that result in an increase in funds raised and significant impact on the lives of individual beneficiaries.

Case Study

Ixo Foundation

Year Founded
2016

Stage
Pilot

Model
Foundation

Application
Records and Verification

Monitoring and evaluation of donor- and government-funded projects is a necessary but laborious and expensive process. As the use of results-based financing grows, it becomes even more important for implementing organizations to maintain verified impact claims data. At the same time, communities need ways to validate whether services are being delivered as promised.

Ixo Foundation is a Swiss-based nonprofit that is building an open-source blockchain protocol for the impact economy. Its first pilot, Project Amply, is being implemented in collaboration with Western Cape Department of Social Development in South Africa and funded by the UNICEF Innovation Fund and Innovation Edge.

Amply allows preschool educators to securely capture children's school attendance using a mobile application and automates the generation of the Schedule B form required for the schools to receive government subsidies upon proof of attendance. Already, Amply has digitized more than 55,000 preschool attendance records, and the program is poised to scale. The system is a significant upgrade from the previous paper-based process. At the same time, it enables more cost-effective impact data collection, more efficient distribution of government subsidies, and it provides a new level of accountability for the delivery of government services.

In tandem, Ixo is establishing a new pilot with Gold Standard Foundation and Nexleaf that would use IoT sensors to originate carbon credits as carbon tokens from clean-burning cookstoves, while also measuring benefits related to gender and health.

Ixo's long-term vision is much more expansive: scaling and standardizing verified impact data that is universally accessible on a Global Impact Ledger. The Ixo protocol would enable any project to self-certify its impacts, which effectively scales the underwriting process for impact finance, allowing small and remote projects to access the global capital markets for social finance.

Case Study

Disberse

Year Founded
2016

Stage
Pilot

Model
For-Profit

Application
Payments and Money Transfers

Billions of dollars of aid are donated annually to developing countries. Ensuring the effective transfer and utilization of funds is a key challenge for international charities and aid organizations as well as for governments. Up to 10% of funds may be lost in transaction fees and fluctuating exchange rates, not to mention potential loss through intermediaries and corruption. These inefficiencies, combined with a lack of transparency, increase the risk of misuse of funds and perpetuate a lack of trust in the organizations responsible.[12]

Disberse aims to solve this with their fund management platform, which drives the transparent, efficient, and effective flow and delivery of development and humanitarian aid. It enables donors, governments, and NGOs to transfer and trace funds through the whole chain, from donor to beneficiary.[13]

The first pilot project was conducted in 2017 with U.K.-based charity Positive Women, which used the Disberse platform to reduce its transfer fees to educational projects in Swaziland by 2.5%. The savings enabled Positive Women to fund an additional three students' fees for a year.[14] Disberse has also partnered with Start Network, a global network of 42 leading aid agencies, to run a larger pilot with more organizations and broader geographic reach, to test the solution at scale. The first pilot was successfully completed in February with U.K. charity Dorcas.[15] The pilot enabled Dorcas to transfer funds from its international office in the Netherlands to its Albania country office almost instantly, and to trace the funds through an immutable record of the transaction.[16]

The successful pilot and proof of concept is an encouraging indication that Disberse will be able to further scale to other nonprofits and, through reduced costs, help increase the amount of aid funding that ends up where it should — with the beneficiaries.

Case Study

RootProject

Year Founded
2017

Stage
Pilot

Model
Nonprofit

Application
Payments and Money Transfers

One of the key challenges for nonprofits is financial sustainability due to an over-reliance on external funding sources.[17] RootProject believes blockchain can solve this pain point.

To do so, it has established a model utilizing three mechanisms: a crowdfunding platform, its own cryptocurrency (ROOTS), and a pension fund.

Through the 'laborless crowdfunding' platform, anyone can start a social impact project and organize a campaign to fund it. The projects will then be completed either by RootProject itself or one of its partner nonprofits, while sourcing the labor from those below the poverty line.[18] A portion of a project's crowdfunded proceeds goes to token purchases, driving further currency demand, and another portion goes to wages for those completing the project as well as to a deposit into a pension fund-like entity.[19] This flow-through enables the nonprofit to raise funds to complete projects, help those in poverty earn an income, and create a structure through which it can be financially self-sustainable.[20]

This model creates alignment between investors, nonprofits, and the poor. Cofounder Dr. Nicholas Judge states, "RootProject is not a plan to marginally increase nonprofit efficiency. It's a model built to put the full power of markets and investors behind nonprofits."

RootProject is still in early stages, but it has a unique model and the potential to help nonprofit and community organizations scale their impact. It is currently focused on a second round of fund-raising through its ICO in April 2018, before it launches formal pilots with nonprofits.

Its vision is to eventually be in the 50 largest cities in the world where government is not effectively solving poverty problems, and to set a new precedent for nonprofit funding.

Useful Resources

Blockchain and Economic Development: Hype vs. Reality, Center for Global Development, Policy Paper July 2017

Blockchain for Development - Emerging Opportunities for Mobile, Identity and Aid, GSMA

Blockchain - Unpacking the disruptive potential of blockchain technology for human development, Canadian International Development Research Centre

Hack the Future of Development Aid - Blockchain in Development, December 2017, Charities Aid Foundation

Giving Unchained: Philanthropy and the Blockchain, Charities Aid Foundation

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19. Ibid

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Additional Sectors

Overview

While this research found a congregation of blockchain initiatives across eight sectors, blockchain initiatives are not limited to just these sectors. Three other sectors also have some initial blockchain efforts that are worth calling out.

Education

Education projects are enabling secure record-keeping to replace outdated methods of issuing certificates and transcripts.

Blockchain in education is initially focused on providing a more secure and immutable record of attendance and/or performance to replace current methods of issuing certificates and transcripts. Doing so not only provides students with a more efficient way to access records, but it can also reduce the administrative and cost burden on institutions to verify and authenticate records. Many of the organizations currently providing certification operate more broadly in blockchain-based certificates with education as a subset. Edgecoin is an example of a newer organization focused specifically on education. A further permutation of the application to student records involves a portfolio approach, allowing for a more comprehensive overview of all information related to each student throughout their academic career.

Other conceptual cases point toward a more disruptive application over time, supporting lifelong learning and providing verified recognition for learning accomplished outside of formal institutions. The use of tokens to recognize learning and accomplishments gives individuals a more accurate reflection of their holistic education throughout life. This would potentially diversify opportunity for those whose skills are not reflected in their degrees or previous work experience and give employers access to a wider pool of relevant talent. BitDegree is beginning to work in this direction with a blockchain-powered online education platform.

Most of the use cases in Education are still in pilot stages and will take time before they reach significant traction and scale. It is clear, though, that with an evolution toward lifelong learning and

away from a reliance on formal institutions, blockchain potentially has a role to play in how we view and track learning and achievement.

Human Rights

Blockchain enables Human Rights initiatives to create verifiable information streams to track individuals or rights violations across the globe.

Human Rights implications of blockchain are focused on solving diverse challenges. The four initiatives we profiled during our research include two focused on stopping human trafficking or slave labor; one focused on sustainable, participatory, and affordable housing; and one that seeks to provide bail funding for low-income prisoners unable to afford it. The central utility of blockchain to these initiatives is raising and tracking funds and creating a verifiable information stream that can track individuals or claims of rights violations. For example, Stop the Traffik proposes to create the first blockchain-trackable T-shirt supply chain, through which workers can submit verification that their labor rights were respected at each stage of the production process, from cotton harvest through garment production. Most of these initiatives are in the idea or pilot phase, and all started in 2017.

Water and Sanitation

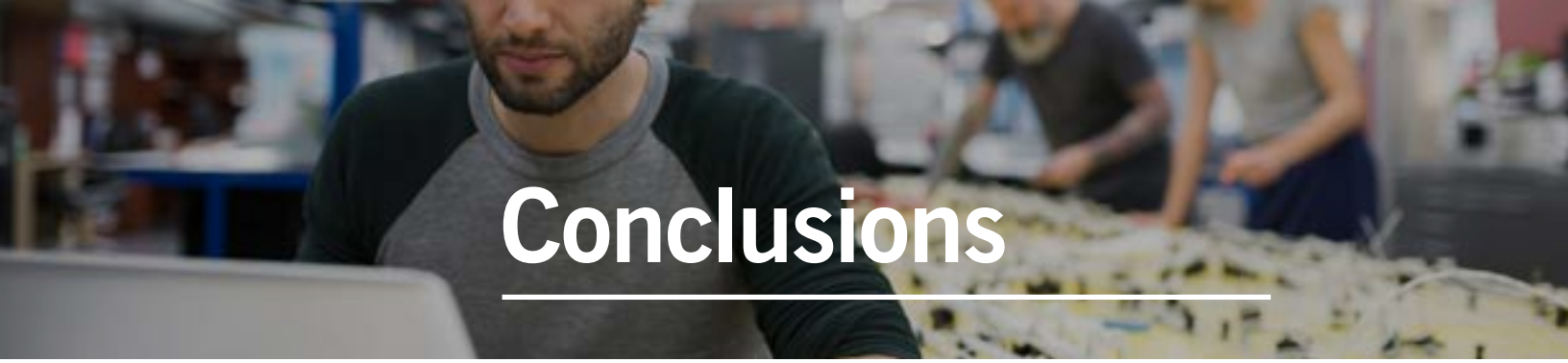
It is very early days for blockchain use in Water applications. Companies are experimenting with using blockchain as an efficient way to track and record water data and to create more efficient markets for these underlying resources.

For example, in Australia, the city of Freemantle is working with Power Ledger to use blockchain to create a more efficient market for water trading, similar to carbon trading markets. Others, like Clean Water Coin, are trying to use the crowdfunding advantages of blockchain to increase the efficiency of funding clean water projects worldwide.

Useful Resources

Impact Chain Lab. “Managing Our Water Supply with Blockchain.” Medium.com (November 30, 2017) https://medium.com/@impactchain-lab/managing-our-watersupply-with-blockchain-46aaf0b7f530

Talton, Ellis and Remington Tonar. “Why Blockchain Is Key to Transforming How Physical Infrastructure Works and How We Think About It.” Forbes. January 22, 2018 https://www.forbes.com/sites/ellistalton/2018/01/22/why-blockchain-is-key-to-transforming-how-physical-infrastructure-works-and-how-we-think-about-it/#530e42464875



Conclusions

It may be too early to tell how prolific the growth and adoption of blockchain applications for social impact will be, but our initial catalog and analysis showed that beyond the hype, potentially transformative blockchain applications for social impact are already emerging.

As these blockchain applications mature, here are two concluding recommendations from our research.

Pay attention to the progress of blockchain applications dedicated toward social impact. Early data suggests that blockchain can provide incremental (65% of initiatives) or transformative solutions (25% of initiatives) for people solving our world's toughest challenges. As more and more initiatives move from pilots to programs, closely monitoring their progress will make sure that proven use cases rise up beyond the hype to gain further support and adoption.

We are already starting to see impact in sectors like democracy and governance, where sixty-seven percent of such initiatives are expected to have demonstrated impact in the next six months. As blockchain applications move toward adoption and impact, we will learn more about whether blockchain can actually unlock solutions that otherwise wouldn't be possible, or at the very least how it can help improve existing solutions.

For those new to blockchain, follow the work of others closely to not just learn but also to explore opportunities to partner. Our research highlights collaboration across sectors to bring forward blockchain solutions. We see potential, particularly for governments and nonprofit organizations, to implement projects in partnership with private sector actors who are pushing forward the advancement of the underlying technology.

Understand the problem you are trying to solve and how blockchain can potentially fit. Blockchain brings the potential to instill trust between multiple parties, reduce costs, increase efficiency, and improve security. As outlined in our research, blockchain can bring

innovative, exciting solutions to those who focus on the benefits. The most common challenges of blockchain are payments, money transfers, and record and identity verification. Blockchain can enable solutions that otherwise would not be possible.

The Deloitte Blockchain Framework offers guidance on four preconditions for which blockchain would be best suited:

- Multiple parties generate transactions that change information in a shared repository
- Parties need to trust that transactions are valid
- Intermediaries are inefficient or not trusted as arbiters of truth
- Enhanced security is needed

Hype often gets amplified when people look to use a new technology for the sake of using it. Instead of being a technology in search of an application, start with the actual problem you are trying to solve to determine if blockchain's attributes can be of value. More focus on how blockchain can best deliver value will make it move further away from hype and closer to reality.

Appendix

Project Background

This research project was started in December 2017 by Doug Galen, Lecturer in Management at Stanford Graduate School of Business and CEO of RippleWorks. The research team was comprised of Galen and seven graduate students from across Stanford University with backgrounds in international development, nonprofits, financial services, consulting, and blockchain and product development. The project was completed as a collaboration between Stanford Graduate School of Business Center for Social Innovation and RippleWorks.

Methodology

The first step in the research process was to comprehensively capture a catalog of the different organizations, initiatives, and projects focused on applications of blockchain technologies for social impact. Research team members did this through initial internet searches, outreach emails to key players, scouring blog posts, conferences, webinars, and community groups related to blockchain for social impact, and a crowdsourcing effort initiated through a blog post and publicly-shared first draft of the catalog. Research team members also participated in a Blockchain for International Development course hosted by TechChange that allowed team members to engage directly with nearly 200 development and social impact professionals, as well as guest lecturers and experts engaging in blockchain for social impact activities.

The final catalogue included 193 organizations, initiatives, and projects. Of these, team members conducted more than 60 deep-dive interviews. Interviews were prioritized for organizations and initiatives that are further along in active implementation or appeared to have the highest potential for social impact. At the same time, an effort was made to ensure that interviewees covered all of the different sectors and use cases of blockchain for social impact.

Interviews were focused predominantly on gathering qualitative data on impact, with questions like these illustrative examples:

1. What is the problem your organization is trying to solve? Who are your end users?
2. How does your initiative use blockchain, and why is blockchain a good technology for this problem?
3. What technologies or services are available to solve this problem, and how is blockchain a better solution?
4. What is your initiative's intended impact? How do you measure it?
5. In what time frame do you think you will see meaningful impact from your blockchain initiative?

A smaller subset of these interviews were selected to be highlighted as case studies, with each selected case study adhering to one or more of the following criteria:

1. High evidence of impact
2. Advancement in actively implementing a blockchain for social impact activities
3. A unique story, process, or evolution of a model that could be useful for the broader community to learn from
4. A strong team or particularly dynamic leader

Simultaneously, all 193 organizations in the catalogue were evaluated on a number of criteria that included identifying information (geographic reach, implementing organization type, year founded, primary use case, primary sector, and description) and a series of impact metrics (current status, future quantitative potential, primary definition of impact, time frame for measurable impact, primary beneficiary/target market, the additive impact of blockchain technologies on the solution, and an overall impression of impact).

Implementers, Foundations, and Conveners

International Development

Examples of development implementers exploring the use of blockchain technologies for international development programs include Mercy Corps, Tetra Tech, RTI International, Development Alternatives Incorporated (DAI), and Save the Children. Some implementers, such as Creative Associates International, Abt Associates, and Chemonics, have established their own in-house labs to focus on the applications of blockchain (and other technologies) in their development programs. Other notable development institutions with their own blockchain labs include the World Bank, which has established its own Blockchain Lab to serve as a forum for learning, experimentation, and collaboration on distributed ledger technology, and GIZ, which has established a blockchain lab to work on increasing the maturity of governance frameworks for blockchain applications.

Foundations

Various cryptocurrencies including Zcash, Bitcoin, Ethereum, Dash, Litecoin, and Ripple have recently started their own foundations. While some of these foundations focus on promoting the acceptance and reach of their respective cryptocurrencies, they also advocate for many social-oriented ideals, including financial privacy, security, and inclusion, and a more accessible and trustworthy internet.

Another notable example of a foundation promoting blockchain for social impact is the Energy Web Foundation in Switzerland, which is a global nonprofit organization focused on accelerating blockchain technology across the energy sector.

Conveners, Accelerators, and Innovation Efforts

UNICEF Innovation (New York, NY): Innovation at UNICEF is driven by an interdisciplinary team of individuals around the world tasked with identifying, prototyping, and scaling technologies and practices that strengthen UNICEF's work for children. Innovations range from new ways to structure programs to new products and technologies. In February 2018, UNICEF Innovation released a funding opportunity for $50–90K equity-free investments for early-stage blockchain startups in UNICEF's program countries.

IDEO CoLab (San Francisco, CA): The CoLab is IDEO's Research and Design Network, focused on bringing together like-minded organizations to understand and shape how emerging technologies will affect our world. Blockchain and Distributed Web is one of the CoLab's current portfolio areas, along with Data Driven Intelligence, and Circular Economy.

Blockchain for Social Impact (Brooklyn, NY): Blockchain for Social Impact Coalition (BSIC) incubates, develops, and implements confederated blockchain products and solutions that can address social and environmental challenges across the United Nations' Sustainable Development Goals. BSIC is an initiative of ConsenSys, a venture production studio based in Brooklyn, NY.

Start Labs (London, U.K.): Start Network, hosted by Save the Children U.K., is made up of 42 aid agencies across five continents focused on delivering effective aid. Start Labs is in a new partnership with Disberse to test blockchain technology for aid disbursement.

Chamber of Digital Commerce (Washington, DC): The Chamber of Digital Commerce is an American advocacy group that promotes the emerging industry behind blockchain technology, digital currency, and digital assets.

New America's Blockchain Trust Accelerator (Washington, DC): Established in 2016, Blockchain Trust Accelerator (BTA) brings together governments, technologists, civil society organizations, and philanthropists to build blockchain pilots that benefit society. BTA operates as a not-for-profit collaboration between New America, The Bitfury Group, and the National Democratic Institute with support from the Rockefeller Foundation.

Infrachain (Luxembourg): Infrachain is a nonprofit organization created by the emerging blockchain-related industry and supported by the Luxembourg government. Infrachain closes the gap between maturing blockchain technologies and regulatory and legal requirements. In order to achieve this goal, Infrachain creates a supplementary governance model on top of existing technologies allowing blockchain proof of concepts to go into operations.

FinTech 4 Good (Global): FinTech 4 Good is a global fintech and blockchain network that works with startups, industry leaders, NPOs, and investors to develop and implement solutions for a better world by providing incubation, assessment, and investment.

Hyperledger (San Francisco, CA): Hyperledger is an open-source collaborative effort created to advance cross-industry blockchain technologies. It is a global collaboration, hosted by The Linux Foundation. Hyperledger launched a healthcare working group to house and foster technical and business-level conversations about appropriate applications for blockchain technology in the healthcare industry. This working group is open to everyone interested in positive, open collaboration toward blockchain adoption in healthcare.

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