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CHANGING GOVERNANCE MODELS BY APPLYING BLOCKCHAIN COMPUTING

Steven Young⁺

Blockchain computing has many great possibilities. Through blockchain-based smart contracts, the nature of the relationship between government and those they govern/serve may be changed forever.¹

Blockchain technology has the power to change the way organizations form and how they function.² Indeed, it may change entire systems of governance, transforming them from centralized firms or governments to decentralized organizations with more power distributed to individuals.³ A preeminent expert on decentralized organizations and the creator of the Ethereum network, Vitalik Buterin, described a decentralized organization as “a set of humans interacting with each other according to a protocol specified in code, and enforced by a

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¹ See Ben Dickson, *How Blockchain Can Create the World's Biggest Supercomputer*, TECHCRUNCH (Dec. 27, 2016), <https://techcrunch.com/2016/12/27/how-blockchain-can-create-the-worlds-biggest-supercomputer/> (“The biggest challenge for supercomputing is the demand to compress time.”).

² See Angela Walch, *The Path of the Blockchain Lexicon (And the Law)*, 36 REV. BANKING & FIN. L. 713, 733 (2016) (“[R]egulators [are] to be daunted and awed by blockchain technology, as it is extraordinarily complex and purportedly will solve virtually every problem that regulators and the financial sector . . . have.”).

³ See Steven Young, *Enforcing Constitutional Rights Through Computer Code*, 26 CATH. U. J. L. & TECH 1, 9 (2017).

blockchain.”⁴ One blockchain already doing this is Ethereum, which “constitutes a decentralised [sic] alternative to the notion of the *organisation* [sic] per se.”⁵ Blockchain computing has various inherent characteristics that allow it to change relationships and governance models.⁶

Blockchain technology is based on the centuries-old method of ledger-keeping banks and other money-lenders use to ensure that individuals do not double spend on their accounts.⁷ Instead of bankers comparing their paper ledgers, a blockchain distributes a ledger across many computers on a network; those computers use peer-to-peer communication to reach a consensus on the relevant transactions.⁸ The algorithms that control this communication use cryptography to ensure that only the proper computers are making the decisions, that the blockchain does not record improper transactions, and that past transactions are safe from being corrupted.⁹ The effect of this system is that there is no need for a central authority or trusted third party to determine what transactions are legitimate.¹⁰ In sum, blockchains are (1) decentralized,¹¹ (2)

⁴ Max Kaplan, *How Ethereum Could Revolutionize Investment Management*, BREVITAS BULL. (June 9, 2016), <https://brevitas.com/bulletin/how-ethereum-could-revolutionize-investment-management/>.

⁵ Primavera De Filippi & Raffaele Mauro, *Ethereum: the decentralised platform that might displace today's institutions*, INTERNET POL'Y REV. (Aug. 25, 2014), <https://policyreview.info/articles/news/ethereum-decentralised-platform-might-displace-todays-institutions/318>.

⁶ See Michael Sherlock, *BitCoin: The Case Against Strict Regulation*, 36 REV. BANKING & FIN. L. 975, 986 (2016) (“BitCoin transactions are protected by the underlying computing power of the Blockchain.”).

⁷ CHRIS DANNEN, INTRODUCING ETHEREUM AND SOLIDITY: FOUNDATIONS OF CRYPTOCURRENCY AND BLOCKCHAIN PROGRAMMING FOR BEGINNERS 4 (Apress Media, LLC 2017).

⁸ *Id.* at 1.

⁹ *Id.*; see also Ryan Surujnath, *Off the Chain: A Guide to Blockchain Derivatives Market and the Implications on Systemic Risk*, 22 FORDHAM J. CORP. & FIN. L. 257, 280, 299 (2017).

¹⁰ See Alan Cohen, Travis West & Chelsea Parker, *Smart After All: Blockchain, Smart Contracts, Parametric Insurance, and Smart Energy Grids*, 1 GEO. L. TECH. REV. 273, 279 (2017).

¹¹ See, e.g., Adam Jeffery, *US SEC Denies a Second Application to List Bitcoin Product*, CNBC (Mar. 29, 2017), <https://www.cnbc.com/2017/03/29/us-sec-denies-a-second-application-to-list-bitcoin-product.html> (concerning issues over trading SolidX Bitcoin Trust since the market for bitcoin is unregulated).

consensus-based,¹² (3) secure,¹³ and (4) trustless.¹⁴ This paper will explain how these characteristics will allow for a fundamental change in how organizations (even governments) interact and how individuals interact in ways that will replace those organizations.¹⁵

I. ORGANIZATIONS ARE ALREADY USING BLOCKCHAIN TECHNOLOGY TO DECENTRALIZE

Organizations such as corporations, clubs, and even governments form because societies need to, among other things, make collective decisions.¹⁶ These organizations allow people with different views to reach a consensus, respond to the needs of the day, and to plan for the future.¹⁷ Blockchain computing changes how consensus can be reached, and will therefore change how any organization that can apply blockchain technology serves the members of that organization.¹⁸

Currently, in most organizations “decision-making is concentrated at the

¹² See, e.g., Chris Hammerschmidt, *Consensus in Blockchains. In Short*, MEDIUM (Jan. 27, 2017), <https://medium.com/@chrshmmmr/consensus-in-blockchain-systems-in-short-691fc7d1fefe> (explaining how once an individual or entity adds information to a blockchain, “distributed operators of blockchain” have to agree before those people are added to the blockchain).

¹³ See Curtis Miles, *Blockchain security: What keeps your transaction data safe?*, IBM (Dec. 12, 2017), <https://www.ibm.com/blogs/blockchain/2017/12/blockchain-security-what-keeps-your-transaction-data-safe/> (requiring “massive amounts of computing power to access every instance (or at least 51 percent majority) of a certain blockchain and alter them all at the same time,” in order to alter the blockchain).

¹⁴ See Preethi Kasireddy, *ELI5: What do we mean by “blockchains are trustless”?*, MEDIUM (Feb. 3, 2018), <https://medium.com/@preethikasireddy/eli5-what-do-we-mean-by-blockchains-are-trustless-aa420635d5f6> (explaining how blockchains “minimize the amount of trust required from any single actor in the system . . . by distributing trust among different actors in the system.”).

¹⁵ See generally, Konstantinos Christidis & Michael Devetsikiotis, *Blockchains and Smart Contracts for the Internet of Things*, IEEE ACCESS J. 2292, 2292 (June 3, 2016), <http://ieeexplore.ieee.org/document/7467408/> (“[B]lockchains have recently attracted the interest of stakeholders across a wide span of industries.”).

¹⁶ See, e.g., *Blockchain Is Pumping New Life into Old-School Companies Like IBM and Visa*, FORTUNE (Dec. 26, 2017), <http://fortune.com/2017/12/26/blockchain-tech-companies-ibm/> (“IBM was one of the first big companies to see blockchain’s promise, contributing code to an open-source effort and encouraging startups to try the technology on its cloud for free.”).

¹⁷ C. Edwin Baker, *Michelman on Constitutional Democracy*, 39 TULSA L. REV. 511, 531 (2004) (discussing how democracy requires that decisions be made collectively despite individual beliefs, and, at different points in time, there will be winners and losers).

¹⁸ See Hammerschmidt, *supra* note 12 (explaining how there are four ways of finding consensus in a blockchain, such as the practical byzantine fault tolerance algorithm (PBFT)).

top.”¹⁹ However, blockchain computing allows for “the decision-making process of a decentralized organization . . . [to] be encoded directly into source code.”²⁰ Indeed, citizens and even residents can take part in decision-making through decentralized voting, and will “distribut[e] authority throughout the organization without the need for any trusted centralized party.”²¹ Buterin provided an example of this, stating:

One can take the shareholder-owned corporation . . . and transplant it entirely on the blockchain; a long-running blockchain-based contract maintains a record of each individual’s holdings of their shares, and on-blockchain voting would allow the shareholders to select the positions of the board of the directors and the employees. Smart property systems can also be integrated into the blockchain directly, potentially allowing [decentralized organizations] to control vehicles, safety deposit boxes and buildings.²²

There are already corporate entities that operate on a blockchain where shareholders have a greater role in the everyday operations and management of their organizations.²³ The members of these organizations are “tak[ing] a greater role in the management of their organizations, with innovations such as real time accounting, nearly instantaneous voting mechanisms, and more efficient markets.”²⁴ These organizations are more dynamic because of the ease of

¹⁹ Aaron Wright & Primavera De Filippi, *Decentralized Blockchain Technology and the Rise of Lex Cryptographia*, SSRN 1, 16 (Mar. 20, 2015); see also Fred Ehrsam, *Blockchain Governance: Programming Our Future*, MEDIUM (Nov. 27, 2017), <https://medium.com/@FEhrsam/blockchain-governance-programming-our-future-c3bfe30f2d74> (arguing “governance should be the primary focus of investors in the space.”).

²⁰ Wright & De Filippi, *supra* note 19; see also Michelle D’Aliessi, *How Does Blockchain Work?*, MEDIUM (June 1, 2016), <https://medium.com/@micheledaliessi/how-does-the-blockchain-work-98c8cd01d2ae> (describing the difficulty of “pre-comput[ing] a series of blocks due to the high number of random guesses needed to solve a block and place it on the blockchain.”).

²¹ Wright & De Filippi, *supra* note 19; see, e.g., Ben Miller, *Blockchain Voting Startup Raises \$2.2M*, GOV’T TECH. (Jan. 8, 2018), <http://www.govtech.com/biz/Blockchain-Voting-Startup-Raises-22M.html> (explaining how Voatz, a blockchain-based voting startup, “relies on third-party ‘validating peers’ to prove using the power of computing that a transaction took place.”).

²² Vitalik Buterin, *DAOs, DACs, DAs and More: An Incomplete Terminology Guide*, ETHEREUM BLOG (May 6, 2014), <https://blog.ethereum.org/2014/05/06/daos-dacs-das-and-more-an-incomplete-terminology-guide/>.

²³ See *About*, CONSENSYS, <https://consensys.net/about/> (last visited May 24, 2018) (explaining how ConsenSys gives shareholders a greater role and enables business models to be built on the blockchain).

²⁴ Wright & De Filippi, *supra* note 19, at 36; see also Bairesdev Ignacio De Marco, *3 Ways Organizations Are Dealing with the Blockchain Developer Shortage*,

voting²⁵ and the incentives to participate.²⁶

II. BLOCKCHAIN COMPUTING CAN ALSO CHANGE PUBLIC ORGANIZATIONS

Blockchain computing can change public institutions in many ways.²⁷ Like the private institutions above,²⁸ it can be used in voting.²⁹ It can also be used to ensure that the government does not violate established law, and that individual rights are guaranteed.³⁰

A. Examples of Governments Using Blockchain Computing for Limited Purposes

Various national and sub-national governments have been moving towards systems that incorporate blockchain in their political system.³¹ Julie Maupin, a senior research fellow at the Max Planck Institute and senior fellow with The

VENTUREBEAT.COM (Jan. 28, 2018), <https://venturebeat.com/2018/01/28/3-ways-organizations-are-dealing-with-the-blockchain-developer-shortage/> (stating how companies, such as IBM, are developing “training centers” to ensure there are “blockchain-related job openings.”).

²⁵ Fiammetta S. Piazza, *Bitcoin and the Blockchain as Possible Corporate Governance Tools: Strengths and Weakness*, 5 PENN. ST. J.L. & INT’L AFF. 262, 293 (2017) (“[V]oting via blockchain would be achieved by allocating eligible voters tokens . . . in a number that represents their voting power,” which solves the issues related to proxy voting).

²⁶ See Roger Aitken, *Smart Contracts on the Blockchain: Can Businesses Reap the Benefits?*, FORBES (Nov. 21, 2017, 11:20 AM), <https://www.forbes.com/sites/rogeraitken/2017/11/21/smart-contracts-on-the-blockchain-can-businesses-reap-the-benefits/#446d3f761074> (stating how companies like IBM and Microsoft are providing “blockchain solutions to enterprise clients” and Blockchain start-ups have grossed more than 3.25 billion dollars). See generally Wright & De Filippi, *supra* note 19, at 37 (explaining how “shareholders could submit any proposals they want.”).

²⁷ Wright & De Filippi, *supra* note 19, at 27–28.

²⁸ *Supra* Part II.

²⁹ Wright & De Filippi, *supra* note 19, at 38–39.

³⁰ See Giulio Prisco, *Blockchain Technology Plays a Critical Role in U.S. and International Open Government Initiatives*, BITCOIN MAG. (Sept. 18, 2017, 2:19 PM), <https://bitcoinmagazine.com/articles/blockchain-technology-plays-critical-role-us-and-international-open-government-initiatives/> (discussing the U.S. case examples of increasing government accountability, transparency, and citizen participation).

³¹ See JP Buntinx, *Top 5 Countries Interested in Bitcoin, According to Google*, MERKLE (May 13, 2017), <https://themerkle.com/top-5-countries-interested-in-bitcoin-according-to-google/> (discussing five countries/national governments that are interested in blockchain technology). See generally Dan Cummings, *Report Says G20 Countries Should Embrace Blockchain Technology*, ETHNEWS (Mar. 20, 2017, 7:55 PM), <https://www.ethnews.com/report-says-g20-countries-should-embrace-the-blockchain> (recognizing some transnational legal and regulatory bodies currently working with blockchain systems).

Centre for International Governance, suggested that “the G20 should take ‘decisive steps’ to harness blockchain technology in order to embrace its socially beneficial properties.”³² For example, Dubai is already testing blockchain concepts for “health records, business registration, title transfer, the diamond trade, shopping, and much more.”³³ Additionally, there is a plan for Dubai to “secure all government documents on a blockchain by 2020.”³⁴ Other countries have also begun to use blockchain to handle government data, thus implying that this could be a trend around the globe.³⁵ In the United States, Delaware is leading the charge and is storing contracts and corporate data as well as backing up government archives on the blockchain.³⁶ The United Kingdom has begun offering its own “blockchain-as-a-service” for government agencies to experiment on to develop new uses.³⁷ The Department for Work and Pensions in the UK has recently launched a trial for allowing pensioners to receive their payments through a blockchain mobile app.³⁸ Russia has considered using blockchain technology to combat voter fraud and has already implemented the use of blockchain to exchange intragovernmental documents.³⁹ Their primary

³² Cummings, *supra* note 31.

³³ Jim Manning, *World Governments Utilizing Blockchain Technology’s Benefits*, ETHNEWS (Apr. 17, 2017, 8:17 PM), <https://www.ethnews.com/world-governments-utilizing-blockchain-technologies-benefits>; *see also* Saqr Ereqat, *Blockchain in Dubai: Smart Cities from Concept to Reality*, IBM BLOCKCHAIN BLOG (Apr. 10, 2017), <https://www.ibm.com/blogs/blockchain/2017/04/blockchain-in-dubai-smart-cities-from-concept-to-reality/> (discussing the current and future uses of blockchain by the Dubai government).

³⁴ Manning, *supra* note 33; *see* Nikhil Lohade, *Dubai Aims to Be City Built on Blockchain*, WALL ST. J. (Apr. 24, 2017, 10:08 PM), <https://www.wsj.com/articles/dubai-aims-to-be-a-city-built-on-blockchain-1493086080> (“The goal of Dubai’s government is to conduct a majority of the emirate’s business using blockchain, which it expects will make government services more efficient and help promote enterprise in Dubai as it will become easier to do business there.”).

³⁵ *See* Steve Delahunty, *Developments and Adoption of Blockchain by the U.S. Federal Government*, FORBES (Jan. 25, 2018, 9:30 AM), <https://www.forbes.com/sites/forbestechcouncil/2018/01/25/developments-and-adoption-of-blockchain-in-the-u-s-federal-government/#77111ba83d99> (discussing ways in which the U.S. has begun to explore ways to take advantage of blockchain technology).

³⁶ Manning, *supra* note 33; *see also* Wonnie Song, *Bullish on Blockchain: Examining Delaware’s Approach to Distributed Ledger Technology in Corporate Governance Law and Beyond*, 8 HARV. BUS. L. REV. 9, 9–10 (2018) (discussing how Delaware amended its corporate statute to allow for storing of corporate records on the blockchain),

³⁷ Stan Higgins, *UK Government Eyes Blockchain Trials in New Digital Strategy Push*, COINDESK (Mar. 13, 2017) <https://www.coindesk.com/uk-government-blockchain-trials-in-new-digital-strategy/>; Manning, *supra* note 33.

³⁸ Manning, *supra* note 33; *see also* GOV’T OFFICE OF SCI., *DISTRIBUTED LEDGER TECHNOLOGY: BEYOND BLOCKCHAIN* 48, 66–67 (2016) (discussing blockchain use by the Department of Work and Pensions for distributing welfare benefits).

³⁹ *See* Stan Higgins, *The Russian Government is Testing Blockchain for Document*

interest is in the “cost-cutting efficiencies” of the blockchain.⁴⁰ Ukraine has recently decided to use blockchain to securely store government data, aiming to “put the entirety of its electronic data on a blockchain platform, increasing efficiency as well as transparency.”⁴¹

Several countries have also sought to use blockchain to assist the government in conducting its duties.⁴² For example, South Africa is developing a blockchain to “provide a digital identity for young children,” and ensure that each child gets the specific funding allotted for his or her education.⁴³ Its overall effort is to prevent fraud where subsidized schools claim to have more students than they actually teach.⁴⁴

Ghana is attempting to fix land registry problems by issuing blockchain land certificates that allow “who-owns-what to be securely tracked across a blockchain-based distributed ledger.”⁴⁵ Similarly, the Republic of Georgia “has

Storage, COINBASE (Oct. 14, 2016), <https://www.coindesk.com/the-russian-government-is-testing-blockchain-for-document-storage/> (discussing early efforts by the Russian government to use blockchain technology to form a document management system); see also Stan Higgins, *Moscow Government Open-Sources Blockchain Voting Tool*, COINDESK (Dec. 4, 2017), <https://www.coindesk.com/blockchain-voting-code-made-open-source-moscows-government/>; *Russian Political Party to Use Blockchain to Combat Election Fraud*, FORKLOG, <http://forklog.net/russian-political-party-to-use-blockchain-to-combat-election-fraud/> (last visited May 24, 2018).

⁴⁰ Manning, *supra* note 33.

⁴¹ *Id.*; see also Gertrude Chavez-Dreyfus, *Ukraine Launches Big Blockchain Deal with Tech Firm Bitfury*, REUTERS (Apr. 19, 2017, 2:35 AM), <http://www.reuters.com/article/us-ukraine-bitfury-blockchain-idUSKBN17F0N2> (explaining how Ukraine’s blockchain initiative emphasizes a growing trend of adopting technology to increase efficiencies and improve transparency).

⁴² See Garry Gabison, *Policy Considerations for the Blockchain Technology Public and Private Applications*, 19 SMU SCI. & TECH. L. REV. 327, 329 (2016) (discussing the ways that blockchain technology has taken over services “that are traditionally provided by public entities.”).

⁴³ Manning, *supra* note 33; see Paul Kohlhaas, *Blockchain for Social Good: Revolutionizing Pre-School Funding in South Africa*, MEDIUM (Mar. 29, 2017), <https://medium.com/@Paul.Haas/blockchain-for-social-good-revolutionizing-pre-school-funding-in-south-africa-f0c7c63ee2ee> (discussing the founding and purpose of Project Amply, “a startup that is building a digital identity and subsidy management system on the Ethereum blockchain for pre-schools in South Africa.”).

⁴⁴ Manning, *supra* note 33; see also Dan Cummings, *Project Amply: An Ethereum Use Case For Social Good*, ETHNEWS (Apr. 1, 2017), <https://www.ethnews.com/project-amply-an-ethereum-use-case-for-social-good> (describing how South Africa’s old system of funding was outdated and led to people committing fraud).

⁴⁵ See Manning, *supra* note 33 (“[T]he government instituted the Land Administration Project (LAP) to reform land registration. That project has entered a new phase as non-profit Bitland is planning to issue blockchain land certificates.”). See generally *Project Components*, GHANA LAND ADMIN. PROJECT, <http://www.ghanalap.gov.gh/index.php/components2> (last visited May 24, 2018) (describing the project components associated with “Land Administration Project 2,” which includes “decentralizing and improving business and service delivery processes.”).

launched a blockchain-based system for validating property-related government transactions, and registering land titles.”⁴⁶ Estonia, which already has a digital ID system, is a frontrunner in the blockchain governance space by giving its citizens “cryptographically secured digital ID cards,” which grant them access to many government services and securely storing information.⁴⁷

Though many states have begun to use blockchain technology to enhance their abilities to do what they already do, blockchain technology is versatile and can offer much more.⁴⁸ As indicated by the above examples,⁴⁹ blockchain technology can change interpersonal business relationships and how governments operate.⁵⁰ However, a government placed on a blockchain will be the best way to ensure a government stays within its mandate; this will be difficult to accomplish.⁵¹ Many governmental parties are reluctant to abdicate their power.⁵² There is, however, hope.⁵³ A Digital Common Law is already developing through individual usage, and countries and companies are finding

⁴⁶ Manning, *supra* note 33; see The Bitfury Group, *The Bitfury Group and Government of Republic of Georgia Expand Historic Blockchain Land-Titling Project*, MEDIUM (Feb. 7, 2017), <https://medium.com/@BitFuryGroup/the-bitfury-group-and-government-of-republic-of-georgia-expand-historic-blockchain-land-titling-4c507a073f6b> (discussing the partnership between The Bitfury Group and the Republic of Georgia, which allows Georgia’s National Agency of Public Registry (NAPR) to “verify and sign a document containing a citizens essential information and proof of ownership of property.”).

⁴⁷ Manning, *supra* note 33. See generally Kaspar Korjus, *Welcome to the blockchain nation*, MEDIUM (July 7, 2017), <https://medium.com/e-residency-blog/welcome-to-the-blockchain-nation-5d9b46c06fd4> (discussing the background of Estonia’s secure ID program called “E-Residency,” and the potential use cases of other nations and blockchain entrepreneurs).

⁴⁸ See Rosamond Hutt, *Beyond bitcoin: 4 surprising uses for blockchain*, WORLD ECON. FORUM (Dec. 13, 2016), <https://www.weforum.org/agenda/2016/12/fighting-human-trafficking-tracing-blood-diamonds-and-other-surprising-uses-for-blockchain/> (stating that blockchain technology is also being used for human trafficking, conflict diamonds, and land rights).

⁴⁹ *Supra* Part III.

⁵⁰ See RJ Krawiec & Jason Killmeyer, *Blockchain technologies could transform government services*, TECHCRUNCH (Nov. 21, 2016), <https://techcrunch.com/2016/11/21/blockchain-technologies-could-transform-government-services/> (demonstrating that blockchain technology could be used by government agencies to make information sharing easier).

⁵¹ See *id.* (illustrating that Congress recently established a Blockchain Caucus to study the technology and how it might aid in financial inclusion, but ultimately the adoption of the technology remains unclear).

⁵² See ORG. FOR ECON. COOPERATION & DEV., *EMBRACING INNOVATION IN GOVERNMENT: GLOBAL TRENDS 14* (Feb. 2017) (emphasizing that officials in “conventional cultures can be reluctant” to take initiative or support efforts to “better connect civil servants within the government, or be transparent and open to public scrutiny.”).

⁵³ See *id.* (stating “government employees who are encouraged to be open and innovative” within their respective jobs, are more likely recognize the value in those qualities and be more transparent with the public).

new ways to use the blockchain.⁵⁴ This will eventually become such a widespread phenomenon that most everything will operate on the blockchain, paving the way for a specific Smart Social Contract to take the place of the Digital Common Law.⁵⁵

B. Voting

By considering a vote as a transaction, citizens can vote on the blockchain.⁵⁶ This ensures the accuracy of total votes, the transparency of accounting, and legitimacy of the election.⁵⁷ A blockchain built for votes would tally the votes as transactions as well as verify that they are legitimate and upload them to the blockchain confirming that it is legitimate, and ensure that the blocks before were untainted as well.⁵⁸ The technology already exists to have a voting system on the blockchain.⁵⁹ “With the cost of voting drastically reduced, politicians hampered by scandal, corruption, or incompetence could easily be removed from their offices, making governance more efficient and decreasing the impact of politicians who have lost the confidence of their constituency.”⁶⁰

When these systems are based on the blockchain, they become more than just straw polls and discussion threads.⁶¹ A true direct democracy can form on the blockchain because citizens could vote on every decision and there would be a clear record of what the government has done.⁶²

People can vote on high-level decision makers, people can vote on trial court

⁵⁴ See *id.* (using the Central Bank of Canada as an example of a country using Blockchain to develop a digital version of the Canadian dollar).

⁵⁵ See Joe Dewey & Shawn Amual, *Blockchain Technology Will Transform the Practice of Law*, LEGAL TECH. LABS (June 25, 2015), <https://static1.squarespace.com/static/55ca96f4e4b078796cbde4a8/t/5617cf0be4b091a935a4ccfc/1444400907504/LegalTech+-+Bloomberg+%28Compiled%29.pdf> (explaining how future lawyers will need to be more technical and have basic to intermediate training in coding in order to draft tailored contracts based on the blockchain).

⁵⁶ ANDREW BARNES, CHRISTOPHER BRAKE & THOMAS PERRY, DIGITAL VOTING WITH THE USE OF BLOCKCHAIN TECHNOLOGY 9, <https://www.economist.com/sites/default/files/plymouth.pdf> (last visited May 24, 2018).

⁵⁷ *Id.* at 8.

⁵⁸ *Id.* at 11–12; Jackie Burns Koven, *Block the Vote: Could Blockchain Technology Cybersecure Elections?*, FORBES (Aug. 30, 2016, 5:01 PM), <https://www.forbes.com/sites/realspin/2016/08/30/block-the-vote-could-blockchain-technology-cybersecure-elections/#444d40662ab3>.

⁵⁹ Amy Castor, *An Ethereum Voting Scheme That Doesn't Give Away Your Vote*, COINDESK (Apr. 11, 2017, 11:51 AM), <https://www.coindesk.com/voting-scheme-ethereum-doesnt-give-away-vote/>.

⁶⁰ Wright & De Filippi, *supra* note 19.

⁶¹ Andrea Vittorio, *Broadridge Tests Blockchain for Corporate America's Ballots*, BNA (Feb. 15, 2018), <https://www.bloomberglaw.com/document/X8180C98000000>.

⁶² *Id.* (providing that corporations utilize blockchain for its shareholder voting because it creates a centralized record).

matters, and people can vote and create laws as lawmakers.⁶³ When the law is based on the blockchain, it will be more efficient and will protect more people.⁶⁴ Though the rules of the system are encoded and enforced automatically, those rules can be written to include humans at every step.⁶⁵ A significant advantage of the peer-to-peer decentralization of the blockchain is that it grants equal opportunity for everyone to involve themselves in every aspect of governance.⁶⁶

A blockchain-based voting system would be nearly hack-proof.⁶⁷ Voting on a blockchain will be a “distributed, irreversible, and encrypted public paper trail that can easily be audited.”⁶⁸ Wright and De Filippi state that “[r]egardless of nationality, people could be granted equal access to basic digital institutions and infrastructure such as decentralized laws, markets, judiciaries, and payment systems, which can be customized to each country’s, group’s, and individual’s needs.”⁶⁹ Indeed, a voting system can take more things into account than just legal jurisdiction.⁷⁰ For example, a person’s CitizenCoin could get a full vote for anything that affects them directly, such as municipal or federal-level elections, less voting power for things that affect them tangentially, for example a neighboring town’s municipal zoning that will have some effect on their own town, and no voting power on something with no effect on them.⁷¹ This will involve many factors and will certainly keep the parties with the most at stake with the most power, but will ensure that everyone has representation on issues

⁶³ See Terry Brock, *Blockchain could Revolutionize Voting and Elections*, BUS. JS. (Dec. 6, 2017, 3:20 AM), <https://www.bizjournals.com/bizjournals/how-to/technology/2017/12/blockchain-could-revolutionize-voting-and.html?s=print> (noting that blockchain has been successfully utilized in elections).

⁶⁴ Jack Tatar, *How the Blockchain can Change how we Vote*, BALANCE (Oct. 29, 2017), <https://www.thebalance.com/how-the-blockchain-will-change-how-we-vote-4012008>.

⁶⁵ See *id.* (describing that one of the latest Blockchain technologies allows users to vote while also vocalizing their opinion on certain political topics to enhance the voting process).

⁶⁶ *Blockchain Technology in Online Voting*, FOLLOW MY VOTE, <https://followmyvote.com/online-voting-technology/blockchain-technology/> (last visited May 24, 2018).

⁶⁷ Deepan Datta, *Blockchain is the Technology of Future, But is it Hack-Proof?*, CRYPTO NEWS (Nov. 16, 2017), <http://www.crypto-news.in/opinions/is-future-technology-hack-proof/>.

⁶⁸ Wright & De Filippi, *supra* note 19, at 13; see also Christopher Malmo, *Bitcoin Could Revolutionize Voting*, VICE (Mar. 31, 2014, 4:25 PM), https://www.vice.com/en_us/article/8gdxzb/bitcoin-could-revolutionize-voting.

⁶⁹ Wright & De Filippi, *supra* note 19, at 56.

⁷⁰ *Voting System Standards, Testing and Certification*, NAT’L CONF. STATE LEG. (Jan. 18, 2018), <http://www.ncsl.org/research/elections-and-campaigns/voting-system-standards-testing-and-certification.aspx>.

⁷¹ See Joseph Lubin, *How Blockchain Will Disrupt Our Election System*, FUTURISM (June 22, 2017, 2:38 PM), <https://futurism.com/how-blockchain-will-disrupt-our-election-system/> (providing that voters will be able to also view issues supported by lobbyists and politicians that could allow voters to make more informed decisions).

that affect them.⁷²

Keep in mind the voting will be on the blockchain and tied to each citizen's unique token.⁷³ Like the blockchain, voting will be ensured, transparent, and nearly instant.⁷⁴ Every campaign would become a grassroots campaign because of the decentralized and transparent nature of the blockchain.⁷⁵ Once a citizen's proposal reaches a certain amount of approval it could then be presented to the elected leaders or those responsible for implementation to see if it fits within the code and within the norms of society (i.e. Constitutionality, which will also be codified on the blockchain).⁷⁶ This would allow for citizen's voices to be heard and to limit the amount of figurative distance between the governed and the governors.⁷⁷

C. Government Security

By implementing the code of blockchain into the government, the government would be more secure and efficient.⁷⁸ When code expresses an organization's governing principles and rules on the blockchain, that organization's foundation becomes verifiable, transparent, and nearly impossible to change without permission of the voting parties (i.e. no extra powers for government actors).⁷⁹ There are various ways in which this technology can serve as a limit to a

⁷² There is much *much* more that could be written on this subject and what factors could be taken into account when making these determinations, such as financial, environmental, health, security, political, educational, historical inequality, and other issues that will enable people to have the most say in the issues that affect them the most. *See generally* SAGAR SHAH & OAISH KANCHWALA, BLOCK CHAIN VOTING SYSTEM 4, <http://www.economist.com/sites/default/files/northeastern.pdf> (last visited May 24, 2018) (providing that some of the factors related to successful of incorporating the blockchain process into voting includes transparency, fairness and the ability to verify the votes).

⁷³ Tatar, *supra* note 64.

⁷⁴ Patrick Nelson, *Blockchain to Revolutionize Elections?*, NETWORKWORLD (July 27, 2016, 2:06 PM), <https://www.networkworld.com/article/3101184/internet/blockchain-to-revolutionize-elections.html>.

⁷⁵ Philip Boucher, *What If Blockchain Technology Revolutionised Voting?*, EUR. PARL. RES. SERV. (2016), http://www.europarl.europa.eu/RegData/etudes/ATAG/2016/581918/EPRS_ATA%282016%29581918_EN.pdf.

⁷⁶ Wright & De Filippi, *supra* note 19, at 39.

⁷⁷ Wietse Van Ransbeeck, *Why the Blockchain Could Transform the Face of Digital Democracy*, CITIZENLAB (May 8, 2017), <https://www.citizenlab.co/blog/civic-tech/blockchain-could-transform-democracy/>.

⁷⁸ MARK WHITE, JASON KILLMEYER & BRUCE CHEW, WILL BLOCKCHAIN TRANSFORM THE PUBLIC SECTOR? 14 (Deloitte U. Press, 2017), https://www2.deloitte.com/content/dam/insights/us/articles/4185_blockchain-public-sector/DUP_will-blockchain-transform-public-sector.pdf.

⁷⁹ Wright & De Filippi, *supra* note 19, at 13–14.

government, allowing individuals to have more sovereignty of their own.⁸⁰ Indeed, “[i]f blockchain technology becomes more widely adopted, centralized authorities, such as governmental agencies and large multinational corporations, may lose the ability to control and shape the activities of disparate people through existing means.”⁸¹ Not only will individuals gain more freedom from their government, they will also be able to exert more power over it.⁸² This will contribute to the well-being of a functional government because governments function best when the citizens trust that when they surrender some individual or group liberties, the government will not abuse those rights, and will benefit them in some way.⁸³

III. PREVENTING ABUSE OF GOVERNMENT POWERS

As discussed above,⁸⁴ there are already various national and provincial-level governments that currently use or are looking to use blockchain for governance.⁸⁵ The benefits for the people in those areas are indicated above,⁸⁶ but the issue of governing the governor can be separate from that of empowering the citizen.⁸⁷ I submit that, in addition to changing the speed and ability of voters to make and influence decisions, there are ways that a blockchain-coded governance model would prevent government actors from abusing their

⁸⁰ *Id.* at 38.

⁸¹ *Id.* at 4.

⁸² *Id.* at 22–23.

⁸³ See John Mackenzie, *Classical Theory of Government and the Social Contract*, U. DEL., http://www1.udel.edu/johnmack/frec406/theories_of_govt1.html (last visited May 24, 2018) (discussing that citizens surrender their liberties in exchange for social order from the government).

⁸⁴ *Supra* Part III.

⁸⁵ See *Governments May Be Big Backers of the Blockchain*, ECONOMIST (June 1, 2017), <https://www.economist.com/news/business/21722869-anti-establishment-technology-faces-ironic-turn-fortune-governments-may-be-big-backers> (discussing various countries looking into establishing blockchain). See generally Eric Sweden, *Blockchains: Moving Digital Government Forward in the States*, NASCIO (2017), <https://www.nascio.org/Portals/0/Publications/Documents/2017/NASCIO%20Blockchains%20in%20State%20Government.pdf?ver=2017-05-16-090507-033> (reporting on state level discussions on how Blockchain may be applied to government).

⁸⁶ *Supra* Part III.

⁸⁷ See Ian Bogost, *Cryptocurrency Might Be a Path to Authoritarianism*, ATLANTIC (May 30, 2017), <https://www.theatlantic.com/technology/archive/2017/05/blockchain-of-command/528543/> (speculating how instead of decentralizing power, it could consolidate a government’s control instead); Marcella Atzori, *Blockchain Technology and Decentralized Governance: Is the State Still Necessary?*, SSRN 1, 25 (Dec. 1, 2015), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2709713 (discussing how a stateless society may actually disempower citizens rather than empower them as they begin to not see themselves as part of a whole).

powers.⁸⁸

Blockchain code enforcement can limit governmental actions.⁸⁹ If the governmental action used government property that uses computer code (so-called Smart Property)⁹⁰, a blockchain network would prevent the property from being used outside of its already enumerated permissions.⁹¹ An example is that if a government agency's espionage devices use code (like the NSA's many programs), a blockchain could control the code (remember, distributed and secure) that would prevent persons from using the program to spy on an individual unless the overall blockchain protocols permits it.⁹² The blockchain could prevent espionage tools from being used unless a warrant was uploaded into the system allowing it to operate.⁹³ This removes the ability of government actors to make a choice that goes beyond their enumerated powers.⁹⁴ The balance of this paper discusses the use of blockchain computing to ensure that governments operate only within their enumerated powers.⁹⁵

A. Governing the Governor

There are already various national and provincial-level governments that currently use or are looking to use blockchain for governance.⁹⁶ The benefits for

⁸⁸ See WHITE ET AL., *supra* note 78 (describing how blockchains could streamline and secure government transactions ranging from customs to taxes to voter fraud).

⁸⁹ See Michael Mainelli, *Blockchain Could Help Us Reclaim Control of Our Personal Data*, HARV. BUS. REV. (Oct. 05, 2012), <https://hbr.org/2017/10/smart-ledgers-can-help-us-reclaim-control-of-our-personal-data> (discussing how blockchain could be used to create encrypted tamperproof personal records to protect data privacy).

⁹⁰ Noelle Acheson, *Smart Property: What Does That Mean for the Blockchain?*, FINTECHBLUE (Dec. 9, 2015), <http://www.fintechblue.com/2015/12/smart-property-what-does-that-mean-for-the-blockchain>.

⁹¹ Wright & De Filippi, *supra* note 19, at 43 (discussing the power and control that could be taken away from government agencies and large corporations with the further development of blockchain technology).

⁹² Roger Aitken, *New Blockchain Platforms Emerge to Fight Cybercrime & Secure the Future*, FORBES (Nov. 13, 2017), <https://www.forbes.com/sites/rogeraitken/2017/11/13/new-blockchain-platforms-emerge-to-fight-cybercrime-secure-the-future/#5e00903268ad>.

⁹³ See *id.* (describing smart contracts that automatically execute upon a given condition; such a system could theoretically protect NSA tools and condition their use to specific requirements).

⁹⁴ See Aitken, *supra* note 26 (stating that blockchain smart contract technology would allow businesses to ensure “that their transactions and agreements are verifiable”; which could be useful for preventing government overreach).

⁹⁵ See *id.* (stating that self-executing blockchain smart contract technology could be used to constrain government's use of powers).

⁹⁶ See *Governments May Be Big Backers of the Blockchain*, *supra* note 85 (elaborating on what specific uses countries are exploring). See generally Sweden, *supra* note 85 (detailing the potential uses of blockchain technology at the state level).

the people in those areas are indicated above,⁹⁷ but the issue of governing the governor can be separate from that of empowering the citizen.⁹⁸ This paper discusses four main ways in which a government will be placed on a blockchain. First, a blockchain government would operate using individual electronic wallets and tokens for citizens and elected leaders, here called “GovernmentCoin.”⁹⁹ Second, computer code would express the code of a Constitution or system on the blockchain, allowing the individual GovernmentCoin to work.¹⁰⁰ Third, multisignature technology would require the government to come to consensus.¹⁰¹ Fourth, the blockchain, using the Internet of Things, can connect and control nearly everything the government uses through the code.¹⁰²

1. Blockchain Tokens

Blockchain tokens are digital representations of digital or real-world assets.¹⁰³ Tokens are “specific amounts of digital resources which you control.”¹⁰⁴ Not limited to just money, a token “can be any kind of digital asset or any digital representation of a physical asset.”¹⁰⁵ Blockchain technology will allow individuals under the jurisdiction of a government to make or receive unique digital token, similar to a Bitcoin.¹⁰⁶ Tokens can operate on their own specific blockchain, or they can operate on an already existing one that is made for

⁹⁷ *Supra* Part III & IV.

⁹⁸ *See* Bogost, *supra* note 87 (speculating how instead of decentralizing power, it could consolidate a government’s control instead). *But see* Atzori, *supra* note 87, at 27 (suggesting that the owners of blockchains could become the next generation oligarchies).

⁹⁹ *See* Philip Evans, *Thinking Outside the Block*, BCG (Dec. 1, 2016), <https://www.bcg.com/blockchain/thinking-outside-the-blocks.html> (providing a strategic context to understanding “how the economic transaction costs and trust can be reshaped by tokens and blockchains.”). *See generally* Antony Lewis, *A Gentle Introduction to Digital Tokens*, BITS ON BLOCKS (Sept. 28 2015), <https://bitsonblocks.net/2015/09/28/a-gentle-introduction-to-digital-tokens> (introducing basic concepts of digital tokens).

¹⁰⁰ *See generally* Bogost, *supra* note 87 (speculating how not fulfilling requirements could lead to automatically revoked permissions; for example, not having enough bitcoin to pay for parking could shut down your car until paid).

¹⁰¹ Andrea Potter, *How Blockchain Can Help Create Better Public Services*, EQ, <https://betterworkingworld.ey.com/digital/how-blockchain-can-help-create-better-public-services> (last visited May 24, 2018); MELANIE SWAN, *BLOCKCHAIN: BLUEPRINT FOR A NEW ECONOMY 22* (Tim McGovern eds., 2015).

¹⁰² *See generally* De Filippi & Mauro, *supra* note 5 (explaining how social contracts on Ethereum are linked to tokens that determine who uses them and how they are used).

¹⁰³ *See generally* Lewis, *supra* note 99 (explaining what Digital Tokens are and various types of them).

¹⁰⁴ *Id.*

¹⁰⁵ Evans, *supra* note 99. *See generally* Lewis, *supra* note 99.

¹⁰⁶ *See generally* Evans, *supra* note 99 (showing how stacked architecture helps the development of other “digital tokens”).

various types of tokens.¹⁰⁷ Additionally, because they are a blockchain token, they are unique, secure, and the network verifies them.¹⁰⁸ Blockchain tokens are merely a representation of a share in a company, or can have functionality based on smart contracts (programmable computer codes that are self-executing) that enables the token holder to use to token for voting and controlling devices or property connected to the blockchain.¹⁰⁹

A government that uses a blockchain network would require tokens.¹¹⁰ This article will refer to a Government issued blockchain token as “GovernmentCoin.”¹¹¹ These tokens could be used for a variety of purposes.¹¹² As discussed above,¹¹³ corporations use tokens to vote and have specific permissions in corporate governance; government operations could follow this paradigm.¹¹⁴ Each citizen of a country would use their token, unique and nearly impossible to replicate.¹¹⁵

2. Encoded Constitution

As I posited in a previous paper, blockchain computing represents the next step forward in the evolution of public governance.¹¹⁶ Currently, people use written constitutions to ensure individual liberty and limit government action.¹¹⁷ The next step is to encode a government’s powers on a blockchain.¹¹⁸ When Smart Contracts ensure that all agreed upon terms are met, an individual no longer needs to go to court to prevent government overreach.¹¹⁹ Rather, the government needs to seek out the permission of the people to change the terms in the blockchain constitution to act in a new way.¹²⁰ When a constitution is encoded on a blockchain network, it returns much of the government power to the individual.¹²¹ Not only does blockchain computing allow individuals to hold

¹⁰⁷ See Aziz Dolce, *Coins, Tokens & Altcoins: What’s the Difference?*, MASTERTHECRYPTO, <https://masterthecrypto.com/differences-between-cryptocurrency-coins-and-tokens> (last visited May 24, 2018).

¹⁰⁸ *Id.*

¹⁰⁹ *Id.*

¹¹⁰ Manning, *supra* note 33.

¹¹¹ Delahunty, *supra* note 35.

¹¹² *Id.* (providing an example of the United States government utilizing blockchain technology centering around its decentralized nature and potential reduced cost outcomes).

¹¹³ *Supra* Part III.A.

¹¹⁴ Piazza, *supra* note 25.

¹¹⁵ *Id.*

¹¹⁶ Young, *supra* note 3.

¹¹⁷ *Id.* at 17.

¹¹⁸ Piazza, *supra* note 25, at 298.

¹¹⁹ *Id.* at 297.

¹²⁰ Young, *supra* note 3, at 13.

¹²¹ *Id.*

tokens that give them power over their government, but it also limits government actors to previously enumerated powers by removing the ability to operate outside of the agreed upon “Smart Social Contract.”¹²² In addition to those factors, blockchain will better guarantee individual rights.¹²³

3. *Multisignature Code*

Like the GoldenEye launch device, multisignature code (multisig) requires more than one individual to agree to an operation.¹²⁴ Various blockchains already enable multisig tokens and other operations.¹²⁵ Using multisig code can prevent individual actors from controlling a blockchain-connected asset without the other required signers agreeing to the operation.¹²⁶ Using multisig can “completely eliminate single points of failure” by separating the controlling devices and the controllers.¹²⁷ Organizations already use multisig to encode limitations into the power of individuals within the organization.¹²⁸

Likewise, each government actor (President, Senator, Congressperson, Police Officer, County Clerk) could have special permissions and restrictions connected to their GovernmentCoin.¹²⁹ Using multisig, a Constitution could be written so that the President can only enter into a treaty for the U.S. if two-thirds of the Senate agrees, and any instrument the President signed would not be binding on the U.S. unless at least two-thirds of the Senate approved it. If the constitution, like the U.S. Constitution, did not mention Executive Agreements, then if there were no treaty, there would be no international agreement. Without the proper signatures, the blockchain would not permit the non-treaty to be part of the U.S. law on the blockchain and would not be enforceable.

4. *The Internet of Things*

The Internet of Things is the term applied to real-world objects that connect

¹²² *Id.* at 15.

¹²³ Piazza, *supra* note 25, at 297.

¹²⁴ See GOLDENEYE (United Artists 1995).

¹²⁵ Ben Davenport, *What is Multi-Sig and What Can It Do?*, COIN CTR. (Jan. 1, 2015), <https://coincenter.org/entry/what-is-multi-sig-and-what-can-it-do>.

¹²⁶ *Id.*

¹²⁷ *Id.*

¹²⁸ Surujnath, *supra* note 9, at 274.

¹²⁹ *Id.* at 286–87.

to the internet.¹³⁰ These objects are also sometimes called “Smart Property.”¹³¹ Whether it is a simple coffee maker or a part of a complex jet engine, just about anything can connect to the internet.¹³² On a broad scale, the Internet of Things can improve efficiency and create “smart cities.”¹³³ As the Internet of Things connects more devices and components, government devices will start to connect.¹³⁴ When these devices connect, the code on which they run can control these devices.¹³⁵

By connecting the Smart Property that the government owns to a blockchain constitution, the constitution can ensure that nobody uses the property in an unconstitutional manner.¹³⁶ For example, if there was a government shutdown because of budgeting, all of the coffee makers would not turn on, etc.¹³⁷ While that is hardly a constitutional violation, it illustrates that the blockchain can even control little things without an overwhelming new bureaucracy.¹³⁸ It is the overall thesis of this paper that blockchain can prevent the government from acting outside of its mandate.¹³⁹

¹³⁰ Jacob Morgan, *A Simple Explanation of Internet of Things*, FORBES (Mar. 13, 2014, 12:05 AM), <https://www.forbes.com/sites/jacobmorgan/2014/05/13/simple-explanation-internet-things-that-anyone-can-understand/#587f43ed1d09>.

¹³¹ Larissa Lee, *New Kids on the Blockchain: How Bitcoin’s Technology Could Reinvent the Stock Market*, 12 HASTINGS BUS. L. J. 81, 114 (2016).

¹³² Morgan, *supra* note 130.

¹³³ *Id.*

¹³⁴ Tam Harbert, *Practical Uses of the Internet of Things in Government Are Everywhere*, GOVTECH, <http://www.govtech.com/network/Practical-Uses-of-the-Internet-of-Things-in-Government-Are-Everywhere.html> (last visited May 24, 2018).

¹³⁵ See Robin Kester, *Demystifying the Internet of Things: Industry Impact, Standardization Problems, and Legal Considerations*, 8 ELON L. REV. 205, 218 (2016) (describing Allseen, a company created for the sole purpose to find a way for all Internet devices to coordinate with each other).

¹³⁶ See, e.g., Gabison, *supra* note 42, at 346 (describing how placing public records on blockchain would improve government transparency and make Freedom of Information Act requests obsolete).

¹³⁷ See Young, *supra* note 3, at 20 (explaining, uniquely, when items are connected through the blockchain, code becomes the law and the government cannot manipulate it).

¹³⁸ See Surujnath, *supra* note 9, at 299 (explaining that private blockchains are controlled through a central administrator, which is the only source to write new transactions which are added to the private blockchain); see also John L. Douglas, *New Wine into Old Bottles: Fintech Meets the Bank Regulatory World*, 20 N.C. BANKING INST. 17, 47–48 (2016) (describing only four steps for creating and controlling virtual currency).

¹³⁹ See Kelsey L. Penrose, *Banking on Bitcoin: Applying Anti-Money Laundering and Money Transmitter Laws*, 18 N.C. BANKING INST. 529, 532 (2014) (explaining that in order for a block to be made and added to the chain, the entire network has to check that the block is correct); e.g., Kelly J. Winstead, *The North Carolina State Tax Treatment of Virtual Currency: An Unanswered Question*, 21 N.C. BANKING INST. 501, 504–05 (2017) (describing bitcoin mining on a blockchain and how the block become encrypted once it is mined).

IV. APPLICATION OF BLOCKCHAIN TO THE GOVERNMENT

Blockchains are already used to create and express various relationships.¹⁴⁰ Businesses, individuals, and governments are already finding uses for blockchains.¹⁴¹ Regular usage will develop naturally to form a part of our legal system, as cyber law and other systems developed to regulate new inventions.¹⁴² However, entities should use blockchain technology to change governance, not just be another thing to be governed.¹⁴³

A. Governments and Citizens Placed on Blockchain

The particular makeup of the ideal system that a blockchain can enforce needs to be explored more in depth.¹⁴⁴ Blockchain technology can be used for discovering and determining the most effective and efficient levels of government power and individual liberties, but there are many systems that a blockchain can enforce.¹⁴⁵ Due to its greater transparency and security, a

¹⁴⁰ See Brad Jacobsen & Fred Pena, *What Every Lawyer Should Know About Bitcoins*, 27 UTAH B. J. 40, 40–41 (2014) (describing bitcoin, the virtual asset on the blockchain, as a system network among every person who had sold or bought that bitcoin); e.g., Riley T. Svikhart, *Blockchain's Big Hurdle*, 70 STAN. L. REV. ONLINE 100, 103 (2017) (showing Arizona's legislature amending its Electronic Transactions Act to clarify that electronic records on blockchain are a valid electronic form under the Act).

¹⁴¹ See Mary Jo Foley, *Microsoft, Intel, Banks Form Enterprise Ethereum Blockchain Alliance*, ZDNET (Apr. 24, 2017), <http://www.zdnet.com/article/microsoft-intel-banks-form-enterprise-ethereum-blockchain-alliance/> (showing that Microsoft, Intel, Accenture and more than two dozen banks and other companies have formed alliances with blockchain).

¹⁴² See Dewey & Amual, *supra* note 55 (explaining that parties using blockchain may not know the identity of the other party, which may have redressability problems in the court system if a contractual issue were to arise); e.g., Surujnath, *supra* note 9, at 284–85 (providing an example from the United Kingdom, in which it provides a “regulatory sandbox” where startups can test out blockchain usage without subjecting themselves to the UK regulatory laws);

¹⁴³ See Vili Lehdonvirta, *The Blockchain Paradox: Why Distributed Ledger Technologies May Do Little to Transform the Economy*, OXFORD INTERNET INST.: BLOG (Nov. 21, 2016), <https://www.oii.ox.ac.uk/blog/the-blockchain-paradox-why-distributed-ledger-technologies-may-do-little-to-transform-the-economy/> (expecting blockchain to accomplish more than just being a platform for bitcoins but it will be limited by regulations).

¹⁴⁴ See generally Catherine M. Christopher, *The Bridging Model: Exploring the Roles of Trust and Enforcement in Banking, Bitcoin, and the Blockchain*, 17 NEV. L. J. 139, 155 (2016) (arguing that investigation needs to be done to determine the use of blockchain in contracts and the social impacts of that use); Wright & De Filippi, *supra* note 19, at 4 (arguing that research is needed to discover the best system of laws for blockchain technology).

¹⁴⁵ See generally Bryan Wilson, *Smarter Cities, Smarter Regulations: A Case for the Algorithmic Regulation of Platform-Based Sharing Economy Firms*, 85 UMKC L. REV. 845, 892 (2017) (showing that blockchain already has the ability to coordinate large numbers of

blockchain can be used to adapt a system to overcome any prior inequalities while maximizing liberties.¹⁴⁶

1. *GovernmentCoin*

A blockchain governmental tokens will provide at least two services: (1) power within or over the government; and (2) access to government institutions.¹⁴⁷ The first, “GovernmentCoin,” divides up the powers of the government and provides citizens with the power to affect the government.¹⁴⁸ The second, “CitizenCoin,” will be discussed below.¹⁴⁹

GovernmentCoin may contain an individual’s information, but it may also just be connected to an individual only for them to exercise their civic responsibilities.¹⁵⁰ Estonia, as mentioned above, is a government that already has many government functions running, guaranteed digitally, and accessed via a single ID with digital information.¹⁵¹ Like Estonia’s ID, a citizen’s GovernmentCoin will be unique to them and will allow the citizen to vote and

transactions and improve efficiency); Wright & De Filippi, *supra* note 19, at 2 (explaining blockchain technology can allow government to become more efficient in governing but will keep personal liberties for citizens).

¹⁴⁶ See generally Christine Bennett, *Evolving Government: Blockchain’s Potential to Increase Citizen Trust*, FEDSCOOP (July 28, 2017), <https://www.fedscoop.com/evolving-government-blockchains-potential-increase-citizen-trust/> (arguing that prior inequalities such as the Government losing/wasting money with Army contracts and federal spending could be prevented with blockchain technology in the future).

¹⁴⁷ See generally Piazza, *supra* note 25 (describing voting through blockchain); Preethi Kasireddy, *Bitcoin, Ethereum, Blockchain, Tokens, ICOs: Why Should Anyone Care?*, HACKERNOON (July 5, 2017), <https://hackernoon.com/bitcoin-ethereum-blockchain-tokens-icos-why-should-anyone-care-890b868cec06> (explaining that tokens are like currency and blockchain is like the policy that governs it).

¹⁴⁸ See generally Gareth Jenkinson, *Regulated, Government Issued Cryptos to Challenge Bitcoin in 2018*, COINTELEGRAPH (Feb. 1, 2018), <https://cointelegraph.com/news/regulated-government-issued-cryptos-to-challenge-bitcoin-in-2018> (showing several countries interested in being involved with cryptocurrencies); Lewis, *supra* note 99 (explaining how tokens can be used to represent more than monetary value such as shares, etc.).

¹⁴⁹ *Infra* Part V.A.2.

¹⁵⁰ See generally Stephanie A. Lemchuk, *Virtual Whats?: Defining Virtual Currencies in the Face of Conflicting Regulatory Guidances*, 15 CARDOZO PUB. L. POL’Y & ETHICS J. 319, 332 (2017) (describing a virtual wallets and that personal information is available to the third party hosting the wallet but not to any other party); Vivienne Walt, *Is This Tiny European Nation a Preview of Our Tech Future?*, FORTUNE (Apr. 27, 2017), <http://fortune.com/2017/04/27/estonia-digital-life-tech-startups/> (discussing how blockchain works to uphold civil liberties such as voting).

¹⁵¹ See Scott J. Shackelford et al., *Making Democracy Harder to Hack*, 50 U. MICH. J. L. REFORM 629, 649 (2017) (describing Estonia’s forty-three vital services including its citizens’ ID card which allows for these services and I-voting); Walt, *supra* note 150 (describing Estonia’s transition to digital in the past twenty years).

to do all of the things a government ID allows one to do.¹⁵² Additionally, because of the inherent openness of the blockchain, the citizens have oversight into the government's blockchain because they can see every transaction the blockchain makes and can personally verify that the code has not changed.¹⁵³ Also, through multisig code, individuals can have a greater say in governance, and individuals in the government will not be able to wield certain powers without the required consensus.¹⁵⁴

An individual may upgrade his or her personal coin to GovernmentCoin when citizens vote them into a leadership role.¹⁵⁵ Alternatively, every citizen will have a GovernmentCoin; the only differences are that some will have greater powers to vote on certain things based on the blockchain votes the GovernmentCoin of their constituents gives to them.¹⁵⁶ Either way, the blockchain will record "GovernmentCoin's" activity providing for the transparency of elected officials and their decisions.¹⁵⁷ Blockchains are "based on crypto proof instead of trust,"¹⁵⁸ and therefore can be decentralized, removing or limiting the need to

¹⁵² See generally Lonnie Eldridge, *Internet Commerce and the Meltdown of Certification Authorities: Is the Washington State Solution a Good Model?* 45 UCLA L. REV. 1805, 1818 (1998) (describing how a digital coin can have a unique serial number and information on it only to be unlocked with a private key); Walt, *supra* note 150 (explaining how Estonia's ID acts like a digital social security number that accesses everything from taxes to medical records, etc.).

¹⁵³ See generally Ronald L. Chichester, *Wide Open Spaces*, 80 TEX. B.J. 228, 229 (2017) (explaining that when a block is added to the blockchain, it becomes transparent and available for anyone to verify its authenticity); Erik Luna, *Transparent Policing*, 85 IOWA L. REV. 1107, 1193 (2000) (concluding that transparency in law enforcement would create trust between citizens and the government over time).

¹⁵⁴ See *Governments May Be Big Backers of the Blockchain*, *supra* note 85 (discussing how blockchain can help improve transparency, efficiency, and trust with the government by encrypting files and not allowing for a change in documents without an electronic trail).

¹⁵⁵ See generally Mark Gimbel, *Some Thoughts on the Implications of Trusted Systems for Intellectual Property Law*, 50 STAN. L. REV. 1671, 1676 n. 24 (1998) (suggesting that cryptography containing more sensitive information should be on a system with higher level of security and cryptography with less sensitive information should be on a system with a lower level of security); Lewis, *supra* note 99 (explaining what Digital Tokens are and various types of them including various levels that could be set up).

¹⁵⁶ See generally Lewis, *supra* note 99 (explaining what Digital Tokens are and how values can be assigned to different ones). *But see* Eugene M. Katz & Theodore F. Claypoole, *Willie Sutton is on the Internet: Bank Security Strategy in a Shared Risk Environment*, 5 N.C. BANKING INST. 167, 195 (2001) (describing a bank that embraces advanced technology is also at risk encountering issues associated with the technology, creating the need for a third party vendor to manage the system so that the technology will perform properly).

¹⁵⁷ See *Blockchain Technology in Online Voting*, *supra* note 66 (explaining in detail how blockchain is used in online voting).

¹⁵⁸ Satoshi Nakamoto, *Bitcoin Open Source Implementation of P2P Currency*, P2P FOUND. (Feb. 11, 2009, 10:27 PM), <http://p2pfoundation.ning.com/forum/topics/bitcoin->

have to trust in elected leaders (and non-elected bureaucracies) and placing the trust in the code.¹⁵⁹

Using the GovernmentCoin as a platform for voting will enable electors to ensure a secure vote tally and prevent outside interference.¹⁶⁰ An open blockchain enables all to see and verify that the transactions are legitimate.¹⁶¹ A blockchain will create an audit trail that can “verify that no votes were changed or removed, and no illegitimate votes were added.”¹⁶² It is the blockchain that ensures the process – not electors or an electoral college.¹⁶³ The same process can be used for rapid voting on popular/relevant issues, and not just voting for officials.¹⁶⁴ This will allow greater individual participation in law creation and enforcement.¹⁶⁵

2. CitizenCoin

As a blockchain for citizens is created, each citizen would receive a unique cryptographic token as an ID, perhaps called CitizenCoin, which will identify them as a citizen, enable them to vote within the government system, and let them take advantage of government-distributed benefits.¹⁶⁶ This token is a piece

open-source (“With e-currency based on cryptographic proof, without the need to trust a third party middleman, money can be secure and transactions effortless.”).

¹⁵⁹ See generally *Blockchain Technology in Online Voting*, *supra* note 66 (describing how consensus protocol allows voting to be more secure).

¹⁶⁰ See, e.g., Nicolas Wenker, *Online Currencies, Real-World Chaos: The Struggle to Regulate the Rise of Bitcoin*, 19 TEX. REV. L. & POL. 145, 157 (2014) (showing a potential hacker of bitcoin on a blockchain would have to circumvent every honest block in the chain leading to the most resent transaction); *Blockchain Technology in Online Voting*, *supra* note 66 (explaining the transparency of voting through blockchain, where everyone can count the vote themselves, illegal votes cannot be added, and legal votes cannot be changed or taken away).

¹⁶¹ See Marco Iansiti & Karim R. Lakhani, *The Truth About Blockchain*, HARVARD BUS. REV. (2017), <https://hbr.org/2017/01/the-truth-about-blockchain> (discussing how blockchain will affect businesses).

¹⁶² *Blockchain Technology in Online Voting*, *supra* note 66.

¹⁶³ See KEVIN KIRBY, ANTHONY MASI & FERNANDO MAYMIA, VOTEBOOK: A PROPOSAL FOR A BLOCKCHAIN-BASED ELECTRONIC VOTING SYSTEM 2–3 (Sept. 29, 2016), <https://www.economist.com/sites/default/files/nyu.pdf> (proposing a voting system based on blockchain technology).

¹⁶⁴ Charles Brett, *ClearPoll exploits blockchain to open up polling*, ENTERPRISE TIMES (Sept. 18, 2017), <https://www.enterprisetimes.co.uk/2017/09/18/clearpoll-exploits-blockchain-to-open-up-polling/>.

¹⁶⁵ PR: *ClearPoll, A Social Public Opinion Poll System Using Blockchain, Launches Their Pre- ICO*, BITCOIN.COM (Sept. 23, 2017), <https://news.bitcoin.com/pr-clearpoll-social-public-opinion-poll-system-using-blockchain-launches-pre-ico/> (describing how the blockchain voting helps involve the public generally).

¹⁶⁶ See Julian Gottlieb, *How the technology behind Bitcoin can save our elections*, SALON (July 23, 2017, 9:00 AM), <http://www.salon.com/2017/07/23/how-the-technology-behind-bitcoin-can-save-our-elections/> (discussing how blockchain technology can be used

of software, and it authorizes the citizen to work within the government system and to work with other citizens.¹⁶⁷ Estonia did this by issuing electronic ID cards for use to access government services.¹⁶⁸ An example of this can be found in Estonia.¹⁶⁹ Their local government has begun to coordinate e-Residency through an online distributed program that issues individuals a “transnational digital identity.”¹⁷⁰ There is even an effort to erase national borders and have every individual become a “World Citizen” through the blockchain-based Bitnation.¹⁷¹ Bitnation provides various governmental benefits, including identification and notaries, as well as a scalable system of civic engagement.¹⁷²

It is also possible that a specific governmental actor’s power could depend on various factors (votes of the other members, a specific threshold number, a specific minimum number, a specific set of prerequisites).¹⁷³ In reality, the code can do whatever the coders want. The framers of the new Smart Constitution will have many codified processes and government ideals from which to draw to create a system of checks and balances.¹⁷⁴ However, the most important check will be the blockchain itself, preventing actions taken that do not conform to the established Smart Constitution. Similarly, duties of citizenship can be decided on and placed on the blockchain.¹⁷⁵ For example, taxes may be levied as soon as a payment is issued in the code or citizens will still have to pay their taxes proactively, but when they do not do so, their individual CitizenCoin will be

to create a new voting method).

¹⁶⁷ *Id.*

¹⁶⁸ See Shaun Waterman, *Nasdaq says Estonia e-voting pilot successful*, CYBERSCOOP (Jan. 25, 2017), <https://www.cyberscoop.com/nasdaq-estonia-evoting-pilot/>.

¹⁶⁹ See *id.* (discussing Estonia’s use of blockchain to establish a national e-voting system).

¹⁷⁰ DON TAPSCOTT & ALEX TAPSCOTT, *BLOCKCHAIN REVOLUTION: HOW THE TECHNOLOGY BEHIND BITCOIN IS CHANGING MONEY, BUSINESS, AND THE WORLD* 198 (2016).

¹⁷¹ *BITNATION World Citizenship ID v. 0.2*, BITNATION, <https://bitnation.co/world-citizenship-id/> (last visited May 24, 2018); Sarah Souli, *I Became a Citizen of Bitnation, a Blockchain-Powered Virtual Nation. Now What?*, MOTHERBOARD (Sept. 12, 2016, 8:00 AM), https://motherboard.vice.com/en_us/article/xyg5x7/bitnation-or-bust.

¹⁷² See *Bitnation Public Notary (BPN)*, BITNATION, <https://bitnation.co/notary/> (last visited May 24, 2018) (discussing the benefits of blockchain notarization).

¹⁷³ Wright & De Filippi, *supra* note 19, at 13, 31, 32; *If blockchains ran the world, Disrupting the trust business*, ECONOMIST (July 15, 2017), <https://www.economist.com/news/world-if/21724906-trust-business-little-noticed-huge-startups-deploying-blockchain-technology-threaten> (explaining that blockchain technology could improve the efficiency of government programs and greater transparency on behalf of the government would increase citizens’ trust in its authority).

¹⁷⁴ Shermin Voshmgir, *Blockchain & The Constitutional Bug*, MEDIUM (Mar. 15, 2016), <https://medium.com/blockchain-hub/blockchain-the-constitutional-bug-51b28fe71869>.

¹⁷⁵ See Bennett, *supra* note 146 (explaining how blockchain technology allows feasibility in carrying out citizen duties such as taxes, and voting).

blocked from using certain public amenities of which they are now in breach of contract for failure to pay.¹⁷⁶

Historically, it has been difficult to coordinate direct democracies in sovereignties with large population.¹⁷⁷ The blockchain will allow societies to coordinate to any level – large or small.¹⁷⁸ Citizens, through the permissions their individual CitizenCoins give, will be able to participate in the lawmaking or enforcement process.¹⁷⁹ With rapid and blockchain-verified digital public voting, “towns, cities, and even entire nations can be managed more directly by their population using blockchain technology.”¹⁸⁰ The creation of smart contracts (small programs that operate automatically on the blockchain and prevent individuals from breaching a contract), can guarantee even constitutional rights.¹⁸¹ Under a new blockchain paradigm, “people would be free to choose among a particular set of provisions that better reflect their underlying preferences or needs.”¹⁸²

With elected officials that represent the peoples underlying preferences may come new types of laws and governance models could be implemented at any level.¹⁸³ For example, “politicians could become unelected during their term if they fail to maintain minimum public approval levels.”¹⁸⁴ Importantly, public approval will not be based on polls that only reach a certain segment of the population.¹⁸⁵ Instead, they can reflect each citizen and give citizens a chance to explain why they disapprove.¹⁸⁶ There is room for improvement in even the best government today.¹⁸⁷ The blockchain, with its transparent and greater universal reach, can facilitate improvement.¹⁸⁸

¹⁷⁶ See *Unlocking the Blockchain*, DIGITALFUTURES <http://digitalfutures.co/digital-currency-distributed-ledger-technologies/> (last visited May 24, 2018) (explaining the changes that would occur in the tax system when it comes to paying for public amenities on the blockchain).

¹⁷⁷ Wright & De Filippi, *supra* note 19, at 18, 38.

¹⁷⁸ *Id.* at 38–39.

¹⁷⁹ *Id.* at 39; Tatar, *supra* note 64.

¹⁸⁰ Wright & De Filippi, *supra* note 19, at 38–39.

¹⁸¹ *Id.* at 50.

¹⁸² *Id.* at 41.

¹⁸³ See *generally id.* at 40–41 (explaining how because of blockchain technology new types of laws and models could be substituted with current system allowing a new style of governance between citizens and governments).

¹⁸⁴ *Id.* at 39.

¹⁸⁵ See Gottlieb, *supra* note 166 (discussing how blockchain can create a new voting system).

¹⁸⁶ Wright & De Filippi, *supra* note 19, at 39.

¹⁸⁷ See Alexander S. Blum, *Blockchain and Government: The Balancing Act*, HUFFPOST, http://www.huffingtonpost.com/entry/blockchain-and-government-the-balancing-act_us_59b5b7dee4b0bef3378ce18a (last updated Sept. 12, 2017) (discussing how blockchain technology has the potential to affect our system of governance).

¹⁸⁸ KIRBY ET AL., *supra* note 163.

A blockchain can be created so each citizen has one or more specific tokens or IDs that are unique to them.¹⁸⁹ Citizens will have access via their phone or computer to use that token within the governance system the blockchain is running.¹⁹⁰ There are already apps that connect government officials to their constituents, and blockchain could adapt these apps into Decentralized Applications (Dapps) running on the blockchain.¹⁹¹ Like Estonia, a government that already has many government functions running and guaranteed digitally,¹⁹² a CitizenCoin may contain identification, driver's license, insurance information, public transit account, banking information, contact information, etc.¹⁹³ This will be in an electronic wallet stored on the blockchain.¹⁹⁴ There are also hardware devices that operate on the blockchain and could hold the keys to

¹⁸⁹ See *Project Description*, GOLIGHTLY, <https://golightlyplus.com/portfolio-items/bitnation-world-citizenship-id-v-0-2/> (last visited May 24, 2018) (permitting any individual with access to a computer to use the "Bitnation Project" to "[b]ecome an official World Citizen through time-stamping [their] identity" and joining the blockchain); see also *If blockchains ran the world, Disrupting the trust business*, *supra* note 173 (noting how anchoring one's identity in one or more blockchains would enable people to exert greater control over their personal identity and data); Stephanie Perez, *Does Blockchain Need a Token?*, MEDIUM (Dec. 8, 2017), <https://medium.com/swlh/does-a-blockchain-need-a-token-66c894d566fb> (stating that a token is "a unit of value . . . a specific amount of digital resources which you control and can reassign control of to someone else.").

¹⁹⁰ See generally Alison DeNisco Rayome, *Why blockchain could be your next form of ID as a world citizen*, TECHREPUBLIC (June 20, 2017, 9:13 AM), <http://www.techrepublic.com/article/why-blockchain-could-be-your-next-form-of-id-as-a-world-citizen/> (explaining the development of record-keeping blockchain technology, and how it could be used to empower citizens around the world with a legal identity); Lewis, *supra* note 99 (explaining the the various forms that tokens can take on blockchains, and how they are accessed).

¹⁹¹ See Krawiec & Killmeyer, *supra* note 50 (explaining that many governments are already exploring their ability to "marshal this technology in service of [their] citizens."); *What are Dapps? The New Decentralized Future*, BLOCKGEEKS.COM, <https://blockgeeks.com/guides/dapps/> (last visited May 24, 2018) (explaining that "there might not be one definition of what a Dapp is" but pointing to "noticeable common feature of Dapps" including features such as being "Open Source", "Decentralized", "Incentivized", and having a "Protocol"); see also SWAN, *supra* note 101 (explaining the current progression trajectory of blockchain applications, including "government document registries.").

¹⁹² See TAPSCOTT & TAPSCOTT, *supra* note 170, at 197–98 (recognizing that as of 2012, ninety percent of Estonians "had an electronic ID card to access government services and travel within the European Union"); Waterman, *supra* note 168 (explaining that Estonia's e-ID program involves the issuance of an electronic token to enable its citizens secure online identity verification).

¹⁹³ See TAPSCOTT & TAPSCOTT, *supra* note 170.

¹⁹⁴ See Stan Higgins, *Bitcoin's Biggest Software Wallet Blockchain Adds Ethereum*, COINDESK (Aug. 17, 2017), <https://www.bcg.com/blockchain/seven-possible-killer-apps-for-blockchain-and-digital-tokens.html> (explaining that users can store their digital assets in their "blockchain wallets."); see also SWAN, *supra* note 101, at 3 (explaining that electronic wallet software is stored on one's computer, and "can keep a copy of the blockchain . . . as part of the decentralized scheme by which coin transactions are verified.").

the individual's electronic wallet.¹⁹⁵

B. The Constitutional Code

The code of the Smart Social Contract will determine what abilities the holder of each GovernmentCoin has.¹⁹⁶ Votes can be cast, and ensured, through GovernmentCoin.¹⁹⁷ Each GovernmentCoin could have permissions to vote.¹⁹⁸ When voters elect someone to a leadership or a bureaucratic role, that person's GovernmentCoin will receive greater privileges, and then have access to the government infrastructure (computers, vehicles, intelligence, military) assigned to the function to which they were elected.¹⁹⁹ This way something something for which the individual is responsible can be tracked to the exact individual.²⁰⁰ Additionally, an individual could be prevented from acting *ultra vires*, because the government's checks and balances are built into the system.²⁰¹

Citizens can control fiscal and physical assets over the blockchain.²⁰² The blockchain's capabilities range from governing facets of corporations such as "vehicles, safety deposit boxes, and buildings" to a government's military,

¹⁹⁵ See *How To Store Bitcoin On USB Stick*, WEUSECOINS (June 16, 2015), <https://www.weusecoins.com/how-to-store-bitcoin-USB-stick/> (listing different hardware devices that can operate on the blockchain and could be apart of the electronic wallet); see also EUROPEAN SECURITIES & MARKETS AUTHORITY, *THE DISTRIBUTED LEDGER TECHNOLOGY APPLIED TO SECURITIES MARKETS* 10–12, 18 (Feb. 7, 2017), https://www.esma.europa.eu/sites/default/files/library/dlt_report_-_esma50-1121423017-285.pdf (emphasizing the importance of key security and the risks associated with the management and storage of private keys); SWAN, *supra* note 101, at 14, 15 (explaining that users can access blockchains [devices] by presenting hardware or software tokens to match the asset . . . and that blockchain technology . . . integrates "physical-world hardware technologies with digital-based software technologies.").

¹⁹⁶ See generally De Filippi & Mauro, *supra* note 5 (explaining that on Ethereum, smart, physical assets can be linked to tokens that determine by who, and how they are used).

¹⁹⁷ *Blockchain Technology in Online Voting*, *supra* note 66 ("By casting votes as transactions, we can create a blockchain which keeps track of the tallies of the votes.").

¹⁹⁸ See generally Lewis, *supra* note 99 (explaining how tokens can be given different permissions); Atzori, *supra* note 87, at 19 (stating that "permissioned blockchains may represent . . . a valid solution for governmental online services . . . including e-vote systems.").

¹⁹⁹ See generally Lewis, *supra* note 99 (explaining how tokens can have permissions changed).

²⁰⁰ See Sweden, *supra* note 85 (explaining that tracking each entry into the blockchain can lead to greater transparency and integrity of the transaction).

²⁰¹ See Buterin, *supra* note 22 (explaining how smart contracts only allow what is already coded within them).

²⁰² See *id.* (explaining how physical property can be placed on the blockchain); Mark Staples, *Blockchain is useful for a lot more than just Bitcoin*, CONVERSATION (May 9, 2016), <http://theconversation.com/blockchain-is-useful-for-a-lot-more-than-just-bitcoin-58921> (stating that blockchain technology can be used for creating and transferring physical assets).

intelligence, and infrastructure.²⁰³ Any amount of citizen-control can be input to the political process, a blockchain-enforced Constitution can be used for any type of government structure.²⁰⁴

The specificity of the permissions depends on the designers of the particular blockchain and the voters on that blockchain.²⁰⁵ It could ensure that only soldiers with specific training can have the correlating permission granted to their GovernmentCoin.²⁰⁶ For instance, only after a drone operator has gone through the training would they be able to unlock a drone's capacity to fly in a combat zone.²⁰⁷ This applies to the highest levels of government as well.²⁰⁸ For instance, the President of the United States could be powerless to keep troops in a foreign land after 60 days, because his GovernmentCoin permissions to launch the ships would revert to Congress after that.²⁰⁹ This would ensure the procurement of Congressional approval or the troops would return.²¹⁰ Through the Internet of Things, the permissions of the President to a Private could be turned off, taking the ability to launch nuclear weapons or to fire a single bullet off the table for a government actor without the proper permissions.²¹¹

This level of widespread information and power would be easily hacked or used improperly if it were based on a centralized system, or relied on the central government to verify every transaction.²¹² The blockchain keeps the government

²⁰³ Buterin, *supra* note 22; *see also* SWAN, *supra* note 101, at 38–39 (explaining the many “legal and civic applications” for which blockchain can be used).

²⁰⁴ *See generally* Buterin, *supra* note 22 (explaining how smart contracts are like regular contracts and must be agreed upon); SWAN, *supra* note 101, at 24 (stating that “a Dapp might adopt more complicated functionality such as a constitution, which would outline its governance publicly on the blockchain.”).

²⁰⁵ *See generally* Smart Contracts: The Blockchain Technology that Will Replace Lawyers, BLOCKGEEKS, <https://blockgeeks.com/guides/smart-contracts/> (last visited May 24, 2018) (explaining that smart contracts, like regular contracts, require specific language and functionality before they are implemented).

²⁰⁶ *See id.* (describing how contracts only operate when conditions are met).

²⁰⁷ *See id.* (describing, through examples, how contracts only operate when conditions are met).

²⁰⁸ *See* Wright & De Filippi, *supra* note 19, at 18, 20, 23, 57 (addressing potential blockchain implications on United States and foreign central banking systems, various state and federal governments, and the judiciary system). *See generally* Bogost, *supra* note 87 (referencing the interests shown by the Federal Reserve and other central banks, and presenting hypotheticals of state legislatures or other countries mandating crypto platforms).

²⁰⁹ *See* Bogost, *supra* note 87 (posing a hypothetical about failing to fulfill certain requirements (e.g. not having enough bitcoins), which could result in a loss of permissions (e.g. shutting down your car)).

²¹⁰ *See* Smart Contracts: The Blockchain Technology that Will Replace Lawyers, *supra* note 208 (describing, through examples, how contracts only operate when conditions are met).

²¹¹ *See id.* (explaining the conditional nature of contracts).

²¹² *E.g.*, Wright & De Filippi, *supra* note 19, at 13–14 (“[V]oters could verify that their

system going because it is decentralized, based on cryptographic proofs, and publicly recorded.²¹³ Estonia's system, for example, ensures "it is impossible for the government to lie to its citizens" because "stakeholders can see who has accessed which information, when, and what they may have done with it."²¹⁴ So, even if the citizens of a blockchain-based state did not want to take the ability of a Private to use a rifle, they would know exactly which private unlocked which rifle and when that rifle was used.²¹⁵

C. Multisig and Government Interaction

Vitalik Buterin, in describing how this blockchains will affect financial systems, states the 'question of "where do you store your funds?" will be dead.²¹⁶ Instead, the question will be, "what are the withdrawal conditions of this account, and what is the policy of each key?"²¹⁷ When multi-sig verification is applied to a government, or even just our tax dollars, the issue is no longer trying to determine which government department gets how much money."²¹⁸ The issue instead will be to determine which government department can appeal to enough taxpayers to keep providing its services."²¹⁹

There are domestic examples of where multi-sig and blockchain technology will keep a state's police powers in check.²²⁰ Police forces are increasing their

own votes were counted," and encryption would allow such a voting system to be resistant to hackers. Further "[e]lections and proxy fights would no longer need to rely on the fallibility of paper and hanging chads" as mobile devices would provide a safe and sufficient alternative).

²¹³ Vitalik Buterin, *The Meaning of Decentralization*, MEDIUM (Feb. 6, 2017), <https://medium.com/@VitalikButerin/the-meaning-of-decentralization-a0c92b76a274>; Wright & De Filippi, *supra* note 19, at 7–8 (explaining the proof of work system inherent in blockchain technology, which relies on public consensus in order to verify transactions).

²¹⁴ TAPSCOTT & TAPSCOTT, *supra* note 170, at 199 n.3; Waterman, *supra* note 168.

²¹⁵ Clare McDonald, *Governments Consider Use Cases for Blockchain*, COMPUTERWEEKLY.COM (Aug. 3, 2017), <http://www.computerweekly.com/news/450300763/Government-considers-use-cases-for-blockchain>.

²¹⁶ Vitalik Buterin, *Bitcoin Multisig Wallet: The Future of Bitcoin*, BITCOIN MAG. (Mar. 13, 2014), <https://bitcoinmagazine.com/articles/multisig-future-bitcoin-1394686504/>.

²¹⁷ *Id.*

²¹⁸ *See id.* (discussing the future of cryptocurrency); Stan Higgins, *US Central Bank Chair: Blockchain Could Have 'Significant' Impact*, COINDESK (Sept. 28, 2016), <https://www.coindesk.com/us-fed-yellen-blockchain-impact/> (discussing how the central bank will incorporate cryptocurrency).

²¹⁹ *See* Buterin, *supra* note 216 (discussing how multi-sig is being used in practice); Higgins, *supra* note 218 (discussing how the central bank will incorporate cryptocurrency).

²²⁰ *See* Charles C. Marshall, *State Police Powers and Federal Property Guarantees*, 4 COLUM. L. REV. 153, 158 (1904) (discussing the State's police powers); Svihart, *supra* note 140 (discussing how blockchain technology can be used to limit the state of Arizona's police power).

use of body cameras in the United States.²²¹ Many police forces and civil rights advocates are in favor of this.²²² However, some departments are trying to keep control over the recordings.²²³ If the recordings were on the blockchain and had a multisig protocol, then they could have the option to only play recordings on the condition there were representatives of both sides or various human rights representatives watching.²²⁴ That way, the police will be unable to sweep indiscretions under the rug.²²⁵ Remember, on the blockchain this will all be encrypted and only viewed with representatives from all interested parties.²²⁶ This ensures that the government will not record and use individual data for big-data purposes, but attorneys for the police or the defense who will be able to recognize and subpoena more witnesses based on the information in the recordings.²²⁷

Not only could multisig limit the actions that a government can take through requiring consensus, but it can also limit a government's ability to act with

²²¹ See Barak Ariel, *Police Body Cameras in Large Police Departments*, 106 J. CRIM. L. & CRIMINOLOGY 729, 730–31 (2016) (discussing the increased use of body cameras by police in America).

²²² See Wesley G. Jennings et al., *Cops and Cameras: Officer Perceptions of the Use of Body-Worn Cameras in Law Enforcement*, 42 J. CRIM. JUST. 549, 549 (2014) (discussing the supportive perspective towards body cameras use in policing).

²²³ See Associated Press, *Lawsuit Challenges NYPD Body Camera Policy*, N.Y. POST (Apr. 21, 2017, 1:40 AM), <http://nypost.com/2017/04/21/lawsuit-challenges-nypd-body-camera-policy/> (explaining New York's attempt at having control over their body cameras' recordings and the class action suit against the New York Police Department, seeking a court ordered requirement for police encounters to be recorded and made public).

²²⁴ See Bela Gipp, Kosti Jagrut & Corinna Breitingner, *Securing Video Integrity Using Decentralized Trusted Timestamping on the Blockchain*, PROCEEDINGS IN 10TH MEDITERRANEAN CONF. ON INFO. SYS 1 (2016) <https://www.gipp.com/wp-content/papercite-data/pdf/gipp2016a.pdf> (discussing the use of blockchain technology to secure the integrity of video files).

²²⁵ See Peter Hermann, *Baltimore Police Investigate Officers After One Seen Putting Bag of Drugs at Scene*, WASH. POST (July 19, 2017), https://www.washingtonpost.com/local/public-safety/baltimore-police-investigate-officers-after-one-seen-putting-bag-of-drugs-at-scene/2017/07/19/148986c2-6ca5-11e7-9c15-177740635e83_story.html?utm_term=.c1d31e794485 (demonstrating police abusing the power of body cameras); Erica R. Hendry & Joshua Barajas, *Three Police Misconduct Cases - All Involving Body Cameras - Had New Developments This Week. Here's What Happened*, PBS (2017), <https://www.pbs.org/newshour/nation/three-police-misconduct-cases-involving-body-cameras-new-developments-week-heres-happened> (discussing several misuses of body cameras by police departments in the United States).

²²⁶ See Kevin Petrasic, *Beyond Bitcoin: The Blockchain Revolution in Financial Services.*, WHITE & CASE (Mar. 7, 2016), <https://www.whitecase.com/publications/insight/beyond-bitcoin-blockchain-revolution-financial-services> (discussing private blockchains).

²²⁷ See Gipp et al., *supra* note 224, at 3 (providing an example how blockchains can ensure individual data is not recorded by the government).

impunity.²²⁸ When certain governmental powers require civilian CitizenCoin to sign off on them (such as the review of a police recording), self-interested organizations that were previously able to sweep information under the rug will not trample on individual civil rights.²²⁹

The internet-based blockchain will increase the speed of decision-making of the government and will include the citizenry in more decision-making.²³⁰ Likewise, it will limit the government's decisions by controlling access to government assets.²³¹ Part of the blockchain that may limit government actors will be "by distributing decision-making power to multiple parties using multiple signature (multisig) code, which prevents the execution of an action until multiple parties agree to a transaction."²³² Essentially, a unitary actor will make fewer decisions because the costs of distributing the decision are lower, and the people in a blockchain democracy will have a greater say about more issues more often.²³³

Multisig can be used across the entire network based on a leaders' overall power on their approval ratings.²³⁴ For instance, an elected official may have

²²⁸ See *id.* at 1–4 (discussing the services to be offered through blockchain and how it can limit a government's ability to act with impunity).

²²⁹ See Radly Balko, *A New Report Shows the Limits of Police Body Cameras*, WASH. POST (Feb. 5, 2016), https://www.washingtonpost.com/news/the-watch/wp/2016/02/05/a-new-report-shows-the-limits-of-police-body-cameras/?utm_term=.d644146b5761 (discussing civil libertarian groups concern about the privacy of people caught in body camera footage and important questions about public access, review, storage, tampering and disciplinary action for officers who don't use the devices properly).

²³⁰ See Potter, *supra* note 101 (discussing the potential to make government operations more efficient and improve the delivery of public services). See generally SWAN, *supra* note 101 (discussing the different features available to citizens using Bitcoin 1.0, 2.0, and 3.0).

²³¹ See McDonald, *supra* note 215 (discussing the Deputy Governor of the Bank of England support for blockchain and the positive impact it will have on public trust of government functions); Meridith Hobbs, *Once Shadowy Blockchain Is a New Practice for Morris Manning & Martin*, DAILY REPORT (Oct. 16, 2017) (discussing how blockchain has the potential to disrupt any online business or industry managed by a central gatekeeper such as the government because the distributed computing platform allows the activity of the users to create and maintain the market).

²³² Wright & De Filippi, *supra* note 19, at 16 n.20; see Buterin, *supra* note 213 (discussing the benefits of decentralization and providing examples such as preventing collusion); Hobbs, *supra* note 231 (discussing how blockchain has the potential to disrupt any online business or industry managed by a central gatekeeper such as the government because the distributed computing platform allows the activity of the users to create and maintain the market).

²³³ See Buterin, *supra* note 213 (discussing decentralized systems are less likely to fail accidentally because they rely on many separate components that are not likely); SWAN, *supra* note 101 (discussing the prevalence of decentralized models).

²³⁴ TAPSCOTT & TAPSCOTT, *supra* note 170, at 202; see Ian DeMartino, *NXT Teases Voting System 'Two Phase Transactions' and a Foundation*, COIN TELEGRAPH (Feb. 3, 2015), <https://cointelegraph.com/news/nxt-teases-voting-system-two-phase-transactions-and-a-foundation> (discussing how multisig technology will impact the political voting

certain inherent powers and other powers unlocked only if the voting GovernmentCoin or citizens decide.²³⁵ The multisig code will not allow an official act outside the mandate in real time if they cannot convince enough GovernmentCoin holders that what they want to do is in the citizenry's best interests.²³⁶ Once a critical mass of GovernmentCoin tokens vote in favor (give their approving signature), the multisig code will process and allow the official to act in the manner they described.²³⁷ Simply put, the citizens will have greater power, and because blockchain is inherently scalable, it could wield that power more often than just once every few years.²³⁸

The multisig code can ensure that elected leaders only operate within their mandate and that their mandate includes achieving consensus among leadership and approval from the citizenry.²³⁹ An official may be able to do some things (like issue "decrees" without enforcement possibilities) with a simple majority of the voters lending their codified support on the blockchain.²⁴⁰ An official may

structure); *see also* SWAN, *supra* note 101 (offering examples of private industry use of Multisig that may be applied to government such as stocks, bonds, futures, and loans).

²³⁵ *See* Prisco, *supra* note 30 (discussing fresh ideas on how bitcoin can be used to increase government accountability, transparency and citizen participation); DeMartino, *supra* note 234 (discussing the large number of customization options that make virtually any kind of voting poll possible); *see also* Alex Tapscott, *Blockchain Democracy: Government of the People, by the People, for the People*, FORBES (Aug. 16, 2016), <https://www.forbes.com/sites/alextapscott/2016/08/16/blockchain-democracy-government-of-the-people-by-the-people-for-the-people/#52b1adc94434> (explaining the ways in which blockchain can be applied to government, such as allowing voters to trace exactly who donated to a candidate's campaign, even when through a SuperPAC).

²³⁶ *See* Prisco, *supra* note 30 (discussing the open government innovation initiative aimed at improving the internal operations of government agencies through blockchain technology); *see also* Tapscott, *supra* note 235 (explaining the ways in which blockchain can be applied to government).

²³⁷ A historical analogue to this would be the ratification of the 27th Amendment to the US Constitution that came into effect nearly 203 years after it was initially proposed, because the State legislatures had not all voted for it. It remained open to ratification indefinitely until the minimum number of states required ratified it. *See* Prisco, *supra* note 30 (noting the Association believes that blockchain technology, Bitcoin, distributed ledgers and cryptocurrencies will fundamentally transform how the government interacts with its constituent).

²³⁸ *See generally* John Palfreyman, *Blockchain for Government: Building Trust, Demolishing Bureaucracy*, IBM (Feb. 1, 2017), <https://www.ibm.com/blogs/blockchain/2017/02/blockchain-government-building-trust-demolishing-bureaucracy/>.

²³⁹ *See generally id.* (discussing how the governments must create, update and enforce regulations, which often cross departmental and national borders and that once agreed through consensus and deployed as smart contracts onto the blockchain, they can be automatically enforced).

²⁴⁰ *See* DeMartino, *supra* note 234 (discussing the large number of customization options that make virtually any kind of voting poll possible).

be able to do other things requiring a two-thirds majority (like agree to a treaty, or pass a law).²⁴¹ Another option for an official would be to require unanimity (like launch a nuclear first strike).²⁴² Rather than this being written in lovely cursive on parchment, subject to being ignored by a powerful Executive branch, this will be encoded on the blockchain and tied to every asset of the government.²⁴³ Simply put, checks and balances, whatever the framers decide, will be inviolable *ex ante*.²⁴⁴ For example, in the U.S. a treaty requires a two-thirds majority of the Senate to become binding law.²⁴⁵ However, there are many instances where the President has signed an international agreement without any input from the Senate.²⁴⁶ This is not a treaty, but instead an Executive Agreement, something the U.S. Constitution does not mention.²⁴⁷ If multisig technology encoded the current model of the U.S. Constitution on a blockchain and two-thirds of the Senators did not give their GovernmentCoin token permission to the treaty, it would not become law because the blockchain would not recognize it as a proper transaction.²⁴⁸ This would prevent the President from acting outside of his or her powers.²⁴⁹ Under the current system, government

²⁴¹ *Id.*; Robert Longley, *What is a Supermajority Vote in US Congress?*, THOUGHTCO (Oct. 3, 2017), <https://www.thoughtco.com/the-supermajority-vote-in-us-government-3322045> (discussing the “supermajority” voting procedure utilized by the United States government).

²⁴² Tapscott, *supra* note 235 (discussing how blockchain technology can enforce transparency with the government, allow all citizens access to review documents (which would unveil corruption and spying on citizens), reduce unreasonable force from the government, and educate all citizens on political activities).

²⁴³ *Id.* (discussing how blockchain technology can enforce transparency with the government, allow all citizens access to review documents (which would unveil corruption and spying on citizens), reduce unreasonable force from the government, and educate all citizens on political activities).

²⁴⁴ *See id.* (stating that checks and balances are necessary for a functioning government).

²⁴⁵ U.S. CONST. art. II, § 2, cl. 2.

²⁴⁶ *International Agreements Without Senate Approval*, JUSTIA, <https://lawjustia.com/constitution/us/article-2/20-international-agreements-without-senate-approval.html> (last visited May 24, 2018).

²⁴⁷ *See How Blockchain Improves Governemnt Processes and Procedures All Around the World*, IOTCORESOFT (Nov. 16, 2017), <https://www.iotcoresoft.com/iot-knowledge-center/how-blockchain-improves-government-processes-and-procedures-all-around-the-world> (stating that executive agreements make it possible for the president to make international agreements without Congress); *Treaty v. Executive Agreement*, U.S. DEP’T OF STATE, <https://www.state.gov/s/l/treaty/faqs/70133.htm> (last visited May 24, 2018).

²⁴⁸ Niall Firth, *Want to Make Democracy Really Count? Stick a Blockchain on It*, NEW SCIENTIST (Sept. 6, 2017), <https://www.newscientist.com/article/mg23531424-500-bitcoin-tech-to-put-political-power-in-the-hands-of-voters/>.

²⁴⁹ *The Senates Role in Treaties*, U.S. SENATE <https://www.senate.gov/artandhistory/history/common/briefing/Treaties.htm> (last visited May 24, 2018); *see also* Tapscott, *supra* note 235 (explaining that blockchain technology would create a system where politicians would have to operate as a “peer amongst peers”); *Checks, Balances, and Bitcoin: The Genius of Blockchain*, MX TECH (2016),

actors can take advantage of the lack of specificity in the Constitution and invent powers for their office.²⁵⁰ Under a blockchain system, the blockchain would not recognize invented powers, and the blockchain-connected Smart Property would not function unless the relevant GovernmentCoin and/or CitizenCoin holders voted and approved it.²⁵¹

Multisig will be a method of ensuring that various branches of government do not operate *ultra vires*.²⁵² There is much debate as to whether US troops operating in Iraq or Syria is lawful under the U.S. Constitution regardless of the international law implications.²⁵³ The Constitution says that Congress declares war, not the President.²⁵⁴ However, presidents have called war by other names to have *de facto* conflicts all around the world.²⁵⁵ When a government's powers are connected to a blockchain, governmental actors will not be able to act unilaterally unless previously given the power to do so.²⁵⁶ A President will simply be unable to send troops, launch missiles, or act aggressively toward another State without Congress's declaration of war (or perhaps even the approval of the voters on the blockchain).²⁵⁷ The transports, missiles, and other material will have unique tokens on the blockchain (anything that can be connected to the Internet can be controlled through blockchains), and with multisig protocols will be physically unable to operate without requisite governmental checks and balances.²⁵⁸

In addition to requiring multiple actors to approve of a GovernmentCoin transaction, the blockchain is inherently transparent.²⁵⁹ This allows for greater

<https://www.mx.com/moneysummit/checks-balances-and-bitcoin-the-genius-of-the-blockchain>.

²⁵⁰ *International Agreements Without Senate Approval*, *supra* note 246.

²⁵¹ *The Senates Role in Treaties*, *supra* note 249; *see also* Tapscott, *supra* note 235; Brian Forde, *Using Blockchain to Keep Public Data Public*, HARV. BUS. REV. (Mar. 31, 2017), <https://hbr.org/2017/03/using-blockchain-to-keep-public-data-public>.

²⁵² *See* Tapscott, *supra* note 235; *Checks, Balances, and Bitcoin: The Genius of Blockchain*, *supra* note 249.

²⁵³ *See* Michael J. Glennon, *Smith v. Obama: The Political Question Doctrine Misapplied*, JUST SECURITY (Nov. 22, 2016), <https://www.justsecurity.org/34803/smith-v-obama-political-question-doctrine-misapplied/>; U.S. CONST. art. II, § 2, cl. 2.

²⁵⁴ U.S. CONST. art. I, § 8, cl. 11.

²⁵⁵ U.S. CONST. art. II, § 2, cl. 2.

²⁵⁶ Ben Dickson, *Blockchains Brilliant Approach to Cybersecurity*, VENTUREBEAT (Jan. 22, 2017), <https://venturebeat.com/2017/01/22/blockchains-brilliant-approach-to-cybersecurity/>; Forde, *supra* note 251.

²⁵⁷ *See* Tapscott, *supra* note 235; Forde, *supra* note 251.

²⁵⁸ Dickson, *supra* note 256; Forde, *supra* note 251.

²⁵⁹ *See* Tapscott, *supra* note 235 (stating that blockchain would require politicians to operate in "broad daylight"); *see also* Steven Chang, Matthias Daub, Axel Domeyer & Martin Lundqvist, *Using blockchain to improve data management in the public sector*, MCKINSEY (Feb., 2017), <https://www.mckinsey.com/business-functions/digital->

openness and citizen oversight.²⁶⁰

V. CONCLUSION

The inherent consensus-seeking, scalability, and decentralization make blockchain computing the next step in evolution for public governance.²⁶¹ Controlling a government's institutions by connecting them to a blockchain system will create greater oversight of the government, and will prevent government actors from acting beyond their mandate.²⁶² The blockchain-encoded Smart Constitution will provide specific powers and limitations, and the code controls what each actor can do, and that they must request voter permission to change those limitations.²⁶³ Multisignature technology ensures there is consensus among leaders and potentially among citizens as well.²⁶⁴ When attached to government property, blockchain computing allows for potentially unlimited checks and balances on a government.²⁶⁵ Wright and De Filippi state, “[a] person who qualifies as the technological owner (as opposed to the legal owner) of smart property enjoys absolute sovereignty over that resource, which cannot be seized by anyone unless specifically provided for by the underlying code.”²⁶⁶ Indeed, “every piece of property could be tied to a potential kill switch” that the people control, meaning that when government resources and property are connected to the blockchain, each citizen could exercise actual power over their government.²⁶⁷

mckinsey/our-insights/using-blockchain-to-improve-data-management-in-the-public-sector.

²⁶⁰ See Tapscott, *supra* note 235 (explaining that blockchain allows for inclusion of all citizens across government and greater transparency); Chang et al., *supra* note 259.

²⁶¹ Wright & De Filippi, *supra* note 19, at 36.

²⁶² *How Blockchain Improves Governemnt Processes and Procedures All Around the World*, *supra* note 247; see Samantha Rodocchia, *How Blockchain Could Eventually Change the Way that Governments Function*, FORBES (Nov. 29, 2017), <https://www.forbes.com/sites/quora/2017/11/29/how-blockchain-could-eventually-change-the-way-governments-function/#4dd14b2313d5> (explaining that blockchain can improve transparency and increase compliance).

²⁶³ See generally Tapscott, *supra* note 235 (arguing that if governments embraced blockchain there would be specific powers and limits they would have over citizens); *Checks, Balances, and Bitcoin: The Genius of Blockchain*, *supra* note 249.

²⁶⁴ SWAN, *supra* note 101, at 45 (“The blockchain-as-an-information-technology idea is further underscored in blockchain governance as a new, more efficient system for organizing, administering, coordinating, and recording all human interactions, whether business, government, or personal.”).

²⁶⁵ See, e.g., Forde, *supra* note 251 (“Regulations, which specify how to execute laws in much more detail, should be regarded . . . as a constantly updated tool set to achieve the outcomes specified in the laws.”).

²⁶⁶ Wright & De Filippi, *supra* note 19, at 35.

²⁶⁷ *Id.*; see also Cathy Reizenwitz, *Smart contracts promise for the Poor*, BITCOIN MAG. (Jan. 27, 2014), <https://bitcoinmagazine.com/articles/smart-propertys-promise-poor-1390852097/> (“Smart Property makes it possible for locks to change automatically the

moment a renter violates their lease agreement. And makes possible for a car to refuse to start the moment a payment is late. Most importantly, it does so on a trustless basis.”); Chang, et al., *supra* note 259.