BLOCKCHAIN & GOVERNMENT

Using an emerging technology to reduce government's interference in your life.

10th ANNIVERSARY

IDAHO FREEDOM FOUNDATION

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Phil Haunschild began working with the Idaho Freedom Foundation in 2017. He graduated from Northwest Nazarene University. Phil's work has focused on the impact of government regulations upon employment and economic opportunity, the power of special interests in the Legislative process, and the revolutionary capabilities of blockchain technology to reduce the size of government.

Phil's work surrounding blockchain technology has been featured by the National Review Online and the Cato Institute, among others.

Why is an Idaho think tank researching blockchain technology?

That is often the first question I hear from supporters, experts in the field, and others when I tell them about the work we are doing at the Idaho Freedom Foundation.

My answer: Blockchain technology has the potential to radically transform the role of government in areas as diverse as welfare, voting, and business regulation. In some areas, blockchain technology can streamline government services, thereby reducing the deadweight-loss in the economy and in our lives. In other areas, blockchain technology can completely eliminate the need for government intervention.

IFF is an organization that advances ideas and policy solutions that would help make Idaho the best place to live, work, and raise a family. We think this technology is exactly the kind of solution we look for. And Idaho is the perfect place to start. Not only is the technology sector rapidly growing in the state, there is a populace open to reducing the scope of the government's involvement in day-to-day life.

At its simplest, blockchain technology is a new way of storing sequential information across a distributed electronic network. This is accomplished through the combination of a shared ledger and cryptography. The end result is that data held on a blockchain is far more secure and can be trusted by numerous different parties.

Blockchain has other capabilities as well, such as smart contracts, small sets of computer code that automate functions on the blockchain network. Smart contracts give users the ability to automate functions that are often performed by third parties, reducing costs and simplifying transactions. Smart contracts have already been used for everything from real estate transactions to corporate governance to and private insurance.

The potential of blockchain technology extends far beyond its role as the technology underlying Bitcoin and other cryptocurrencies. Many experts have touted blockchain's ability to remove the middlemen in industries as diverse as retail, finance, and charity. The same is true for government—blockchain can replace government's seemingly ubiquitous role in individuals' lives in areas such as welfare and licensing, among others.

I am excited to see the change blockchain can bring to Idaho as well as governments across the country and around the world. As individuals interested in making communities better, it is imperative that we begin to implement this technology.

Sincerely,

BUSINESS LICENSING

OPPORTUNITY

It is no secret: starting a business takes a lot of work. Entrepreneurs work countless hours to get their goods or services ready for sale and find ways to attract customers. Further, they spend numerous hours passing government inspections, earning the proper licenses, and obtaining registrations. Supposedly, each such regulation is meant to protect the public health and safety but, each has the consequence of making it more difficult to begin and operate a business.

Fortunately, blockchain technology can streamline the regulatory process for business owners, and thus make it easier for business owners to navigate the government regulatory field. This technology can be used to establish an interagency business registry with a single interface for business owners to submit applications and track regulatory actions. Regulators could use the program to track applications and share data across different agencies and levels of government. Implementing such a business registry would help alleviate several negative aspects regulatory policies have on business owners, consumers, and the economy.

First, many who would otherwise start businesses fail to clear the high start-up regulatory hurdle. In Idaho, to start a

Blockchain technology can streamline the regulatory process for business owners, and thus make it easier for business owners to navigate the government regulatory field.

restaurant, an entrepreneur has to contact as many as 30 separate local, state, and federal agencies before that entrepreneur gains approval to open its doors.[1] In addition, there is an even greater number of forms to complete and submit. This period at the start of a business' life can be particularly trying for entrepreneurs because they have to invest significant time and money. Every day a business owners spends getting regulatory approval they are not making money.

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1   The list of thirty agencies a restaurant that serves and caters food and alcohol would have to work with includes: Division of Public Works, Division of Building Safety, Planning and Zoning Commission, City Clerk, County Commissioners, Citizenship and Immigration Services, Internal Revenue Service, State Tax Commission, Secretary of State, County Assessor, Department of Labor, U.S. Department of Labor, Industrial Commission, Occupational Safety and Health Administration, Human Rights Commission, Unemployment Insurance Division, Employment Services Division, Department of the Treasury, State Police, State Liquor Division, Fire Marshal, Department of Health and Welfare, District Health Department, County Sheriff, Highway District, County Auditor/Recorder.

The businesses that cannot make it through never get a trial by the market while the public never gets to determine whether the services they provide are of value. Additionally, many might have an idea that they believe could add value to their society, but upon investigating the amount of work it would take to start their business, they opt not to act. A common rule of thumb for those interested in starting a business is to take the amount of time and money they expect to spend and double it — a daunting proposition for many. During this period, rather than having a new restaurant, a new plumber, or a new contractor, consumers end up going without.

Additionally, money spent to comply with the regulatory process is money not spent on employees, improved goods and services, or making the economy stronger. Every dollar spent on attorneys and tax professionals to ensure documents are filed properly is one less dollar spent for value creation. These businesses seek to meet a need in their community, real or perceived, but when they are delayed in starting, their communities go for a longer period without those needs met.

The current regulatory process also creates an additional burden on public agencies and taxpayers, as government employees spend time to verify business information, update changes and regularly communicate between agencies to ensure that regulations are enforced effectively. Every application submitted by a business must be manually reviewed by each agency even if duplicate information is held by another agency. The same is true when a business revises its information with one agency, such as its annual earnings statement, their primary place of business, etc.. Every agency has to go through the same manual process of updating this information in their separate systems. Additionally, when one agency makes a separate change, there is no central way to ensure other entities know about this. Suppose a restaurant was given a permit to sell liquor by local officials, but the local law enforcement agency was not alerted to this fact. Without immediate access to these changes, public entities make enforcement actions based on different information.

SIMILAR EFFORTS

Deloitte

In Toronto, Ontario, the consultant firm Deloitte partnered with the city, provincial, and federal governments to develop a proof-of-concept for a blockchain business registry, providing businesses with a one-stop portal for obtaining and storing permits, licenses, and registrations.[2] This gave business owners a dramatically simplified method to interact with the three separate levels of government. Moreover, government agencies could easily track and manage the information input by the businesses.

This business registry proof-of-concept operated on an Ethereum platform. Public data, such as registrations, licenses, and the names of business owners, was stored on a public blockchain, allowing anyone to access the information. Private information, such as the names of shareholders and employees, as well as proprietary information was stored on a private blockchain where businesses could control who had access. The private blockchain in particular was used to provide business entities and public agencies with one accurate location where all of their registry information was stored. Only the agencies that required information about a business were given access to view that information.

2   The Mythical 'Business One-Stop': The Holy Grail of Government to Business Service Delivery." Kevin Armstrong. June 2017. https://www.publicsectordigest.com/article/mythical-business-one-stop-holy-grail-government-business-service-delivery

Business owners could submit all their registration information through a one-stop portal. This portal guided business owners to submit each kind of license, registration, and permit they needed. Once the applications were submitted, the portal would direct the owner through the process of sharing the registration information with each agency that requires access. Each agency then received the application in the proper order, and any permit approvals or changes to the status of the application were stored on the blockchain network for the business owner and public agencies to see.

Once the business owner's application was submitted, they could see updates on the status of their approvals and any revisions they might need to make. Once approved, the permits and licenses could all be stored in a single electronic wallet. The owner could grant third party entities, such as a bank, insurance agency, or an attorney, access to the wallet so that they, too, could see what permits and licenses the business held.

Dubai Department of Economic Development

The Dubai Department of Economic Development (DED), in partnership with IBM and Smart Dubai, established a blockchain business registry as a key part of their effort to run the entire city on blockchain by 2020.[3] This registry, which began in May 2018, is in its pilot stages within the Dubai Silicon Oasis, a free-trade zone for tech industries. The blockchain platform is the central feature of the Unified Commercial Registry, which would house all registration information for businesses in Dubai.

Similar to the business registry implemented in Toronto, this DED blockchain business registry would create a seamless and efficient location for businesses to register and receive their licenses and permits to operate in the city. This information is then available to the various public entities that oversee commercial activity in Dubai. Other private entities can also access or add to the data when needed. The Unified Commercial Registry also provides a mechanism for consistent updates to business information, to ensure that every entity has up-to-date data.

Imagine, a bank might need access to see whether a business has the proper permits before the bank offers a loan. Once the bank approves the loan, it would then share that information on the blockchain so other private or public entities could see it. Once that loan is paid off, the bank would add that to the blockchain, and the updated information would be shared with every entity on the network.

FRAMEWORK

The Toronto and Dubai business registries are similar in how they were implemented and provide an excellent template for other blockchain business registries. They each contain several of the key features for a successful registry, described below, thereby increasing the ease of doing business within their jurisdictions and reducing the costs of oversight and upkeep.

The first feature necessary for an effective blockchain registry is a simple user interface, which allows business owners to input their business information and receive direction for the entire application process. Ideally, the application could be integrated with other software systems that businesses already use (such as CRM or accounting software). Practically, this application would operate for

3   "DED and DSOA unveil blockchain commercial registry project for improved ease of business." May 1, 2018. http://www.dubaided.ae/English/MediaCenter/Pages/PressReleasesDetails.aspx?ItemId=298

business owners similar to the way Turbotax does for taxpayers each year. Come tax season, each user inputs their identifying information, and the key features of their business(es), income sources, and so forth. As Turbotax users input the information, the software walks them through each separate form, ensuring that the user fills out each form completely. At the end, the Turbotax software files the forms with the proper state and federal agencies.

The state of Idaho currently offers a similar portal through the Reducing Idaho's Bureaucracy Committee, via the Idaho Biz Help website, which compiles a list of agencies that business owners might need to contact in order to receive approval. The website does not offer a central place to submit business applications or other documents. The website is simply informational, directing business owners to the correct agencies.[4] In addition, the list of agencies includes many of the application forms that need to be filed, some of which can be used for multiple separate agencies.

A second feature of the blockchain registry, is that the identifying business information that owners put into the system would remain under their control. This information would be cryptographically secured on the blockchain network, and only the agencies, and other individuals the owners opt to share the information with, would be granted access. Once public agencies receive an application from a business owner, they could look over the information, and approve or deny the application, or request additional information. The owner would receive real time updates on the status of their applications throughout the process. Once an application is approved, the owner could then have it automatically directed to the next agency they need approval from.

Once a permit or license is approved, some information would be accessible to the public through the central registry. Currently, much business information is publicly available, such as who holds permits, restaurant inspections, or key officers. This could all be accessed through the portal, providing the public with a single place to find all the information regarding individual businesses, rather than having to scour the web for the numerous sites where it is all accessible from currently.

The remainder of the information which public agencies require businesses to provide, such as shareholders, assets and debts, or other financial information, would be secured by the blockchain network, and would only be accessible by those who have the authorization to view it. Any time an update was made to the information housed on the network, be it by an agency, an owner, or a third party entity, the information would be updated for all participants on the network. If this change directly affected any other entity on the network, then the system could send out a notification to the affected party. For example, if a state health inspector found a restaurant unsanitary, the system could notify city officials the restaurant's license was revoked.

By building this system on a blockchain network, no agency would have to rely on the accuracy of other databases. There would be no central agency overseeing the development and management of the single business registry. Rather, every entity would maintain their own control over the information they input. The blockchain network would also allow for smart contracts to control the transfer of applications and data on the network. By utilizing smart contracts, business owners would see exactly where and how their information would be used and the network would ensure the applications are directed to the correct agencies.

4   See: https://idahobizhelp.idaho.gov/BusinessWizard.aspx

BENEFITS

The benefits of a blockchain business registry include time-savings, cost-savings, increased security, and accuracy of business information, which help create a stronger environment for business creation and growth. First, the time savings would be recognized by both business owners and regulators. Business owners could open their doors sooner, with fewer days lost waiting for regulatory approval. Once their business is fully operational, they would also have a single location to manage all of their licenses and permits, making it easier to comply with ongoing regulations. Regulators would see a reduction in application processing time as they could readily see what actions previous regulators have taken. Similarly, the capability to immediately share data between regulatory agencies would strengthen workflows, reducing the time required for reviews, renewals, and other regulatory actions.

Reducing the time lost to regulatory actions would also help reduce costs, the second major benefit to the registry. With less time spent seeking regulatory approval, businesses could streamline their operations, and dedicate more resources to productive endeavors. For larger businesses, fewer workers or contractors would be needed for paperwork compliance. And again, regulators would realize cost-savings as they spend less time to process applications manually, communicate between agencies, and manually update the information contained in their legacy databases. Taxpayers would no longer need to pay for such inefficiencies and they could receive tax reductions.

The third major benefit of a blockchain registry is that the data held on the blockchain network would be more secure, accurate, and timely. The data would be tamper-proof. Because every agency uses a different database currently, there are multiple points of failure, where data

With lower costs to start a business, more individuals could pursue their passion and offer goods or services to their communities.

can be modified or deleted. With a blockchain network, the data would be secured by the numerous agencies and other entities on the network; any modification would be tracked and rectified by the entities on the network. The data held by each regulator or third-party entity would also maintain its continual accuracy as any change made by a regulator, business owner, or third-party would be transmitted across the network and everyone would have a copy of the information. Anyone could go to this single registry as the complete source for business information with the knowledge that it is up-to-date and untampered.

Finally, each of the previous benefits would further strengthen business growth. With lower costs to start a business, more individuals could pursue their passion and offer goods or services to their communities. Communities could see more jobs and opportunities available from these new businesses. Individuals could have their wants or needs met by the goods and services these businesses would offer. Meanwhile, competition would help lower costs to consumers. The effect of new businesses, compounded with reducing the damper that compliance with regulatory paperwork has, economies as a whole could see increased growth. By clearing away much of the red tape that businesses face at every stage, from their startup clear through their dissolution, a blockchain business registry could dramatically improve livelihoods and communities. ❧

WELFARE REFORM

OPPORTUNITY

Blockchain technology could revolutionize the many welfare programs that have become a major facet of society — to not only make them more efficient, but restructure them entirely. Rather than relying on the government to alleviate societal woes, blockchain could strengthen our ability to do so through private charity. From the point of their inception, and with particular vigor since the middle of the 20th Century, public welfare programs have expanded to cover an ever-increasing number of citizens and services, yet, there have been few changes to the way such services are delivered.[1]

For the majority of American history, societal woes were alleviated through the activities of private charities and other coalitions of interested individuals. But, as public welfare programs have grown in scope and coverage they have overtaken much of the work accomplished by private, voluntary activities. In short, public welfare agencies were ingrained into the delivery of social services, becoming the intermediary institution—the third party—between recipients of the social services and those private entities who willingly choose to meet the needs of the recipients.

Eliminating the third party intermediary is one of blockchain's most recognized features. When it comes to modern welfare systems, the trusted government intermediary can be removed from the delivery of social services. In so doing, introducing blockchain technology could alleviate three major dysfunctions of current welfare systems.

The first dysfunction that could be alleviated is administrative costs, which could be greatly reduced and shown more transparently. Program participants receive only a portion of the total funding for a program, the remainder goes to the numerous layers of bureaucracy present within each program. For example, take the administration of the Supplemental Nutrition Assistance Program. After leaving the pocketbooks of taxpayers, the funding for such a program passes through at least five distinct agencies at the state and federal level before recipients ever receive money. This consumes roughly $4.5 billion out of a total SNAP budget of $68 billion.[2] The $4.5 billion figure does not account for the cost of collecting the money by the IRS or for the numerous other state and federal agencies that provide administrative services. This administrative bloat is not a

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1   For example, programs have been instituted to provide support for housing, medical care, food,

2   "Supplemental Nutrition Assistance Program Participation and Costs." August 3, 2018. Found at: https://fns-prod.azureedge.net/sites/default/files/pd/SNAPsummary.pdf

phenomenon unique to government, the same could be said of many small or large nonprofits and charities. Regardless of who the administrator is, there is plenty of room for great reductions in program costs.

Second, the inflexible programs that we have today foster dependency and fail to elevate individuals out of poverty to a point where they can sufficiently meet their own needs. After a half-century-long "war on poverty" there has been no victory. Consider, in 1964 Lyndon B. Johnson declared to Congress and the nation that the war on poverty was not simply going "to relieve the symptom of poverty but to cure it and, above all, to prevent it."[3] Today, the poverty rate is nearly identical to what it was when Johnson left office in 1969, 12.7 percent.[4]

Critics often argue that these figures only include pre-tax earnings, therefore they do not account for the monetary value of the welfare earnings, which would lift a sizable number of individuals above the poverty threshold.[5] This argument misses the point: The stated aim of welfare programs is to lift people out of poverty so they no longer require government assistance. The current systems are not equipped to accomplish such an end, and as such, we continue to spend without a long-term decline in the poverty rate. More than $22 trillion dollars have been spent on welfare programs since their inception with no discernible impact on the stagnant

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3   "Annual Message to the Congress on the State of the Union." January 8, 1964. Found at: http://www.presidency.ucsb.edu/ws/?pid=26787.

4   "Income and Poverty in the United States: 2016." Jessica L. Semega, Kayla R. Fontenot, and Melissa A. Kollar. September 2017. Found at: https://www.census.gov/content/dam/Census/library/publications/2017/demo/P60-259.pdf pg. 12

5   See: "Official Poverty Measure Masks Gains Made Over Last 50 Years." Arloc Sherman. September 13, 2013. Found at: https://www.cbpp.org/sites/default/files/atoms/files/9-13-13pov.pdf

Blockchain technology could be a key factor in re-establishing relationships between givers and recipients within a community.

poverty rate.[6] Welfare programs must have a way to keep from fostering dependency among their recipients.

And finally, the third major dysfunction with public welfare agencies is that they are often viewed by taxpayers and welfare recipients as a faceless bureaucracy, with no individual invested in the life of another. With current programs, funds are automatically taken out of the pockets of taxpayers, shuffled through a maze of public agencies and distributed to recipients, generally without any face-to-face interaction. This has the detrimental effect of eliminating relationships between those in need of assistance and those who can offer help within a community. Take, for example, an experience many face every day in cities across the country, driving past a panhandler. Some will stop and offer some support. But, many will drive right past, believing they have already done their part in helping by paying their share of taxes. After all, their taxes are supposed to fund programs for those in their community who need a hand up.

Often, technology has had a compounding effect of weakening relationships within communities.[7] However, If implemented correctly, blockchain technology could be a key factor in re-establishing relationships between givers and recipients within a community.

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6   "The War on Poverty After 50 Years." Rachel Sheffield and Robert Rector. September 15, 2014. https://www.heritage.org/poverty-and-inequality/report/the-war-poverty-after-50-years

7   This is a central tenet of Robert Putnam's seminal work on the decline of American social capital, "Bowling Alone."

SIMILAR EFFORTS

Many have touted the potential of blockchain as a tool to alleviate poverty and cure many of the most pronounced societal ills.[8] However, only a handful of projects have demonstrated viability and the potential to get government out of the way, connecting donors and recipients in ways that are not possible with traditional welfare systems.

Alice

Alice is a blockchain platform used to bring transparency to charitable funding and to increase the impact of social projects.[9] The platform is established on an Ethereum network, utilizing smart contracts that automate and verify transactions and donations made on the network. Donors can see exactly where their money goes and the impact it has, while recipients organizations receive a greater percentage of the funding as there are fewer costs associated with transferring and tracking the donations.

The platform Alice has developed allows donors to set parameters for the donations they make, and their money is only distributed once those parameters have been met. Additionally, Alice has developed a donation application, allowing donors a simple interface to track the balance of their donations, the status of projects they have funded, and to make or receive donations.[10]

Alice is primarily designed to facilitate contributions for social welfare organizations, rather than directly connecting the end-recipients and donors. Yet, its platform has the

long-term potential to dramatically improve and disrupt current mechanisms for charity. By utilizing performance tracking measures and allowing donors to set parameters for their donations and to fund particular projects, Alice could bring needed transparency to the distribution of social services.

Aidcoin

Aidcoin is a well-recognized token that has been listed on several of the largest cryptocurrency exchanges.[11] The token was also developed as a mechanism for providing more transparency and reduced costs in getting assistance to those who need it. AidChain is the blockchain network that the token operates on, built upon the Ethereum platform. CharityStars, a major fundraising company for charitable organizations, conceived of and developed the AidChain network. With it, they have also developed AidPay, an application that allows organizations to receive donations in cryptocurrency, which are then converted into AidCoin.

The key features of the AidCoin system include identity management for charities and organizations, tools for tax compliance, a cryptocurrency wallet, and customizable smart contracts. With the identity management on the AidChain system, charities must verify their identity, ensuring they provide accurate information to donors, such as budgets, major projects, expenses, and more. By tracking such information on the blockchain, charitable organizations can then use the verified data for tax documentation and reporting.

With customizable smart contracts, each organization is able to quickly and simply adjust the parameters of their donation

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8   See: "How Blockchain Can End Poverty." Phil Gramm and Hernando de Soto. Jan. 25, 2018. Wall Street Journal.

9   See: https://alice.si/

10 See: http://donationsapp.alice.si/how-it-works/faq

11 See: https://www.aidcoin.co/

campaigns, which their donors are able to see. Along with the use of the AidCoin token, donors can track their donations until the funds reach the intended persons, ensuring donors maintain some control and direction over the money they give to the charity.

LaLa World

LaLa World, a Singapore-based blockchain startup, has developed a blockchain financial platform designed to provide financial services for the unbanked and those who are excluded from financial systems.[12] LaLa World's suite of products allow system users to borrow or lend microloans, send or receive remittances, or pay bills electronically. Many around the world do not have access to services such as these

LaLa World's system allows individuals to invest in other's activities, thereby building relationships among community members or internationally. In so doing, their system has the potential to connect those in need of help with those who can offer it. Though their platform was initially designed for the transfer of money, it has the framework to allow for expanded uses such as healthcare management or building partnerships between government agencies, individuals, and non-governmental entities. Anyone can download LaLa World's application, which grants the user access to the tools they have established on their network.

World Food Program

The World Food Program (WFP) has implemented one of the most promising blockchain developments. As one of the largest agencies working in post-conflict and disaster zones, the WFP meets a crucial need in providing food to some 80 million people.[13] A stated goal with the blockchain trial is to build a system which can outlast the WFP itself and ensure those who are vulnerable can continue to receive food through donations.

The majority of WFP food assistance is given as in-kind meals or food staples that are distributed in bulk. In the past decade, however, a growing portion of the budget has gone towards cash assistance, which is given to recipients as either vouchers, bank-notes, or electronic transfers. This cash assistance has grown to represent more than a quarter of the total support the WFP provides.[14] The benefits of cash versus in-kind assistance include ease of distribution, recipient choice in the foods they can purchase, and strengthened local economies because local food producers get additional business rather than harmed by a market flooded with foreign foodstuffs.

In early 2017, the WFP, began testing blockchain for distributing cash assistance to refugees.[15] The Innovation Accelerator, a subset of the organization taking aim at food insecurity and hunger through technology and the implementation of new ideas, took the lead on this project. As the WFP tries to stretch every penny cutting down on marginal costs is crucial. Blockchain has helped eliminate inefficiencies in distributing vouchers and reduced the fees that banks charge for transferring money to recipients.

A pilot project has been in use to provide 100,000 refugees in Jordan with monthly funds (set to reach 500,000 by the end of 2018). The system operates on a permissioned Ethereum blockchain network. Recipients can use a phone

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12 See: https://lalaworld.io/

13 See: http://www1.wfp.org/overview

14 See: http://www1.wfp.org/food-assistance

15 See: https://innovation.wfp.org/project/building-blocks

application to pay stores for their food; for those who do not have a smartphone, select stores are equipped with an iris scanner that provides access to their funds. At the end of every month the WFP settles with the stores to exchange the blockchain currency for traditional currency.[16]

This system is a dramatic improvement over the paper vouchers and other cash transfer systems that the WFP uses in other areas. First, the cost is far less. Banks charge between 1.5 to three percent per transaction in addition to other up-front costs; the cost of using the blockchain network is minimal. Second, the efficiency and scalability of the distribution is dramatically improved. Quickly providing vouchers to the throngs of people that come in all at once during crises is nigh impossible, while simple electronic transfers are not an option for many who do not have bank accounts. For the WFP, blockchain has created a way to get recipients their benefits at a lower cost, in less time, and with fewer hassles.[17]

FRAMEWORK

A mobile application is a central feature of replacing public welfare systems with a blockchain-based community-care alternative. The application would provide participants with access to digital wallets and gives donors a way to donate directly to participants This application would take the information stored on the blockchain network and make it accessible to users. Transferring money through this new blockchain application could

be similar to, and as simple as, current transfer systems, such as Venmo or Zelle, which act as a third party intermediary for transferring money between users.

However, the key difference underlying the application would be that the data is stored on a blockchain, which provides verifiability, security, privacy, and permanence. Those who create personal accounts on the network do not have to provide their information to another third-party in order to participate. In addition, the donors could see what the money they provide is spent on. Users maintain ownership of their private identity and information, though they are able to share any piece of data (such as account numbers, expenses, income, work history, etc.) with another user if they so wish.

Another crucial feature that blockchain technology allows for is the ability to attach smart contracts[18] to the transfer of any currency.. For example, a donor could provide $20 to a participant under the condition that he follows a budget for at least one week. When the participant accomplishes this, the smart contract would execute and he would receive the $20. Donors could choose from a wide array of parameters when setting up the smart contracts, which would allow flexibility and help ensure that donors provide recipients the help they need. A non-profit community organization could also tailor a program to fit their own needs, which would allow them to offer beneficiaries more customized care.

Programs with the same parameters to the welfare programs we have today could also be implemented. A new blockchain program could be established similar to the Supplemental Nutrition Assistance Program (SNAP), Women,

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16   "Fighting hunger with blockchain." March 21, 2018. https://paritytech.io/fighting-hunger-with-blockchain/

17   The United Kingdom Department of Works and Pensions initiated a similar trial for a handful of recipients to receive their welfare payments via a blockchain network. Their trial was deemed "not viable due to limited take up potential and the expenses it would incur."

18   Smart contracts are small sets of computer code that check for inputs and automate functions programmed into the contract when the preset conditions are met

Infants, and Children (WIC), or other such welfare programs. Currently, to be eligible, participants receiving SNAP benefits have to prove to the department administering the program that they are under 130 percent of the federal poverty line.[19] WIC participants have to show that they meet at least one of many criteria, such as whether they are the right age, at the right income level, at health risk, or are a recent mother. Smart contracts could be used to replicate the criteria of the WIC, SNAP, or other such programs, giving the same or similar benefits to participants, albeit with lower overhead and automated eligibility verifications. As private charity would offer the same services through this system, public welfare agencies could be weaned off of the tax revenues they currently utilize. A tax credit could be offered to donors, to provide an incentive to fund the system.

Outcomes for participants could also be improved through the use of a match percentage, offering participants the opportunity to invest in themselves and receive a greater benefit amount, and allowing others the ability to invest in specific individuals. The way this match percentage would work is by increasing the amount that a recipient receives in direct contributions by a set percentage. This would encourage beneficiaries to build a support network by seeking help from others in their community and to invest in themselves, giving them a greater sense of ownership over their benefits.

To envision this, picture a recipient who received a base $20 in benefits from a charitable organization. He then adds $5 of his own money and receives $5 in a direct donation from another individual in his community. The $10 extra he receives are then multiplied

Each of these community-care aspects would give participants the tools they need to succeed on their own, without the need for assistance from others.

by a factor of 1.5 (or whatever percentage the organization selects), meaning he receives a total of $35 for the month. The money used for the base amount each month, in addition to the match percentage, would come from private donors or organizations who do not have a specific individual they choose to support.

For the final piece of this community care program, identity verification could be required of participants whenever they make a purchase using the funds they have received. If accessing their digital wallet on their cellphone, a program participant might have to use facial recognition or a thumbprint in order to access a scannable QR code on their phone.[20] If they do not have a smartphone (an exceeding rarity these days) they could print out a QR code on a piece of paper and show some form of ID to the cashier making the purchase or utilize two-step verification through text messages. This identity verification could reduce the risk of trafficking in welfare benefits, a real threat to contemporary welfare systems. Once a purchase has been made, the store that receives the digital currency could then automatically exchange it for the same amount in US dollars through the blockchain application.

BENEFITS

Transitioning from the welfare systems we have today to a new blockchain-based

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19 See: https://www.fns.usda.gov/snap/eligibility

20 Civic, a blockchain-based identity security company has developed similar services. See: https://www.civic.com/.

community-care alternative would have a host of benefits for recipients and society. First among the benefits is the ability to lessen the dependency that modern programs have created for participants. Under this new model, participants would have an incentive to invest in their own wellbeing, donors and participants would strengthen community networks through their connections with one another, and participants would receive greater individualized care to pull them out of poverty. Each of these community-care aspects would give participants the tools they need to succeed on their own, without the need for assistance from others.

A second benefit is that the whole process—from the verification of participants' eligibility, to the distribution of benefits, to the purchase of goods or services —would be more efficient. Because participants could upload their credentials for verification within the application, be it their income level, age, or some other factor, they could then have their benefits automatically transferred to their digital wallet. For stores that provide goods to participants, payments could be settled in a matter of seconds, rather than monthly, as is currently the case via government welfare programs. For example, as concerns the WIC program in Idaho, stores collect paper vouchers from participants, keep them until the end of each month, then settle with the state agency for reimbursement.

A tertiary benefit of this new system is that participants could receive a greater amount of the resources they need. With a match percentage, their benefits would steadily increase the more they put into the system. As there would also be fewer administrative costs, the money that would otherwise be spent just getting benefits to participants, could now be spent by participants as benefits. ✒

COMMUNITY CARE SYSTEM

1 DONOR MONEY

Churches, individuals, charities, and businesses put money into the community care system.

Churches   Charity   Business   Donor

THE BLOCKCHAIN APPLICATION

2 MONEY DISTRIBUTION

Donor money enters into a smart contract, which automatically calculates and disburses the funds to program participants.

3 EXTRA FUNDS

The blockchain application stores any excess funds to cover operating costs or future shortfalls.

4 FUND MATCHING

Any person or organization can donate directly to an individual participant, and a smart contract will automatically increase the amount received (up to a set maximum monthly amount).

A 20% match: Give $1.00, participant gets $1.20

B 50% match: Give $1.00, participant gets $1.50

C Match rates can vary by program needs

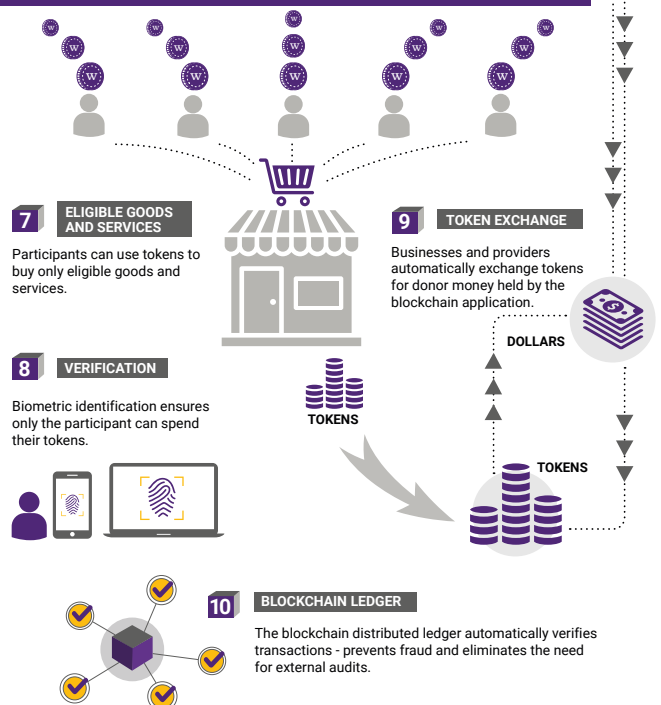**5 THIS FRAMEWORK ENCOURAGES**

Building a support network

Peer-to-peer charity

Investing in one's own wellbeing
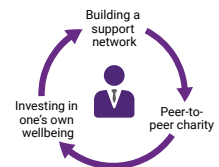
6 DIGITAL WALLET

Every month, the blockchain application dispenses tokens into each participant's digital wallet.

THE BLOCKCHAIN APPLICATION

7 ELIGIBLE GOODS AND SERVICES

Participants can use tokens to buy only eligible goods and services.

9 TOKEN EXCHANGE

Businesses and providers automatically exchange tokens for donor money held by the blockchain application.

DOLLARS

TOKENS

8 VERIFICATION

Biometric identification ensures only the participant can spend their tokens.

TOKENS

10 BLOCKCHAIN LEDGER

The blockchain distributed ledger automatically verifies transactions - prevents fraud and eliminates the need for external audits.

LEGAL NOTICES

OPPORTUNITY

"Wherever the people are well informed they can be trusted with their own government," Thomas Jefferson wrote more than 200 years ago concerning the ratification of the U.S. Constitution.[1] In order to remain well informed, the public must have unfettered access to what actions their government officials take. Blockchain technology offers an opportunity to do just that — to provide the public greater access to what their public officials are up to.

Presently, measures such as the Freedom of Information Act (FOIA), public records requests, open meeting laws, and public legal notices provide members of the public with some semblance of public information. Yet, these measures abound with flaws, denying the public access to some information. There are exemptions, such as documents that are not subject to the public record or executive sessions during public meetings. There are often substantial costs to produce this information for the public, costs that are either assessed in fees to those who request information, or are absorbed by government agency budgets.[2] Additionally, the labyrinthine

With blockchain technology, the public can receive government information, instantly, continuously, and at a lower cost than is currently the case.

process to obtain the information can be difficult to manage and can obscure what information the public does receive.

With blockchain technology, the public can receive government information, instantly, continuously, and at a lower cost than is currently the case. This could start with the publication of legal notices. Currently, such notices are published in local newspapers to inform the public what is happening at their city hall, county courthouse, state Capitol, or other government agencies. In all 50 states, these notices are mandated of government agencies, required to be posted for a number of days or weeks when public officials set a budget, offer property up for auction, or hold a public hearing, among other actions.[3]

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1   "Letter to Richard Price." Thomas Jefferson. January 8, 1789. Found at: https://www.loc.gov/exhibits/jefferson/60.html

2   "Essential or extravagant: Considering FOIA budgets,

costs and fees." A.J. Wagner. 2017. Found at: https://static1.squarespace.com/static/57c99b8829687f97347637d8/t/59cec9c74c326d95b87f1723/1506724296501/Essential+or+Extravagant.pdf

3   Idaho Freedom Foundation Research: Legal Notices across the States

In the state of Idaho alone, government agencies have spent more than $3 million per year for the past several years to publish such notices in local newspapers across the state.[4] State law fixes the price based on the notice length. For long notices, such as a county treasurer's report, the cost can exceed several hundred dollars. For shorter notices, the cost can be just $10 or $20.

When multiplied across the nation, government entities easily spend hundreds of millions of dollars to post such notices each year. Every state has an explicit requirement to publish these notices in local newspapers. This effectively serves as a taxpayer subsidy to newsprint media companies. In 2017, the amount of money Idaho newspapers received from legal notices even exceeded the amount of money appropriated from the state General Fund to the state-run media organization, Idaho Public Television.[5]

In addition to the high cost to post these notices, local newspapers have gradually lost their effectiveness as a medium for notifying the public what is happening in their communities. A 2017 Pew Research Center study found that newspapers were printed for fewer than one in 10 Americans. Additionally, this study found that the number of newspapers printed had declined by nearly 10 percent each year for three years prior.[6] With an ever-shrinking readership, publishing notices in newspapers is no longer an effective means for adequately notifying the public of what actions public officials are taking.

Newspapers are also a difficult medium for interested individuals to search through to find complete records of legal notices. Each locality has different newspapers, and only a handful of states require that these notices are stored in a central repository. In Idaho, for example, there are more than 50 newspapers that publish legal notices. If an individual wanted a record of each legal notice published in the state, they would have to purchase a copy of each newspaper on the day the notices were published, an expensive and laborious task to take on.[7]

The difficulty to find notices has particular impact when public agencies are publishing bids and requests for proposals for construction projects or other contract work. When private contractors do not have a central clearinghouse to look for projects that are listed, they can easily miss out on public projects. This has a twofold cost, first to the private companies, that are not able to stay abreast of the potential work. Second, the cost to taxpayers comes in the form of higher payments going to the contractors that do learn about the projects available. If fewer capable companies are aware of the available public projects, then there will be fewer bids made, thereby reducing competition and likely increasing the prices charged to accomplish the same projects.

FRAMEWORK

The three key features that must be part of publishing legal notices are immutability, verifiability, and ubiquity. In other words, the notices must be permanent and unchangeable, must have their veracity attested to, and must be easily accessible by a wide swath of the

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4   Idaho Freedom Foundation Research: The Costs of Legal Notices

5   Idaho Public television received just over $3 million from the General Fund in FY 2019. See: https://legislature.idaho.gov/wp-content/uploads/sessioninfo/2017/legislation/S1138SOP.pdf

6   "Newspapers Fact Sheet." June 13, 2018. http://www.journalism.org/fact-sheet/newspapers/

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7   Idaho Association of Newspapers does keep a repository for the notices published by members of their association, but this does not account for notices published by non-members.

population. Fortunately, these are three of the most basic features of a blockchain network.

A legal notice blockchain network would operate with each state agency, city, or other government entity as a separate node on the network. This would ensure that: multiple entities store copies of each notice; multiple entities verify the information and time of each posting; and, individuals can readily access the notices posted on the network.

The vast majority of network users would interact the same as they already do with the legal notices posted online regardless of whether they are posted on a traditional database or on a blockchain network. Government entities could integrate a posting mechanism into their website, which would post notices on the blockchain network rather than solely on their traditional website. When individual users look at notices online, they could access the entire database of legal notices through an Application Program Interface (API), which would be found on each of the government entities' websites. This API could present the information on any traditional website page, which each government entity could customize it to match their look and needs. Along with access through the API, notices could be set to automatically post on social media sites,[8] and could be accessed through traditional search engines, such as Google or Yahoo.[9]

Each entity that posts on the blockchain network would have to maintain a specific set of uniform features in order for the blockchain network to operate fluidly. This would include templates for the notices and tags that are used

for search functions, which would be necessary for a central repository of all legal notices. The protocols established to manage and maintain the network could either be done by consensus or by a single public entity responsible for overseeing the network. If governed by consensus, then a majority of the entities on the network would have to approve other entities in order to add a new user to the network and the current members would have to agree on the protocols used for tags, templates, and other key features. If governed by a central entity, then a central entity[10] would set the parameters for posting and give access to government entities seeking to post on the network.

It would be necessary to have a protocol for verifying that new users are government entities, as there should only be notices that are posted by public agencies on such a network. If anyone could post any message on the legal notice blockchain, then the system could rapidly become inundated with information and posts that are irrelevant or incorrect. In order to ensure only approved users are on the system, each posting entity would receive a private key that gives them access. This would create a hybrid-permissioned blockchain, where anyone can read the data stored on the network, but only users with permission could post.

Each permissioned user on the network would verify other users' posts. In order to make a scalable system, each user could verify the posts of a limited number of other users, such that every user would have multiple other entities verify their posts. The number of other users verifying each post could be set at a specified number, such as 10 or 15. Even with a vast number of users, the copies would all be interconnected. Similar to a web of overlapped
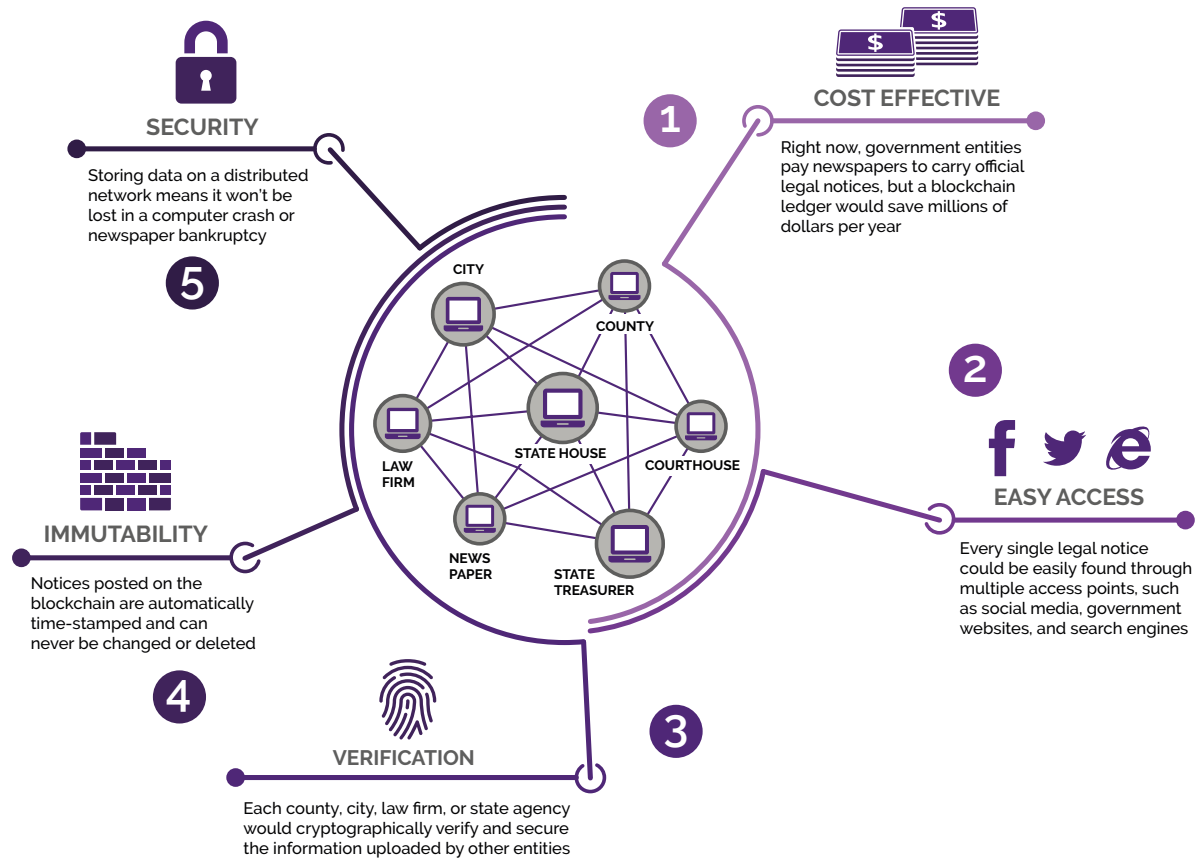
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8   This does not require blockchain, but would be an important feature of online notification.

9   This would require SEO. Of particular importance, an individual could set up alerts using these search engines so that they can stay immediately updated.

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10 Such as a state Chief Information Officer, Auditor, or other office.

NEXT GEN **LEGAL NOTICES**

SECURITY

Storing data on a distributed network means it won't be lost in a computer crash or newspaper bankruptcy

5

1

COST EFFECTIVE

Right now, government entities pay newspapers to carry official legal notices, but a blockchain ledger would save millions of dollars per year

2

EASY ACCESS

Every single legal notice could be easily found through multiple access points, such as social media, government websites, and search engines

IMMUTABILITY

Notices posted on the blockchain are automatically time-stamped and can never be changed or deleted

4

VERIFICATION

3

Each county, city, law firm, or state agency would cryptographically verify and secure the information uploaded by other entities

CITY

COUNTY

STATE HOUSE

LAW FIRM

COURTHOUSE

NEWS PAPER

STATE TREASURER

circles, the entire network would be weaved together through these multiple copies.

Each of the users that verifies a post would keep the time-stamp, to show when the notice was posted, and would also store the hash, a string of characters that is cryptographically developed based on the underlying data. If a single entity were to change the text in their copy of a notice, either unintentionally or as a result of a hack, this would change the hash and every other user with the data would recognize the change. The same would be true of time-stamps, as every other user would keep the record of when exactly a notice was posted, so no entity could show a different time.

BENEFITS

A blockchain network for publishing legal notices would have four key advantages over traditional hardcopy notices. First, it could save taxpayers vast sums of money that their government entities currently pay to print public notices in newspapers. The cost to develop a simple blockchain network, such as what would be required to post legal notices, is minimal. Ongoing operating costs would also be greatly reduced. Today, a message that would cost hundreds of dollars to print in a newspaper costs just pennies to post on blockchain networks that are already established with thousands of users backing up the data.

Second, individuals would be able to view legal notices in a much simpler fashion as they would all be stored in a central database. Every public entity on the blockchain network, would have to include an API on their website, providing access to their notices. From that single access point, individuals could access the notices posted by every notice posted by every entity on the network. They could also search this central database by key features such as type – if they only need to see government construction bids, foreclosures, or another category – date, or location.

Third, there would greater permanence for legal notices posted on the blockchain. Currently, newspaper publishers and some government agencies are the only ones that store a permanent copy of the notice. With a blockchain network, there would be a far larger number of entities that store the notice and in a more secure fashion. The hard-copy that most newspaper publishers store could easily be lost to natural disasters, amidst a bankruptcy, or just misplaced as time passes by.

Finally, such an inter-governmental blockchain network could be an excellent point to start for posting additional government records. Eventually, public meeting minutes, agendas, and notices could all be added to the same system, as could government budgets or other financial information. With this information posted in a single place, the public would have greater access to a host of data about their government agencies. This would give the public the ability to hold public officials more accountable. ☙

Today, a message that would cost hundreds of dollars to print in a newspaper costs just pennies to post on blockchain networks

BLOCKCHAIN VOTING

PROBLEM

Election integrity has been at the forefront of American discourse for the past two years. The possibility of foreign interference at the ballot box is worrisome to many, while voter fraud is alarming to others. One recent survey found that the majority of voting-age Americans were concerned there would be foreign interference in the November 2018 election, and roughly one-third do not trust that their votes would not be accurately counted.[1] For a country that prides itself on its democratically-elected republican form of government, the lack of public trust in election results could readily foster a crisis of legitimacy.

Fortunately, blockchain has the potential to increase the security of elections and to restore public trust in the democratic process. By advancing to a blockchain voting system, state, local, and federal governments could alleviate several pressing issues. First, voter identity would be far easier to verify, greatly reducing voter fraud. Second, the costs of managing elections would be reduced. Third, many of the oldest systems of managing elections could be modernized. This would have the additional

In a period of concern over election security, transitioning to a blockchain network can be one of the most cost-effective solutions to strengthen the security of elections.

benefit of shortening the time spent tabulating results and validating votes.

Voter identity laws are a patchwork across the United States. According to the National Conference of State Legislatures, 34 states have laws that require voters to show some form of identification at the polling station. The other 16 have no such requirement.[2] For the states that do require identity verification there are frequent cries of voter suppression. At least two state identification laws have been struck down by the courts on the grounds of voter suppression. For those states that require little to no voter verification there are frequent concerns of voter fraud. Estimates for the number of fraudulent votes are nigh impossible, just as with many other criminal activities. Regardless of which way a state leans, towards strict identification laws or none at all,

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1   "Exclusive poll: Majority expects foreign meddling in midterms." Shannon Vavra. Axios/SurveyMonkey. June 5, 2018.

2   "Voter Identification Requirements." Wendy Underhill. National Conference of State Legislatures. May 5, 2018.

there are downsides and pitfalls.

In addition, there are many factors that can render an individual eligible or ineligible to vote, which also vary from state to state. For example, an individual convicted of a felony loses the right to vote in all but two states.[3] The right to vote is restored under different conditions across the states, upon completion of a prison sentence, upon completion of parole or probation, or only when the governor grants a pardon.[4] The varied conditions for voting right restorations can make it confusing to verify who can and cannot vote in any given election.

Additionally, the complex process for holding an election can make it an expensive undertaking. However, a reliable estimate of the cost it takes to hold an election is difficult to come by. Each state administers its elections differently, some are run at the state level, some by individual election districts, and some by counties. In each place, expenditures are tracked differently or are not tracked at all. The federal government does provide a fraction of support for electoral administration. In 2018, the federal government granted the states $380 million for improving election security.[5]

Yet, the cost of managing an election falls largely on local governments. In Colorado (where election costs are recorded thoroughly) the impact these costs have on local budgets is distinctly visible. In the most rural counties, costs per voter easily exceeded $20. In more

populous counties, the election-cost per voter was as low as $1.55.[6] Since physical polling locations are spread out all across the county, those with less dense populations end up paying far more per voter (and per resident) to operate their elections than others.

The high costs for elections could be further exacerbated by the movement in recent years to shun technological advancements in favor of traditional paper ballots.[7] Many states and counties would have to purchase new (perhaps old?) equipment, for polling places that operate using paper ballots, rather than newer technologies. Expanding the use of older technologies could lengthen the time that individuals spend in line waiting to vote, lengthen the time it takes to count ballots, and otherwise inconvenience those who are managing or participating in elections.

SIMILAR PROJECTS

West Virginia

West Virginia is in the middle of a trial using a blockchain-based voting system for overseas military members. This system, operated by the West Virginia Secretary of State is the first of its kind to be used in any U.S. federal election. During West Virginia's May 2018 primary election, two counties participated in the trial, which gave residents who qualified under the Uniformed and Overseas Citizens Absentee Voting Act (UOCAVA) the ability to vote using their mobile phones on the blockchain network. For the general election in November 2018, each of the state's 55 counties will have the

3   "Felon Voting Rights." National Conference of State Legislatures. April 30, 2017.

4   In 14 states felons receive their voting rights upon their release from prison. In 21 states voting rights are restored upon completion of parole or probation. In 13 states voting rights are restored after the ex-felon completes additional actions post-probation/parole, or receives a pardon.

5   "2018 HAVA Election Security Funds." U.S. Election Assistance Commission.

6   "Accountability in Colorado Elections: Election Cost Statistics." Colorado Secretary of State

7   See: "Back to the future: Paper ballots still the best fraud prevention." Theresa Payton. The Hill. Dec 3, 2016. "Paper ballots are back in vogue thanks to Russian hacking fears." Elizabeth Weise. USA Today. Sept 19, 2017.

option to allow UOCAVA-eligible voters to use the trial system.

Voatz, a Boston-based blockchain company, partnered with the West Virginia Secretary of State to implement and improve this trial system. To vote, participants had to download an app on their smartphone and add a copy of a government-issued ID such as a driver's license or passport, at which point they received their individual ballot electronically. This ballot was made available 46 days before the primary election was held, allowing overseas voters to cast their vote early. They could then cast their ballot for municipal, county, state, and federal votes. To submit their ballot, the voter would either use facial recognition or thumbprint scanner in their smartphone to verify their identity. Once this was completed, the vote is tied to their identity, and is submitted through the tamper-proof blockchain network, where it is tallied by county election officials and the Secretary of State.

As a result of this project between the Secretary of State and Voatz, deployed service members have the option to use a more convenient voting system than postcards, faxes, or emails, which are used currently. Along with the convenience, voters have greater confidence in the anonymity of their vote and that their vote will be counted in time. For election officials, electronic ballots make it far easier to tally votes and though the voter's identity remains anonymous, officials can see that the identity of the voter was verified by the system using the biometric security functions on their phone.

Switzerland

Zug, Switzerland, a town of roughly 30,000 and self-dubbed "Crypto Valley," recently used blockchain for a non-binding vote in which residents provided their opinion on actions their

municipal government ought to take.[8] The votes of each resident were secured using the digital ID they receive from the municipal government. This digital ID operates on the Ethereum blockchain, using an identity management system developed by the blockchain company uPort.[9] In order to receive this ID, residents had to register in advance online, then take a copy of their regular identification to a government office for verification.[10]

Residents could then use a mobile app to track and manage their digital ID. Using the app, each resident could submit their vote to local officials. Nearly every resident that used the system stated it was easy to use.[11] Local officials also stated the inaugural vote was a success, however, they will continue to parse through the technology and the results of the vote to ensure it met the necessary standards of secrecy, security, and verifiability.

Nasdaq and Estonia

In 2017, The Nasdaq Stock Exchange partnered with the government of Estonia to integrate blockchain voting for Estonian company shareholders. Both Nasdaq and Estonia are known for their cutting-edge technological innovation; Nasdaq was the first and remains the largest electronic stock market in the world[12] while Estonia is the first and only country to offer an e-residency to non-citizens.[13]

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8   "Switzerland's first municipal blockchain vote hailed a success." Swissinfo.ch. July 2, 2018.

9   See: https://www.uport.me/

10 "First official registration of a Zug citizen on Ethereum." uPort. Nov 15, 2017.

11 "Switzerland's first municipal blockchain vote hailed a success." Swissinfo.ch. July 2, 2018.

12 "History of the American and NASDAQ Stock Exchanges." Ellen Terrell. Library of Congress. Ocotber 2012.

13 See: https://e-resident.gov.ee/

The two saw potential to improve the way that companies operate their annual general meeting (AGM), where investors come together to vote and company issues. These meetings are generally expensive to put on, have low voter turnout, and can be difficult for cross-border investors to attend.

Nasdaq's blockchain voting system was used at the AGM for Estonian-based LHV Group, a financial services firm. Using a web-based interface, shareholders could vote, provide their vote to a proxy, and receive information about the current or previous meetings — all on the blockchain network. The identity of users were verified using their e-residency cards for international shareholders or the Estonian ID card for citizens.[14] The outcome of the vote held in early 2017 was positive, with both shareholders and managers expressing the convenience and benefits of a blockchain-based vote.

FRAMEWORK

A blockchain system used for voting in public elections must capitalize on blockchain technology's inherent capabilities: security, identity, and privacy. The voting system must have the capability to ensure only eligible voters have the ability to cast a ballot. The blockchain platform also must be set up to keep replicated copies of each vote. Additionally, votes must be traceable from the time they are cast through until they are counted, while protecting the anonymity that is crucial to a free and fair election.

Blockchain technology is built around tracking and ordering transactions into sequential blocks of data. This is why the Bitcoin blockchain, as a

record of monetary transactions, has remained the most well-known use of blockchain. This tracking and ordering capability lends itself well to electoral systems, as blockchain tokens can be used to identify each voter and track each vote that is cast. Each eligible voter could be granted a token tied to each vote to be cast on their ballot. When a voter casts a ballot, the token would then be transferred from the voter to the candidate. At the end of the voting period, the tokens held by each candidate would be tallied, showing the number of votes cast in a candidate's favor.

Each vote could be tracked by the voters, administrators, or auditors. Every voter would receive a transaction ID, unique to their ballot, once their ballot is cast. This transaction ID would enable them to ensure that their token is transferred to the proper candidates. In a contested election, or if there are irregularities that arise in the vote count, auditors could go back and track the transaction information of every single vote that is cast.

As an added layer of security to prevent vote irregularities or contested elections, voting districts could all run separate computing systems, which would secure and validate every vote cast in the election. For example, each county election official might have the system backing up a copy at the polling places and their main offices. In order for a vote to be recognized, it would have to be recognized and verified by every one of these systems. With many separate entities replicating, verifying, and securing each vote cast, the electoral system would be protected from nefarious actors trying to compromise the votes cast at any single location.

Similarly, to prevent either intentional or unintentional error at the administrative level, each ballot would be distributed to voters utilizing smart contracts. Once each voter verifies their identity, such as with a driver's

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14   "Is Blockchain the Answer to E-Voting? NASDAQ Believes So." NASDAQ. Jan 23, 2017.

license, social security number, or other acceptable measure, they would be issued a ballot tied to a unique ID they are given. This ballot would have the votes to be cast in the voter's precinct, ensuring that they have the proper candidates and offices to vote for. By attaching the unique ID to the ballot, but not a voter's name, the vote cast would be anonymous, and voter's information would not be made public.

Using blockchain, the electronic ballot could be securely cast at home or at a polling place. With the ability to ensure that each vote cast is counted, and that votes are not altered in the process, blockchain opens up new possibilities. Votes made at home could be secured using biometric identification, digital identities, or non-technological means, such as a driver's license or proof-of-address. At the polling place, voters could cast their ballot at an electronic booth, allowing them to interface with the blockchain network. Paper ballots could even be utilized, using devices similar to the optical scanners that are currently employed in many jurisdictions to upload vote information to the blockchain. From the point the ballot is scanned onto the blockchain network, voters, administrators, and auditors would benefit from the security of the blockchain network.

BENEFITS

In a period of concern over election security, transitioning to a blockchain network can be one of the most cost-effective solutions to strengthen the security of elections. Additionally, a blockchain network can automate, or entirely eliminate the need for, many of the functions that election clerks and other officials currently perform, such as audits, manual counts, and ballot distribution. With the ability to vote from home, via a smartphone or tablet, there would be less demand at polling

places, reducing the need for polling staff and the other costs associated with operating the locations. By automating functions, a blockchain system could also greatly reduce the time it takes to count votes after an election. Rather than waiting for each precinct to count and tally their votes, reporting them at separate times, every vote would be recognized in real time by every precinct.

The additional security of a blockchain network is arguably its most important feature. First, by issuing ballots using tokens specifically attached to a voter's identity, only verified and identified individuals could cast a vote. This could greatly reduce worries about voter fraud in elections. Similarly, in jurisdictions with different eligibility requirements, the smart contracts used in the system could be established to distribute a ballot only to those who are eligible. Second, voter rolls and election databases would be protected from targeted attacks or hacks. With multiple separate locations holding duplicate records and continually updating the information held in each, any action to take down one piece would be thwarted by the others. ✒

LAND REGISTRY

OPPORTUNITY

For millennia, economists and philosophers have held that private property is at the heart of a functioning society. Aristotle, Thomas Aquinas, John Locke, Adam Smith, Alexis De Tocqueville, and many more have carried on the intellectual tradition of the individual right to ownership of property. This tradition carried through our nation's presidents — George Washington, John Adams, Thomas Jefferson, James Madison — and others were staunch advocates of the right to private property. These leaders, and those who followed, instituted legal systems to protect this right.

A central feature of this legal system is the ability to prove who holds title to real property. Land title databases are kept for that reason, to ensure the public has access to all land transactions records and current ownership. The databases of transactions kept here in the U.S. are largely effective, but could be more efficient. Accessing records or making real estate transactions can be a complex and costly process to navigate using traditional databases. Additionally, there are billions across the world who live in nations without adequate legal systems to secure their title to property.

Blockchain technology can solve these problems with traditional land-titling mechanisms — the high cost and complexity

There are more than 3,600 government entities in the U.S. that store copies of property titles.

in the United States for one, and second, the lack of legal structures to uphold property ownership in many other countries.

Whenever real estate transactions are made in the United States, buyers and sellers pay premiums for property title insurance. This insurance protects homebuyers from costs that might arise from disputed property claims. For example, a dispute could arise if a co-owner has not signed onto an agreement when the property changed hands, or if a bank still holds a second mortgage on a property without being notified of the sale, or if a county assessor never received taxes for a prior year from a previous owner. In 2017, the premiums paid for title insurance exceeded $14 billion across the U.S.[1]

The title insurance premium covers two services offered by a title agent. First, the premium covers insurance against high legal costs over disputes taken to court and any value lost in the future, similar to auto insurance.

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1   "U.S. Property & Casualty and Title Insurance Industries." National Association of Insurance Commissioners. 2017.

Second, the title insurance premium covers the cost of research conducted by the title agent into the property history by going through government tax records, transaction records, and plat records or surveys in order to find all the claims to the property, such as an easement or a lien. The completed history is provided to the home buyer before the purchase. Poring through these records can be an arduous and complex process, which is why property owners often pay large amounts for this work to be done — often well over $1,000 for a residential property.

Adding to the complexity, there is no single database with all the information title insurers would need to research property history. There are more than 3,600 government entities in the U.S. that store copies of property titles. For the information that is not held by public entities, there are numerous private title plants in each state that store copies of other records.[2] With such scattered records, property owners pay more for their insurance when the property history is uncertain and insurers spend extra time and money researching the information.

However, the aforementioned problems of cost and complexity pale in comparison to those which many around the world face with their property titles. Some five billion people around the world do not have access to a secure legal title to their property.[3] For many, this is because their legal systems are ineffective or corrupt, while in others it is due to a lack of the rule of law. Duplicate titles are often issued by corrupt or inept governments, property is stolen through force, and disputes are not resolved through legal methods in many of

these countries.

SIMILAR PROJECTS

The basic features of a blockchain — its immutability, distributed nature, and sequential transactions — lend themselves well to land registries. For this reason, numerous groups have begun looking at blockchain as a solution for land-titling.

Sweden

In Sweden, multiple private companies and the Lantmäteriet, the government agency responsible for tracking all real estate information, have created a blockchain land title registry. This registry is designed to streamline the process for real estate transactions, with unique functions for buyers and sellers, lenders and real estate agents, and government agencies. The Lantmäteriet would continue to store copies of titles and other ownership documents. However, with the distributed network, other entities, such as banks or real estate brokers, would also be able to store copies of the documents. This would ensure that multiple parties are protecting the documents and verifying their authenticity.

Real estate transactions made on this network are completed through an app that has been developed. First, a property seller can pull up their title on the app, see if there are any issues that might prevent them from selling, then, they can initiate the sale. A potential buyer reaches out to their lending institution, which can see the property through its own interface on the app. The owner shares the property information with the lender, which allows them to provide a loan. Once the lender has approved the loan, a contract is distributed via the app to every party— buyer, seller, agents, and lender. After each party has reviewed the contract in the app and taken the actions

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2   A title plant is simply a facility that stores these records

3   "Property rights for world's poor could unlock trillions in 'dead capital': economist." Chris Arsenault. Reuters. July 31, 2016.

required of them, the network automatically executes on the terms of the deal and the title is transferred. The Lantmäteriet also receives a record of the transaction information through the application.

UNDP Project

In India, corruption and fraud dominate the offices of the land registrars. Experts have estimated that some $700 million in bribes are paid annually throughout the country to land registrars, while two-thirds of all civil court cases are land disputes.[4] This is why the United Nations Development Program (UNDP) has established a blockchain land registry in partnership with the city of Panchkula. In this city of a few hundred thousand in northern India, many residents lack faith in the current land registry system.

This blockchain-enabled land registry, which operates off of the Ethereum platform, enables a more secure registry without the tampering that is prevalent today. Property owners can put their land title onto the blockchain network and can then make transfers on the network utilizing smart contracts. Potential buyers are able to see a property's history and receive verification that the seller is the true owner and that the title is clean. Anyone can get real time updates on a property's status, making forgeries nigh impossible, and ensuring that a buyer gets complete information on the property.

In a nation where transparency is desperately needed in its land-titling apparatus, this blockchain land registry has the potential to expand across the nation and spur innovation in the land-titling industry.[5]

De Soto Inc.

De Soto Inc., a partnership between renowned economist Hernando de Soto and Overstock CEO Patrick Byrne, was founded to bring property rights to the world using a blockchain land registry. Hernando de Soto's 2001 book, The Mystery of Capital, brought to light the damage caused by the lack of property rights in developing nations. The lack of property rights, he demonstrated, suppressed prosperity. Through the new company, which will use blockchain to secure property rights globally, de Soto hopes to secure land-titling information so that those who live under regimes without adequate legal systems can still uphold their property rights.

With varying legal structures, and systems for transactions, De Soto Inc.'s blockchain registry will not be tailored to fit each country's unique systems. Rather, the network will serve as a central repository which any property owner could upload their title to as a back-up for their claim of ownership. For countries with spotty or nonexistent legal records, this could be the only way of proving ownership. [6]

Others

Multiple other entities have also begun developing a blockchain land-titling registry within their own jurisdictions. In Brazil, the Real Estate Registry Office has partnered with Ubitquity, a U.S.-based blockchain-services company, to create a land registry operating off of the Bitcoin platform.[7] By putting transactions

4   "An Indian state wants to use blockchain to fight land ownership fraud." Ryan Browne. CNBC. Oct 10, 2017.

5   At least one other state is working on a similar project utilizing blockchain for land registries. See: "Using

Blockchain technology to improve land registry in India." Ruth Smart. Land Justice Network. June 3, 2018

6   "De Soto Inc.: Where Eminent Domain Meets the Blockchain." Andrew Nelson. Bitcoin Magazine. Mar 5, 2018.

7   "Blockchain-based Ubitquity pilots with Brazil's land records bureau." Ian Allison. International Business Times. April 5, 2017. See: https://www.ubitquity.io/web/platform/

on the Bitcoin platform, the largest blockchain network in existence, the title documents are kept secure.

The Cook County Recorder of Deeds in Illinois also tested the Bitcoin network as a legal conveyance for transferring land titles. Velox. RE, a California-based blockchain real estate team worked with the County to develop this capability. The Recorder's office was able to successfully use the blockchain network to convey a title and to store property information. The work done in Cook County showed how blockchain can streamline land-titling across the United States and can solve many of the problems governments face.

The Bitcoin blockchain is also the preferred network in Ghana, where Bitland is implementing an online land registry. The owners of roughly ninety percent of the agricultural land in Ghana hold no title proving their ownership. The Land Commission of Ghana, the agency responsible for overseeing real estate titles and transactions, is not trusted by many citizens or foreign investors. As a result, Bitland is offering an alternative registration mechanism to establish proof of ownership.[8]

Honduras, Dubai, Rwanda, Kenya, and Georgia are but a few of the many countries that are exploring the use of blockchain to store land titles. There is great potential for this technology to radically transform the land-titling industry and to improve the wellbeing of billions around the globe.

FRAMEWORK

The ideal blockchain land registry would not only give the billions in the developing world access to a land registry system, it would also streamline the exchanges made within the developed world. The key features for such a program would include a robust network, smart contracts, comprehensive property information, and public access to all the hosted information.

A robust network is arguably the most important aspect of a successful land registry. Currently, each public recorder across the U.S. stores a copy of transactions. In addition, private title plants keep an index of transactions and other records on hand. This duplication is meant to protect against any loss of records such as in a natural disaster, and so that each file can be protected against errors or disputes.

The replication of each file across multiple users would be a key feature of a blockchain network. Many of the blockchain land registries in development are built upon the Bitcoin platform primarily because this is the largest network with the greatest number of users, which makes for greater information security. Many others have used the Ethereum platform, the second largest network, for the same reasons.

A particular advantage of the Ethereum platform is that it can operate smart contracts — small sets of code that automate functions on the blockchain network. Smart contracts are a crucial piece of a successful blockchain land registry, as they allow users to execute transactions without middlemen. Smart contracts can be used to ensure sellers have all the proper documentation prior to completing a transaction and that each party who has a claim to the property, or a stake in the sale, is properly notified and engaged.

For example, estranged spouses might have a joint claim to a home, however only one is in the area and is party to the sale. Setting up a smart contract that requires both joint-owners

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to agree to the sale would prevent future legal challenges arising from the spouse's claim that the transaction was invalid and they still own the property. Smart contracts can be established for different aspects of a title, such as liens, ownership claims, or changes to the property.

Attaching this additional information to a title, such as who holds a lien, what easements exist on the property, historical appraisals or assessments, and tax information, would dramatically increase the functionality of a blockchain land registry. This information, which is collected and stored by countless different entities— including banks, title plants, county recorders, and private individuals— would all be acessible from a single location and permanently linked to each title. Buyers and others interested in the property could see historical changes to the property, such as improvements, tax assessments, divisions, condemnations, and more. Rather than relying on third parties to store information about each property and investigate it, buyers and sellers would get immediate access to a complete historical record.

For users to investigate historical records, the blockchain platform used for this land registry database would have to be a public network. A public (permissionless) blockchain, such as Bitcoin or Ethereum, allows anyone to join the network as a user, to make a transaction, or to download a complete copy of the ledger. The alternative, a private (permissioned) blockchain, only allows authorized users to make a transaction or access the information on the network. With a public blockchain, the information could be replicated across numerous users, ensuring the continuity and veracity of the records. Just as public recorders and private title plants store databases today, which can be used in tandem to verify the information held in each, so would multiple users across the network ensure the accuracy

of the records they hold. However, rather than manually verifying the records, as is currently the case, the blockchain network would automatically recognize any discrepancies between users and alert participants on the network.

The success of a blockchain network is largely dependent on the miners, the users who provide computer processing power, to secure and verify the information held on the network. Users must have incentives to provide processing power. Greater incentives lead to more processing power and a more secure blockchain network. Today, title plants, with the land records they store, make money by charging a fee to investigate properties prior to a transaction and by assisting when a dispute over a title needs resolution. With a blockchain network, title plants could still play a major role, receiving compensation for the processing power they provide to the network, while still working as mediators and agents to assist with the resolution of disputes over a title. Though there would certainly be fewer errors with property titles, when, for example, an individual who holds a stake in a property has gone missing, there would need to be a mediator to investigate the circumstances and allow a sale to proceed.

BENEFITS

The most obvious benefit of a blockchain land registry is that it would give access to the two-thirds of the global population who lack access to a formal legal process for proving ownership over their private property. Where governments have failed to protect their citizens' rights to private property, blockchain land registries can be the tools that do. Though a land registry itself does not guarantee that the law will be adequately enforced, it does ensure that ownership and transaction information

is widely available and permanent. With the ability to prove property ownership, and assurance it is safe from corrupt actors with nefarious intent, major companies are far more likely to invest in permanent facilities, providing economic growth, jobs, and development in many of the areas where it is most needed. For private individuals, the ability to use the equity in the property they own as collateral for loans allows them to pursue additional businesses, which could have an exponential effect on economic growth.

For those in nations where property rights exist and are enforced, a blockchain land registry would still have myriad benefits. First among them is the efficiency it would provide. Title searches are time-consuming and expensive ordeals using title plants and the disparate sources of records. Of the $14 billion in premiums for title insurance in the U.S., more than three-fourths went to pay for the costs of title searches.[9] The average search for the complete history of a single property can take as long as two hours. A blockchain database could easily be searched in minutes, easily saving billions of dollars for home buyers and others in the U.S.

Another improvement that could save billions in transaction costs is a simplification of the convoluted process. There are some 3,600 public recorders across the U.S., more than 4,500 title insurers and agents, millions of brokers and bankers, and numerous title attorneys.[10] Frequently, there are as many as seven or eight parties to a transaction— a buyer, a seller, their respective brokers, attorneys for each, a lender, and a title company. As the transaction passes through so many

hands, it can substantially delay the process, a major reason the typical closing took 43 days in July, 2018.[11] With all of the information stored in a single database and the ability to automate functions using smart contracts, this new blockchain land registry would make it easier and quicker for homebuyers and other individuals to navigate the process.

A blockchain network would also enhance the long-term security and permanence of land records. There is redundancy built into the existing system, with public agencies and private entities each storing copies. This has prevented the complete loss of some land records, such as in Cook County, where the County Courthouse burned down in 1871 during the Great Chicago Fire. Though the land records held in the courthouse were destroyed, the land records held by three separate private firms were used to establish a complete history. Though this destruction took place long ago, there remains a threat of the loss of records today. A natural disaster, a major hack, or negligence could all lead to the loss of records. A blockchain network would guarantee multiple copies of every record and a more secure network, protecting against any loss of information. ❧

9 "U.S. Property & Casualty and Title Insurance Industries."
   National Association of Insurance Commissioners. 2017.

10 Ibid.

11 "July 2018 Origination Insight Report." Ellie Mae Inc.
    July 2018.

10th ANNIVERSARY

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