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Leveraging Blockchain Technology in Property Records: Establishing Trust in a Risk-Filled Market

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**LEVERAGING BLOCKCHAIN TECHNOLOGY IN PROPERTY
RECORDS: ESTABLISHING TRUST IN A RISK-FILLED MARKET**

*Maksymilian Ewendt**

Blockchain technology has the potential to impact systems and processes across a broad spectrum of industries, including government functions. Several countries are currently exploring the application of blockchain technology to real property record management to take advantage of the security and ease that the platform can foster. Benefits may include lowered transaction costs, more secured parties to transactions, and less property title disputes. The United States has an opportunity to observe the successes and hurdles that these other countries encounter and to determine whether blockchain technology is an appropriate medium to overhaul the current title management system. Substantial time and costs would accompany such a transition, but the wide-reaching and long-term benefits may justify such a move.

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Real property is one of the earliest recognized components of modern society. It is a concept of freedom and wealth that goes back to the Roman Empire and English Feudalism.¹ Although society's reliance on both property and technology has expanded to accommodate a globalized market, the underlying process for property management remains largely unchanged.² Maintaining property records in 2017 is not all that different than at English common law; it is subject to the same challenges that existed at English common law, albeit on a much larger scale. Fraud, human error, ancillary expenses, and lengthy transaction times are all prevalent in modern property transactions.³ However, blockchain technology provides the opportunity to disrupt business practices and improve previously stymied processes, including the entire property record system by digitizing trust for transactions.

This Recent Development seeks to explore the information available about incorporating blockchain technology as new options become available for the United States to evolve the real property record system. Part II introduces blockchain technology and its evolution while dispelling several common misconceptions surrounding the technology. Part III gives an overview of the current real property records landscape including current practices and challenges. Part IV explores forays into using blockchain technology for real property records in other countries, considering both the justifications and results of such programs. Part V examines the potential impact a blockchain-based real property system could

¹ See Paul J. Larkin, Jr., *The Original Understanding of "Property" in the Constitution*, 100 MARQ. L. REV. 1 (2016).

² See S.H. Spencer Compton & Diane Schottenstein, *Blockchain Technology and Its Applicability to the Practice of Real Estate Law*, 2017 EMERGING ISSUES 7512 (Mar. 17, 2017).

³ Joyce Palomar, *The War Between Attorneys and Lay Conveyancers – Empirical Evidence Says 'Cease Fire!'*, 31 CONN. L. REV. 423, 504, 507 (1999).

have in the United States and considers several possible methods of implementing such a system.

II. BACKGROUND

Blockchain technology is a distributed digital ledger system.⁴ The system is considered to be distributed because, rather than relying on a central authority, such as a bank or government agency, transactions are completed and verified by participants throughout a network.⁵ Blockchain systems employ a decentralized design and multiple verification points, two revolutionary features that inherently protect all parties to a transaction.⁶ By design, blockchain technology makes transactions secure during the transfer and difficult to change after they occur.⁷

Conceptually, blockchain technology functions exactly as the name suggests. For any given data set, there is a “block” of data points.⁸ Similar to the law of conservation of mass,⁹ once this block is created, data points cannot be added or removed, although they may be modified through transactions.¹⁰ The transactions involving the data points stem directly from the original block and can be directly linked all the way back to that first data set. The data points involved in each transaction then comprise a smaller, unique sub-block of their own, ready for another transaction to stem from the data points within.¹¹ If presented visually, there is a block of data with chains of transactions all connected to that block.

The proceeding two subsections compare and distinguish blockchain conceptually, while considering some of the more

⁴ See Compton & Schottenstein, *supra* note 2.

⁵ See *id.*

⁶ *Id.* A decentralized ledger allows for disparate parties to view and monitor transaction history. Multiple verification points reduce the trust instilled in a central entity while creating checks and balances. *Id.*

⁷ *Id.*

⁸ Hilary J. Allen, *Is Bitcoin? BITCOIN?*, 76 MD. L. REV. 877, 882 (2017).

⁹ *Conservation of Mass*, MERRIAM-WEBSTER, <https://www.merriam-webster.com/dictionary/conservation%20of%20matter> (last visited Nov. 4, 2017).

¹⁰ Garry Gabison, *Policy Considerations for the Blockchain Technology Public and Private Applications*, 19 SMU SCI. & TECH. L. REV. 327, 329 (2016).

¹¹ See Compton & Schottenstein, *supra* note 2.

commonly known blockchain applications, in order to gain a better understanding of the technology for the property focused discussion that follows. The analysis in these sections is not reflected in the conclusion.

Blockchain technology is currently most used in the financial sector.¹² Its biggest application, with a market capitalization of more than \$150 billion, is in cryptocurrencies.¹³ As their name suggests, cryptocurrencies are encrypted currencies that employ the decentralized ledger of blockchain to create a secure, anonymous virtual currency. Cryptocurrency is not the final product. Rather, it is a protocol incorporating blockchain technology that can be used to create virtual currency.¹⁴

Because blockchain technology is such a recent creation, terminology has often been misused in describing its various applications. Therefore, to properly consider the technology component and its potential value across a variety of applications, it is important to make the distinction between blockchain technology from its most well-known application—cryptocurrencies. Members of the financial sector who create cryptocurrencies use blockchain to accomplish their goals of secure and legal tender, but there is nothing inherent about blockchain that ties it to currencies.

When contemplating cryptocurrencies as a blockchain technology, it is important to note that one of cryptocurrencies' defining features—the use of accounts made anonymous via encryption—is not actually a requirement of blockchain technology.¹⁵ While it is useful in the application for cryptocurrencies, this configuration can be different for more public uses.¹⁶ One way that encryption is utilized in cryptocurrencies is as

¹² Dario de Martino & Spencer Klein, *Don't Want to Be the Next Kodak? Embrace Blockchain*, LAW360 (Sept. 6, 2017), <https://www.law360.com/articles/960825/don-t-want-to-be-the-next-kodak-embrace-blockchain>.

¹³ *See id.*

¹⁴ Sarah Jane Hughes & Stephen T. Middlebrook, *Advancing a Framework for Regulating Cryptocurrency Payments Intermediaries*, 32 YALE J. ON REG. 495, 505 (2015).

¹⁵ Gabison, *supra* note 10, at 341.

¹⁶ *Id.*

an added level of privacy for the users.¹⁷ Much like how individuals would not like others being able to see what is in their physical wallets, cryptocurrency users would like their digital wallets to remain private as well. The downside to the encryption component of cryptocurrencies is the ability for individuals to use the technology to conduct nefarious activities.¹⁸ The encrypted identities of individuals' digital wallets enable people to fund terrorists and criminals in an anonymous and secure way not possible before cryptocurrencies became accessible.¹⁹

Cryptocurrencies are created and then distributed by companies, each with their own proprietary components. The most notable cryptocurrency, and therefore most notable blockchain, is Bitcoin.²⁰ While it is important to understand Bitcoin in the discussion of blockchain to analogize its uses and the regulations that follow, it is equally important to dispel the often-stated assumption that Bitcoin is blockchain technology. Being a cryptocurrency, as mentioned above, Bitcoin does leverage blockchain and, in doing so, has established a market for blockchain while also being the first to push boundaries in usage and regulation.²¹ While countries like China, Iceland, and Thailand have gone so far as to prohibit the use of Bitcoin as a currency, most other countries facing the use of cryptocurrencies have taken a "wait-and-see" approach to establishing regulations.²² The United States falls into that category, stuck between not knowing how to regulate Bitcoin as a new

¹⁷ Paul H. Farmer Jr., Note and Comment, *Speculative Tech: The Bitcoin Legal Quagmire & the Need for Legal Innovation*, 9 J. BUS. & TECH. L. 85, 89–90 (2014).

¹⁸ Eric Engle, *Is Bitcoin Rat Poison? Cryptocurrency, Crime, and Counterfeiting (CCC)*, 16 J. HIGH TECH. L. 340, 343–45 (2016).

¹⁹ See *id.*

²⁰ Divya Joshi, *List of Top Virtual Currencies in 2017 and What Differentiates Them*, BUSINESS INSIDER (Oct. 19, 2017), <http://www.businessinsider.com/list-top-cryptocurrencies-analysis-comparison-2017-10>.

²¹ See Tara Mandjee, *Bitcoin, Its Legal Classification and Its Regulatory Framework*, 15 J. BUS. & SEC. L. 1, 5–7 (2015). Due to the private and decentralized nature of Bitcoin, countries have struggled to regulate Bitcoin because it is difficult to define the market in which it would be traded. *Id.*

²² Kevin V. Tu & Michael W. Meredith, *Rethinking Virtual Currency Regulation in the Bitcoin Age*, 90 WASH. L. REV. 271, 301–03 (2015).

commodity while also not knowing exactly how to apply existing laws to such a new “thing.”²³

For a brief and general overview, Bitcoin releases a block of data points, called Bitcoins, that the market assigns a value to for use in commerce.²⁴ The concept of an electronic currency may seem far-fetched in a country where the economy and value of the dollar are somewhat stable. However, the value of a government’s currency is based on trust. Up until 1971, the U.S. dollar was backed by gold reserve or a convertible into gold.²⁵ Since then, the value of the U.S. dollar is based on trust in the U.S. government that those pieces of paper will continue to have value.²⁶ Consider, then, countries that have recently been through political and economic turmoil, such as Greece and Argentina, whose citizens have lost trust in their governments’ ability to back their currencies, and therefore have seen the value of those currencies plummet.²⁷ A cryptocurrency like Bitcoin relies less on a country’s stability.²⁸ Instead, Bitcoin, like other cryptocurrencies, retains value independently, with trust being held in the value that the digital marketplace has established for the currency, regardless of national borders.²⁹ Rather than being in a situation where an individual’s money has no value in the particular country that issued the currency, that money in a cryptocurrency would retain its value not only in that country but also in other countries where the cryptocurrency is used, too.³⁰ These core attributes that make blockchain technology so impactful in the

²³ *Id.* at 304–05 (discussing Bitcoin being classified as “property,” intangible or otherwise, and its applicability to current computer related crimes).

²⁴ Gabison, *supra* note 10, at 327–28.

²⁵ Lan Cao, *Currency Wars and the Erosion of Dollar Hegemony*, 38 MICH. J. INT’L L. 57, 60 (2016).

²⁶ *Id.* at 57 (adding that in addition to just trust, the “United States has guaranteed Saudi Arabia’s security in exchange for Saudi support for the dollar as the sole medium of exchange for energy exports,” meaning that any purchase of Gulf oil must be done in U.S. dollar, ensuring global demand for the dollar).

²⁷ Allen, *supra* note 8, at 898–99.

²⁸ *Id.* at 905.

²⁹ *Id.* at 883–84.

³⁰ *See generally id.* Because the value of a cryptocurrency would be built upon a value established by those who accept cryptocurrencies across borders, the value would not be reliant on a country’s economic health. *Id.*

financial sector can be applied to other sectors, possibly with as drastic results.

III. THE CURRENT PROPERTY RECORD SYSTEM

Real property is a segment of the economy that holds a tremendous amount of wealth, similar to currency, and similarly could be primed for an influx of technological innovation. While technology components have been added to the process of recording real property transactions, the system itself still mirrors the processes in place from the 18th century.³¹ The land seller and buyer come together at a closing to prove that they are, in fact, the seller and the buyer and that the title being transferred is what it is claimed to be.³² Witnesses are required to validate that these claims are made, typically now in the presence of an attorney.³³ Finally, a record of that transaction is documented in a land registry, usually at the county level.³⁴

The use of electronic databases and the internet to store and access the property registry have made the real estate transaction process more convenient and perhaps more efficient. However, these components are simply a digital substitute for certain aspects of the original process. The property transactions themselves still rely heavily on human action for repeated data entry and verification, which opens the door for human error.³⁵ While the element of human error is lauded in existential philosophy and the game of baseball, it can have a catastrophic impact on property title management.³⁶

A challenge that arises with the human element of these transactions is the cost of trust in the system.³⁷ The current system relies on a central entity, often county government, to maintain the

³¹ See Compton, *supra* note 2.

³² See Abraham Bell & Gideon Parchomovsky, *Of Property and Information*, 116 COLUM. L. REV. 237 (2016).

³³ *Id.*

³⁴ *Id.*

³⁵ See Dean Arthur R. Gaudio, *Electronic Real Estate Records: A Model for Action*, 24 W. NEW ENG. L. REV. 271, 277 (2002).

³⁶ Discussed more fully *infra* Part III.

³⁷ Joshua A.T. Fairfield, *Bitproperty*, 88 S. CAL. L. REV. 805, 813–14 (2015).

registry of property transfers.³⁸ A copy of the deed from the closing is physically filed at the county registry and, in some jurisdictions, it is also uploaded to an electronic index.³⁹ Users of that system, such as buyers and sellers, have to trust that the registry of the transactions (that are manually entered) are both accurate and secure. This unchecked human element of this process within a centralized ledger exposes the buyer and seller to risk. In some states, if the clerk records the deed improperly, the deed is simply not recorded.⁴⁰ While the central entity takes on the expense of verification, that cost is generally passed on to the users.⁴¹

Due to real property's high value, an entire market of title insurance has emerged in response to discrepancies that arise in paper-based property transactions and the value of the subject of the transaction. Title insurance helps mitigate the risks inherent in property transactions, including title defects and "other irregularities relating to real estate, such as compliance with zoning, codes, and permits."⁴² Title insurance was created in the 19th century as an additional guarantee to buyers beyond the opinions that lawyers could offer from a title search.⁴³ In the late 20th century, as lenders were facing the challenge of security in their collateral from property loans, they began requiring title insurance for residential mortgages.⁴⁴ The title insurance market has since grown exponentially.⁴⁵ In 1969, the industry passed the \$1 billion mark in premiums.⁴⁶ In the first quarter of 2017, insurance premiums were

³⁸ See *id.* at 805.

³⁹ Gaudio, *supra* note 35, at 275.

⁴⁰ Donald J. Kochan, *Dealing with Dirty Deeds: Matching Nemo Dat Preferences with Property Law Pragmatism*, 64 U. KAN. L. REV. 1, 38–39 (2015).

⁴¹ See Fairfield, *supra* note 37, at 844–47.

⁴² Jean-Bernard Wurm, *How US-Style Title Insurance Is Transforming Risk Management in European Real Estate Markets*, 20 HOUSING FIN. INT'L 16 (2006), http://www.housingfinance.org/uploads/Publicationsmanager/0606_Uss.pdf.

⁴³ *Id.*

⁴⁴ *Id.*

⁴⁵ *Id.* at 16–17.

⁴⁶ *Id.* at 17.

already at \$3.3 billion.⁴⁷ When compared year-over-year, 2017 is ahead of 2016's pace that totaled \$14.3 billion dollars in premiums for the year.⁴⁸

The requirement of title insurance adds an entirely new component of complication to the process of property transfers. Due to title insurance's nature as a one-time service for parties in a real estate transaction (ancillary to the main objective of transferring the property), there has been a lack of consumer education about the market and a lack of oversight between the corporate entities involved.⁴⁹ Consumers who are unfamiliar with the title insurance market are not able to effectively "shop" for the services they require.⁵⁰ For individuals, this leads to parties unknowingly purchasing coverage at a higher cost than may be necessary.⁵¹ For everyone, this creates an unchecked market price due to the inability to compare policy prices.⁵²

The exclusion of the consumer from the title insurance marketplace has also created an opportunity for fraud and kickbacks among the parties involved, including mortgage brokers, lenders, insurance brokers, and insurance companies.⁵³ In 2015, a kickback

⁴⁷ *Title Industry Generates \$3.3 Billion in Premiums During Q1*, AM. LAND TITLE ASS'N (July 13, 2017), <https://www.alta.org/news/news.cfm?20170713-Title-Industry-Generates-33-Billion-in-Premiums-During-Q1>.

⁴⁸ *2016 Title Premium Volume Up 8.7 Percent*, AM. LAND TITLE ASS'N, <https://www.alta.org/news/news.cfm?20170321-2016-Title-Premium-Volume-Up-87-Percent> (last visited Sept. 30, 2017).

⁴⁹ *See generally* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-07-401, TITLE INSURANCE, ACTIONS NEEDED TO IMPROVE OVERSIGHT OF THE TITLE INDUSTRY AND BETTER PROTECT CONSUMERS (2007), <http://www.gao.gov/new.items/d07401.pdf>.

⁵⁰ *Id.* at 3-4.

⁵¹ *Id.*

⁵² *Id.* at 47.

⁵³ *See generally* CFPB and State of Maryland Take Action Against "Pay-To-Play" Mortgage Kickback Scheme, CONSUMER FIN. PROT. BUREAU (April 29, 2015), <https://www.consumerfinance.gov/about-us/newsroom/cfpb-and-state-of-maryland-take-action-against-pay-to-play-mortgage-kickback-scheme/> [hereinafter CFPB] (detailing a kickback scheme between title insurance companies and loan officers in Maryland); *see also* Governor Cuomo Announces New Regulations to Crack Down on Kickbacks and Improper Expenses in the Title Insurance Industry, N.Y. GOVERNOR'S PRESSROOM (Apr. 29, 2015),

scheme was found in Maryland where referrals to mortgage brokers were rewarded with funneling of property buyers to use the referring title insurance company's services.⁵⁴ Also in 2015, after uncovering kickbacks and other improper expenditures in New York, the governor increased regulations that could see the cost of title insurance reduced by up to 20 percent for new homes, and 60 percent on refinancing.⁵⁵

Despite these abuses, title insurance originated as a legitimate response to the transacting parties' need to protect their investments—both personally, in the sense of an individual purchasing property, and commercially, as with the lenders providing mortgages for such sales. However, while opportunistic business practices have given way to corrupt backdoor dealings, the technological resources available to the real property industry have evolved, opening the door to possibly more secure, more trustworthy processes to achieve the same original goals.⁵⁶ Blockchain technology may provide the required framework to do just that.

IV. INCORPORATING BLOCKCHAIN TECHNOLOGY INTO PROPERTY RECORDS

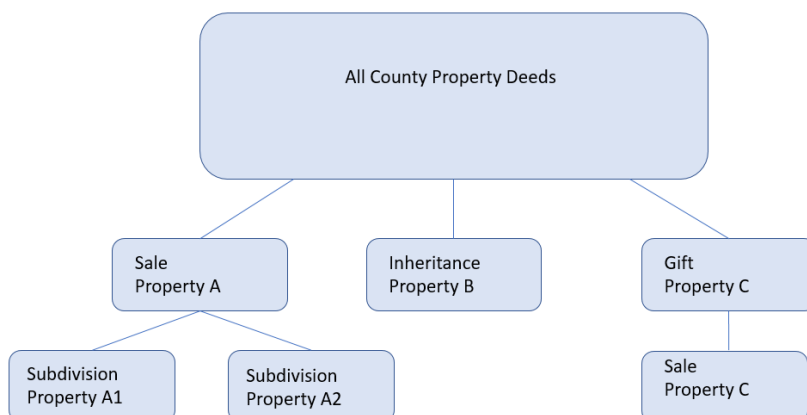
To apply the blockchain concept to property, imagine a starting block that includes every deed of property in a jurisdiction; in our current system, a county. Once all property deeds are accounted for and the block is established, it becomes a closed environment, and no more property can be added. All property transactions for that county (transfers, sub-divisions, gifts, mortgages, inheritances, etc.) stem from that original block. As property transactions occur, the chains grow, showing the connections to the original set of deeds.

<http://www.governor.ny.gov/news/governor-cuomo-announces-new-regulations-crack-down-kickbacks-and-improper-expenses-title>.

⁵⁴ CFPB, *supra* note 53.

⁵⁵ N.Y. GOVERNOR'S PRESSROOM, *supra* note 53.

⁵⁶ Fairfield, *supra* note 37, at 809.



Another application of blockchain technology relevant to property records is the ability to create smart contracts.⁵⁷ Smart contracts capture the requirements of a traditional contract in code, and then electronically advance the contract.⁵⁸ As each requirement is met, it triggers an automated response in the smart contract and moves to the next programmed step.⁵⁹ This technology removes the need for: (1) physically written contracts, (2) parties being present to sign the contracts, and (3) third-party verification of the steps in the contract along the way.⁶⁰ By leveraging the smart contract to verify when/if conditions of the contract are met, including electronic “signatures” of the parties, delivery of goods, and confirmation of payment, the speed of transactions increase while the costs of execution decrease.⁶¹

Still, like traditional paper contracts, personal identification remains a security challenge for smart contracts.⁶² The smart

⁵⁷ Fairfield, *supra* note 37, at 828 (identifying smart contracts also as a standalone application of blockchain technology that could be used distinct of property transactions).

⁵⁸ See Reggie O’Shields, *Smart Contracts: Legal Agreements for the Blockchain*, 21 N.C. BANKING INST. 177, 179 (2017).

⁵⁹ See *id.*

⁶⁰ See *id.*

⁶¹ See *id.* at 177 (explaining how electronic processes can require conditions to be met, such as consumer notifications of signatures and the accessibility of copies of contracts for confirmation).

⁶² *Id.* at 191.

contract will be able to have the users encoded as to who will have access to each transaction through personal identification, allowing for each of those users to add the validation of the transaction as they would with a typical paper contract.⁶³ However, similar to other technologies that support anonymous participation through encryption, it may be a challenge to confirm that the correct party has the key code required to execute that part of the contract.⁶⁴ Even though identification verification may create a few hurdles, this inherent functionality of a faster and more secure contract process would add another level of efficiency to the digital record of the transaction once it is complete.

A. *Blockchain as a Hybrid of Current Systems*

It is a helpful exercise to analyze disparate components of current property systems to help grasp the characteristics of the blockchain system. Blockchain incorporates the perpetual deed process that the Torrens system, discussed later in this section, is built upon, while leveraging the digital access that has been developed for the current title system to increase efficiency for electronic record searches. Those property records in the blockchain system would be similar to those records in a tract index, used primarily in the western United States.⁶⁵ The blockchain system adds the decentralized, immutable component to connect and streamline this array of valuable features.

The Torrens system introduced the concept of a perpetually evolving record of property rights for a parcel and is the recording system currently used in some countries, such as Australia, New Zealand, and Canada.⁶⁶ Under a Torrens system, the original, perfected deed for a property is amended with every subsequent transaction involving the property, showing each transfer of rights

⁶³ Fairfield, *supra* note 37.

⁶⁴ See O'Shields, *supra* note 58, at 177.

⁶⁵ See C. Dent Bostick, *Land Title Registration: An English Solution to an American Problem*, 63 IND. L.J. 55 (1987) (explaining and advocating for a tract system which associates the title to the land itself via a map rather than a parcel ID number).

⁶⁶ See John V. Orth, *Torrens Title in North Carolina—Maybe A Hundred Years is Long Enough*, 39 CAMPBELL L. REV. 271, 274 (2017).

or encumbrance.⁶⁷ Because the grantor's deed is never "re-written" and a new, fresh copy is never given to the grantee, as the current U.S. system requires, there is minimal opportunity for human error.⁶⁸ Furthermore, because all past transfers and encumbrances are present on the deed itself, the need for title searches and title insurance is significantly decreased.⁶⁹ Maintaining such a continually updating record, rather than re-issuing deeds, could foster increased trust among parties to real estate transactions—a characteristic that can be similarly achieved by a system leveraging blockchain.

While the Torrens system is predicated on a paper-based system, a blockchain system would capture the transactions digitally. While the current title system of the United States may be available electronically in certain jurisdictions, making it easier to search for historical records, the digital component is incorporated only after the transaction is complete.⁷⁰ This process fails to take advantage of two key advantages of a complete electronic system: (1) the speed and convenience of being able to conduct the entire transaction electronically, and (2) the reliance on verifiable and secure data entered rather than human entry with potential errors.⁷¹ One benefit being realized from the current electronic component of recording is the ability to cross-reference deeds based on a parcel.⁷² A paper deed only includes the property rights granted to that specific parcel, with no reference to any rights of a dominant parcel, such as easements.⁷³ By adopting an electronic system, a search can return

⁶⁷ See Anh T. Le, *Property—The Effect of the Hersh Decision on the Torrens Act: Getting to the Root of the Problem—Hersh Properties, LLC v. McDonald's Corp.*, 26 WM. MITCHELL L. REV. 601, 608–09 (2000).

⁶⁸ *Id.* at 609–10.

⁶⁹ See Orth, *supra* note 66, at 281.

⁷⁰ See Gaudio, *supra* note 35, at 276.

⁷¹ Though verifiable and secure, the possibility of low-tech fraud mentioned previously is still present. See O'Shields, *supra* note 58, at 177.

⁷² Gaudio, *supra* note 35, at 276.

⁷³ See Charles B. Sheppard, *Assurances of Titles to Real Property Available in the United States: Is a Person Who Assures a Quality of Title to Real Property Liable for a Defect in the Title Caused by Conduct of the Assured*, 79 N.D. L. REV. 311, 356–57 (2003).

all property rights associated with a specific parcel, including the rights held by others over that parcel.⁷⁴

Due to some similarities between the Torrens system and blockchain, if the United States decides to switch from a title system to a blockchain system, the government could identify potential challenges. By analyzing the experiences of countries like Canada, where a majority of provinces and all three of the territories have already made the switch from a title system to a Torrens system, valuable insight could be gained.⁷⁵ Since a reliable record for a piece of property is imperative for both a blockchain and Torrens system, large monetary and time investments are required to research and verify the real property's deed before moving forward in either of the new systems.⁷⁶ In Canada, the government subsidized this effort, realizing the potential long-term cost savings for buyers and sellers, who would no longer require the same level of title insurance or title search.⁷⁷ Since it is the future buyers and sellers that will experience similar cost savings in a blockchain system and not the current property owners, the U.S. government will also likely need to subsidize the monetary and time investments in a similar manner.

Part of this initial investment will likely come in the form of quiet title actions. This judicial process for perfecting the property rights an owner has in a parcel is to give notice and provide an opportunity for the court to hear from all parties to determine who has priority in the land.⁷⁸ If those other parties do not state a claim,

⁷⁴ Gaudio, *supra* note 35, at 276.

⁷⁵ C.A. Mark Coffin, *The Law of the Land: The Advent of the Torrens System in Canada*, by Greg Taylor. Toronto: University of Toronto Press for the Osgoode Society for Canadian Legal History, 2008, 31 DALHOUSIE L.J. 473 (2008) (book review).

⁷⁶ See Bostick, *supra* note 65.

⁷⁷ GREG TAYLOR, THE LAW OF THE LAND: THE ADVENT OF THE TORRENS SYSTEM IN CANADA 98–99, 104–05 (2008).

⁷⁸ See *Quiet Title Action*, LEGAL INFO. INST., https://www.law.cornell.edu/wex/quiet_title_action (last visited Nov. 4, 2017). Conducting quiet title actions for all property records would be an expensive and timely undertaking. In addition to legal and court fees, all individuals with potential rights or claims will have to be identified and notified. These challenges are exasperated by the serious consequences of the originating deeds being incorrect.

they are estopped from later asserting a right.⁷⁹ The foundation of a blockchain system is the initial block of property rights that are continually amended by subsequent transactions, so it is imperative that the initial block establishes the proper rights from the system's inception.

B. *Countries Already Exploring Blockchain for Property Records*

As outdated as the United States' title process may be, countries around the world face similar, or worse, struggles. According to Caroline Heider and April Connelly at the World Bank Group, "70 percent of the world's population still lacks access to proper land titling or demarcation."⁸⁰ Land rights align with significant socio-economic development including poverty eradication, food security, and gender equality.⁸¹ Land rights are a point of emphasis for the goals of the United Nations.⁸² In turn, several countries are investigating blockchain technology to solidify their property records.

1. *Developing Countries Taking Large Steps*

Several countries that struggle with untrustworthy record management and risk of systematic corruption are currently exploring blockchain technology for property record management.⁸³ While the United States may not look to these countries' initiatives as a roadmap for implementation, analyzing their experiences with blockchain will be beneficial. The improvements dealing with issues that the United States may face, but take for granted, will be on a more dramatic scale, highlighting the importance of the benefits the United States could realize.⁸⁴ New blockchain initiatives/programs

⁷⁹ *Id.*

⁸⁰ Caroline Heider & April Connelly, *Why Land Administration Matters for Development*, WORLD BANK GRP. BLOG (June 28, 2016), <http://ieg.worldbankgroup.org/blog/why-land-administration-matters-development>.

⁸¹ *See id.*

⁸² *See id.*

⁸³ *See* Danika Wright, *How the Blockchain Will Transform Housing Markets*, THE CONVERSATION (Apr. 12, 2017, 4:13 PM), <https://theconversation.com/how-the-blockchain-will-transform-housing-markets-75691>.

⁸⁴ For a more detailed discussion, see *infra* subsections a, b, and c.

in the Republic of Georgia, Honduras, and Brazil suggest an understanding that volatile land management systems hinder growth and economic success, and that blockchain technology provides a stabilizing tool that citizens and investors can trust.⁸⁵

Secure property rights are essential to economic growth and stability.⁸⁶ Parties often leverage the equity they have in property as collateral to secure loans allowing them to make new investments, both for personal and business purposes.⁸⁷ Lenders and investors rely on property rights they can trust to protect their assets in case a borrower defaults.⁸⁸ Without this imperative part of the equation, individuals and businesses will not be able to acquire new funds based on their current property rights to re-invest into the country's economy.⁸⁹ In short, the money used to purchase the property has been taken out of the economic marketplace. Because that investment (the property rights) is not secure enough for a lender to assume the risk of losing the collateral, no money can be drawn against that property to put back into the marketplace, resulting in a net loss for the economy.⁹⁰

a. *Republic of Georgia*

The Republic of Georgia started a pilot project in 2016 to register land titles using blockchain technology.⁹¹ Their goals are to have a registry secured against corruption and to solidify the land rights of the people.⁹² The current process for buying property

⁸⁵ *See id.*

⁸⁶ *See, e.g.,* Frank K. Upham, *From Demsetz to Deng: Speculations on the Implications of Chinese Growth for Law and Development Theory*, 41 N.Y.U. J. INT'L L. & POL. 551, 557 (2009).

⁸⁷ Andrew R. Berman, "Once a Mortgage, Always a Mortgage" – *The Use (and Misuse of) Mezzanine Loans and Preferred Equity Investments*, 11 STAN. J. L. BUS. & FIN. 76, 81 (2005).

⁸⁸ *Id.* at 85.

⁸⁹ *See id.*

⁹⁰ *See id.*

⁹¹ Laura Shin, *Republic of Georgia to Pilot Land Titling on Blockchain with Economist Hernando De Soto, BitFury*, FORBES (Apr. 21, 2016, 6:00 PM), <https://www.forbes.com/sites/laurashin/2016/04/21/republic-of-georgia-to-pilot-land-titling-on-blockchain-with-economist-hernando-de-soto-bitfury/#38cf71aa44da>.

⁹² *Id.*

requires the parties to have the transaction notarized at the public registry house for a fee between \$50 and \$200—all taking place in a single day.⁹³ Without a process that leads to a secure record, property owners who cannot use their legal rights to land as collateral for credit are not able to fully participate in a growing economy, and companies are hesitant to purchase property and invest in a country with this level of insecurity.⁹⁴ Blockchain technology has the capability of legitimizing the country's property records while reducing the costs of property transactions.⁹⁵

b. *Honduras*

Similarly, Honduras' goals for implementing blockchain technology for property titling are combating government corruption,⁹⁶ establishing a tool for secure collateral for economic advancement,⁹⁷ and ending the violence caused by land title uncertainty.⁹⁸ The paper-based system in place prior to the blockchain initiative allowed for bureaucrats to access land titles and commit fraud to “get themselves beachfront properties.”⁹⁹ The level of uncertainty, with nearly eighty percent of land either not titled or titled insufficiently, leads to conflicts when developers try to acquire land.¹⁰⁰ When landowners are insecure in their property rights of the land on which they live and work, they are susceptible to manipulation from developers who aim to acquire the land as cheaply as possible.¹⁰¹ That turmoil results in violence, which contributes to Honduras' reputation as one of the world's most

⁹³ *Id.*

⁹⁴ *Id.*

⁹⁵ *Id.*

⁹⁶ *Id.*

⁹⁷ Gertrude Chavez-Dreyfuss, *Honduras to Build Land Title Registry Using Bitcoin Technology*, REUTERS (May 15, 2015, 12:28 PM), <https://in.reuters.com/article/usa-honduras-technology/honduras-to-build-land-title-registry-using-bitcoin-technology-idINKBN001V720150515>.

⁹⁸ *Id.*

⁹⁹ Shin, *supra* note 91 (quoting Factcom CEO John Kirby).

¹⁰⁰ Rina Chandran, *Modernizing Land Records in Honduras Can Help Stem Violence, Says Analyst*, REUTERS (Aug. 11, 2017, 7:39 AM), <https://www.reuters.com/article/us-honduras-landrights-tech/modernizing-land-records-in-honduras-can-help-stem-violence-says-analyst-idUSKBN1AR151>.

¹⁰¹ *Id.*

dangerous places for environmental activists who are trying to protect ancestral and farm lands from big development, stifling opportunities for economic growth.¹⁰²

While the project was initially scheduled to start in 2015, it was delayed one year due to the political nature of the project and the comparatively slower pace at which government systems move than the private sector.¹⁰³ The project was also said to have been delayed due to distractions, simply because they are a government,¹⁰⁴ a possible challenge for any initiative in a complex government environment. As of fall 2017, about one-fifth of Honduran land titles were verified and digitized, while the pilot for incorporating blockchain technology had been started but subsequently stalled.¹⁰⁵

c. *Brazil*

Brazil has taken a slightly different approach than the Republic of Georgia, Honduras, and other countries exploring blockchain property records by implementing the pilot programs in individual cities rather than on a country-wide level.¹⁰⁶ Unique to Brazil, when compared to the other countries mentioned, land-owners register their properties at the city level, resulting in a more piecemeal system than, for instance, the county-based registration system used in the United States.¹⁰⁷ Additionally, Brazilian property owners have a variety of ways to register their property, if they register the title at all, trading time and cost for security based on which method they

¹⁰² *Id.*

¹⁰³ Shin, *supra* note 91.

¹⁰⁴ *Id.*

¹⁰⁵ Chandran, *supra* note 100.

¹⁰⁶ See Garrett Keirns, *Blockchain Land Registry Tech Get Test in Brazil*, COINDESK (Apr. 5, 2017 6:40 PM), <https://www.coindesk.com/blockchain-land-registry-tech-gets-test-brazil/> (stating that two municipalities within Brazil are “embedding land ownership information into the bitcoin blockchain”). The first pilot municipalities are Pelotas and Morro Redondo.

¹⁰⁷ See Anna Cash, *Land Registration in Brazil: An Interview with Alex Ferreira Magalhães*, RIO ON WATCH (July 10, 2016), <http://www.rioonwatch.org/?p=29200> (highlighting that city governments in Brazil register real estate). Managing property records at a city level creates more opportunities for differences in systems than a single *county* system for all cities within that county.

choose.¹⁰⁸ If the pilot programs in those cities are successful, then other cities will be able to follow that established model to implement blockchain into their own land titling processes.¹⁰⁹

2. *Developed Countries Improving Existing Systems*

On the other end of the spectrum, there are developed countries with relatively stable governments, economies, and property record management that are seeking to improve their current processes.¹¹⁰ Among the reasons to consider a blockchain solution is to address similar concerns as the less developed countries discussed above, although admittedly the gains realized will be on a smaller scale than those establishing an entirely new system from scratch.¹¹¹ It is also likely that the world has become aware of the impact blockchain technology can have, and there is interest among countries, just as there is among companies, to be the first to figure out to how to incorporate its many benefits.

a. *Sweden*

Sweden has come the furthest in introducing blockchain technology to maintain its property record system.¹¹² It is one of the few wealthy countries exploring blockchain for property records¹¹³ and began its tests of incorporating the technology in June of 2016.¹¹⁴ Sweden's goal is to have the ability to create a transaction, or link on the chain, as soon as the buyer and seller are under

¹⁰⁸ *Id.* Some property owners don't register their land at all, relying on the presumption of ownership that can be disproved upon investigation.

¹⁰⁹ Keirns, *supra* note 106.

¹¹⁰ Philipp Sandner & Kai Schmidt, *Solving Challenges in Developing Countries with Blockchain Technology* 1, 1–2 (Frankfurt School Blockchain Center, Working Paper, 2017) (highlighting that innovations such as blockchain benefit both developed and developing countries).

¹¹¹ *Id.* While less developed countries will be establishing a framework incorporating both real property recording management and blockchain technology, and will see large gains from their beginning points, more developed countries will look to modify existing property recording management with blockchain and therefore realize only the gains from the blockchain component.

¹¹² Joon I. Wong, *Sweden's Blockchain-powered Land Registry Is Inching Toward Reality*, QUARTZ (Apr. 3, 2017), <https://qz.com/947064/sweden-is-turning-a-blockchain-powered-land-registry-into-a-reality/>.

¹¹³ *Id.*

¹¹⁴ Chavez-Dreyfuss, *supra* note 97.

contract.¹¹⁵ Taking advantage of the decentralized component of the digital ledger, all parties to the deal, including banks, the government, brokers, and buyers, are immediately able to track the transaction.¹¹⁶

So far, Sweden has completed a proof of concept and created a “testbed” for blockchain management of its property records.¹¹⁷ This experiment relied on a private blockchain.¹¹⁸ A private blockchain is typically smaller in scale and restricts membership, as compared to a public blockchain that is larger and accessible to the public.¹¹⁹ This smaller, more regulated blockchain environment is a perfect fit for Sweden’s land registry as it takes advantage of the scrutiny and security of transactions, while the relatively low number of transactions does not burden the system.¹²⁰

Sweden’s testbed focused primarily on the interaction between real estate agents, buyers, sellers, and banks since those are the most prevalent actors in real estate transactions.¹²¹ However, the project’s leaders have noted that adding other actors, such as notaries and insurance companies, would be relatively easy to do by simply replicating parts of the process they already have in place.¹²²

A challenge that did arise—and will be a focal point as the project moves forward—was the security around actor identification as it pertains to fraud.¹²³ The project team identified that the only way to steal property within their testbed was to create a new real estate transaction with fraudulent identities, which they are working

¹¹⁵ *Id.*

¹¹⁶ *Id.* Such digital documentation will give “all parties . . . the highest level of security” (internal quotations omitted).

¹¹⁷ Kairos Future, THE LAND REGISTRY IN THE BLOCKCHAIN – TESTBED 11 (2017), https://chromaway.com/papers/Blockchain_Landregistry_Report_2017.pdf.

¹¹⁸ Wong, *supra* note 112. Used in this context, the “private” delineation refers to the user access available to the blockchain and not the ownership of the system; in the United States, typically reserved for government entities. *See also* de Martino & Klein, *supra* note 12.

¹¹⁹ de Martino & Klein, *supra* note 12.

¹²⁰ Kairos Future, *supra* note 117.

¹²¹ *Id.*

¹²² *Id.*

¹²³ *Id.*

to address.¹²⁴ This issue hints that in any environment there may be potential for identity fraud as individuals can manipulate systems to “create” a new person.¹²⁵ Addressing these attempts will be a balance between adding safeguards (e.g., multiple user confirmations) that slow the process down and a sacrifice of the speed that parties want to benefit.

b. *Australia*

Australia has identified the benefit of avoiding hidden costs in the real estate process as a reason for developed countries to pursue blockchain technology for property records.¹²⁶ Current practices for property transactions require a significant investment of both time and money; the costs outside the purchase price of the home can be up to A\$1000 per transaction, while the time to settle a real estate transaction, like in the United States, can take up to one month.¹²⁷ By themselves, these costs present a substantial opportunity for savings, but Australia also faces a large number of inaccuracies in their current single, centralized database.¹²⁸ The country found 300 incorrect certificates issued in the state of New South Wales alone in 2016.¹²⁹ The quality of the real estate systems could be compromised as several Australian states are considering privatizing land title offices.¹³⁰

So far, the blockchain programs that relate to property in Australia have been implemented in the banking industry.¹³¹ In 2017, Australian banks ANZ and Westpac used blockchain distributed ledger technology to digitize the guarantee process for leasing

¹²⁴ *Id.*

¹²⁵ Fraud seems to adapt to the level of security applied, from simply stating a person is someone they are not, to creating false paper identification documents, to now creating a new digital identity.

¹²⁶ Wright, *supra* note 83.

¹²⁷ *Id.*

¹²⁸ *Id.*

¹²⁹ *Id.*

¹³⁰ *Id.*

¹³¹ Chris Pash, *ANZ and Westpac Just Successfully Used Blockchain on Commercial Property Deals*, BUS. INSIDER AUSTL. (July 10, 2017, 9:15 AM), <https://www.businessinsider.com.au/anz-and-westpac-just-successfully-used-blockchain-on-commercial-property-deals-2017-7>.

commercial property.¹³² This transition enabled users to prove the source of the information involved and the destination where it was sent.¹³³ Additionally, Australia's top science organization has a project dedicated to exploring more ways that the country could benefit from blockchain applications, including government registries and supply chains.¹³⁴ The United States is in a position to observe the impact that blockchain technology has on developing countries while analyzing the implications on other segments of the economy encountered by similarly developed countries.

V. IMPLEMENTATION IN THE UNITED STATES

The United States has the opportunity to glean information from a range of governments as it determines its approach to blockchain technology and property records. Examining the areas beyond the property registry itself that may be impacted, such as mortgages and title insurance, will help flesh out the true scope of such an undertaking. Similarly, analyzing how other countries are deploying their own pilot programs will highlight not only successes to replicate, but also pitfalls to avoid.

There are two primary questions to address when considering the United States and blockchain technology for property records: (1) whether the United States should adopt a blockchain technology based title management system and (2) if so, how should the United States go about it? On a project of this magnitude, those questions can become intertwined. As the initial investment of resources required for such a transition start to add up, the cost-benefit analysis may sway to the negative depending on the scope and execution of the initiative.

A. *Hurdles to Consider*

Vermont, for example, concluded in 2016 that the benefits did not outweigh the costs of applying blockchain to their public

¹³² *Id.*

¹³³ *Id.*

¹³⁴ *Id.*

recordkeeping.¹³⁵ In a report issued by the state, a study group exploring the possible applications for blockchain technology within public records found that while the state would be able to verify parties' submissions, timestamp transactions, and confirm the contents of the record, the costs and challenges of working with such a burgeoning technology were too great.¹³⁶ However, the analysis was focused on the state itself and therefore did not include third-party costs, such as costs to intermediaries, nor the value of the user experience.¹³⁷

In addition to the benefits that blockchain offers, identified above, Vermont did highlight a few shortcomings of using blockchain for property records. The state pointed out that while blockchain automates the property transaction and reduces the need for trust from third parties, the process does not support the accompanying documents that are a part of the transaction.¹³⁸ These transactions taking place electronically still rely on physical documents (titles, deeds, etc.) that will need to be stored securely to be referenced for property description and the rights transferred.¹³⁹ To be clear, document management is not a function of blockchain technology.¹⁴⁰ The benefits of leveraging blockchain technology are focused on verifying and tracking the activities related to that physical document. This limits some of the state cost savings as blockchain will not act as a replacement for document management, but rather will be an additional cost.¹⁴¹

Vermont also recognized similar identification issues expressed in Sweden's testbed. The encryption process relies on two sets of

¹³⁵ VT. SEC'Y OF STATE, BLOCKCHAIN TECHNOLOGY: OPPORTUNITIES AND RISKS 20 (2016), <http://legislature.vermont.gov/assets/Legislative-Reports/blockchain-technology-report-final.pdf>.

¹³⁶ *Id.*

¹³⁷ *Id.*

¹³⁸ *Id.*

¹³⁹ *Id.*

¹⁴⁰ Document management is a concern of storage and access, not trust. Therefore, a blockchain solution for document management would not address the primary needs. A solution that incorporates document management along with the transaction would likely require an integration with a separate document management system.

¹⁴¹ VT. SEC'Y OF STATE, *supra* note 135.

“keys” for identification.¹⁴² One key is public facing and associated with the digital account of the person, while the second key is private and used by the person to access their account.¹⁴³ The electronic process itself is extremely secure; however, the state has concerns about lost or stolen private keys to the person’s blockchain account.¹⁴⁴ Because of the immutable nature of blockchain technology, typically a benefit of the process, the absolute nature of the transactions make fraud difficult to identify and correct, leading to a high degree of personal exposure.¹⁴⁵

The immutable nature of blockchain, which in many respects is seen as a benefit, may cause difficulties in situations of user identification and even the records themselves.¹⁴⁶ Blockchain is susceptible to hacking, and the challenges of changing records after a transaction—while a benefit with respect to security and fraud prevention—make it very hard to correct the aftermath when hacking does occur.¹⁴⁷

Finally, as Honduras’ delayed blockchain implementation shows, a government initiative of this magnitude could be a lengthy—and therefore expensive—proposition in a bureaucratic environment.¹⁴⁸ While the record management of each county may be centralized, the record management of all 3,007 U.S. counties¹⁴⁹ is extremely disparate. That presents an immediate hurdle of how to roll out an initiative of this magnitude.

¹⁴² *Id.*

¹⁴³ *Id.*

¹⁴⁴ *Id.*

¹⁴⁵ *Id.* at 19 (“Based on current implementations of blockchain technology, if a private key is lost or stolen, an individual has no recourse. At best, a person who loses a private key will be required to obtain a new key to add to the blockchain. At worst, the loss or compromise of a private key is complete loss of control over one’s blockchain transactions.”).

¹⁴⁶ Hannah Kuchler, *Cyber Attacks Raise Questions About Blockchain Security*, FIN. TIMES (Sept. 12, 2016), <https://www.ft.com/content/05b5efa4-7382-11e6-bf48-b372cdb1043a>.

¹⁴⁷ *Id.*

¹⁴⁸ See Shin, *supra* note 91.

¹⁴⁹ U.S. GEOLOGICAL SURV., “How Many Counties Are There in the United States?” (last visited Nov. 19, 2017), <https://www.usgs.gov/faqs/how-many-counties-are-there-united-states>.

The options range from an all-at-once country-wide approach to a smaller scale pilot, like Brazil's two city approach, perhaps at the county level that local governments can take on when they are ready. The benefit of a country-wide implementation would be the parties' immediate access to a system that would reference all county records in all states for transactions that may cross county lines, rather than having to adjust their protocols depending on the counties they are working with. The drawback to an all-in approach would be the time and preparation it would take for every county to get on the same page at the same time and feel comfortable taking the leap. Implementations of this magnitude also limit the ability to make small tweaks and adjustments once the system is in use, so the importance of getting it right the first time cannot be understated.

The other end of the spectrum would be to allow and encourage individual counties to implement their own blockchain environments as they complete their due diligence and move forward with the best process and system they identify. This would allow for flexibility and speed as each jurisdiction could map their paper environments to electronic equivalents. It would also limit the federal government's involvement in a constitutionally state-owned matter as more decisions would be left to the counties.¹⁵⁰ This approach, however, could also suffer from several drawbacks. As counties come online with a blockchain system over time, buyers and sellers will have to adjust their practices to (1) identify if the county they are working within has a blockchain system for property records; and (2) take the time to figure out the nuances of that particular county's system. Also, with the ultimate goal of sharing all of the information related to property transactions, it will be imperative that county systems are integrated with each other, a challenge for any individualized rollout where different standards are applied.

The solution may lie in a hybrid approach—a standardized country-wide system that can be implemented by counties on an individual basis. While it may be impossible, if not just impractical,

¹⁵⁰ There are federalism implications to explore as the federal government would likely mandate processes for state governments to follow; however, that analysis is outside the scope of this Recent Development.

for all 3,007 counties to deploy a new system simultaneously, it would be counterproductive for each county to develop and implement their own disparate systems. A phased rollout of a uniform system would allow counties to act on their own accord while guaranteeing that when they make the transition to a blockchain system, they will be in accord with the rest of the interested community. During the transition, parties would likely still have to check multiple systems to determine the best way to move forward, but it would be capped at just the traditional county title registry and the nation-wide blockchain system. An additional benefit to this type of rollout is that the first counties to make the transition would become pilot environments for real-world application.¹⁵¹ This would allow issues that arise to be identified early and fixed on a relatively small scale compared to disrupting every county's process if they all started at the same time.

B. *Potential Benefits*

Countries around the world are investing time and money exploring how to take advantage of the benefits offered by blockchain technology. One of the underlying pillars of blockchain is trust.¹⁵² In an economic sense, trust alleviates risk, which in turn lowers costs. Leveraging blockchain technology in the property title process could lead to a lower cost per transaction. While there are costs associated with the technological infrastructure,¹⁵³ the increase of security for buyers and lenders, the decreased requirement of title insurance, and the reduced amount of resources involved in the current process should have a net positive impact.

As noted above, title insurance is a direct cost to the buyer in a market where the buyer has no leverage.¹⁵⁴ If title insurance is no longer required, or if there is at least an unsubstantial need for it, then buyers will be able to avoid that cost. Additionally, the extra

¹⁵¹ As compared to Brazil's approach creating two test pilot municipalities, *supra* Section IV.

¹⁵² Gabison, *supra* note 10.

¹⁵³ *Id.*

¹⁵⁴ U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 49.

time that obtaining a title insurance policy takes will be saved,¹⁵⁵ creating a more efficient process.

Lenders will also benefit from the lack of a need for title insurance. The lender's increased security will have residual effects on the economy at large. The more secure a lender is in the loan that is being provided, and the less likely it is that there will be a title discrepancy that will have a financial impact on the lender, the lower the interest rate the lender can offer. In addition to the borrower's ability to repay, lenders calculate the interest rate for loans by the amount of risk to which the lenders are exposed.¹⁵⁶ As the risk of loan insecurity declines, so too should the interest rates. While the interest rates in the United States are considerably lower to begin with, this parallels the benefits that Honduras and the Republic of Georgia are looking to achieve as discussed above. Title insurance companies may not appreciate that the services they provide will no longer be relied upon to the extent they have been in the past. It is likely that a change to the title system will be met with considerable resistance from that industry, similar to their response to the Torrens system.¹⁵⁷ It will be intriguing to see how the interests of a large and influential industry, such as title insurance, impact the potential for progress of a system as vital as property records.

A practical benefit for property owners will be the ability to identify all of the dominant parcels that have property rights encumbering their land. Currently, a deed of title only shows the property rights that the owner has on that parcel.¹⁵⁸ If a neighbor has an easement for a driveway through the owner's yard, that right will be documented on the neighbor's deed, but not on the owner's deed, whose land would suffer the inconvenience. While the Torrens system and the digital component of the current title registry system

¹⁵⁵ Avi Spielman, *Blockchain: Digitally Rebuilding the Real Estate Industry* (September 2016) (unpublished M.S. thesis, Massachusetts Institute of Technology), http://dci.mit.edu/assets/papers/spielman_thesis.pdf.

¹⁵⁶ See generally Jason Scott Johnston, *Do Product Bans Help Consumers? Questioning the Economic Foundations of Dodd-Frank Mortgage Regulation*, 23 GEO. MASON L. REV. 617 (2016) (highlighting that risk is comprised of the borrower's credit, the lender, the security of the loan, and the contract type).

¹⁵⁷ Orth, *supra* note 66.

¹⁵⁸ Sheppard, *supra* note 73.

provide a method to tie in all these types of ancillary rights affecting the property, a blockchain system will ensure an all-encompassing record of ancillary property rights that is easily accessible via a user interface on the internet.

VI. CONCLUSION

The benefits of an immutable, decentralized ledger of real property records are substantial. The increased security, lower costs, improved user experience, and avoidance of conflicts should be a welcome change to the current environment. However, it would take considerable resources to make a change from such a longstanding process that is not only engrained in the government's infrastructure but also has spawned dependent industry markets.

It will be difficult, if not impossible, to think of, consider, and calculate every facet that would be involved and impacted by a transition to blockchain property recording. The time may never come when blockchain is proven to be a sure-fire solution to an antiquated process. However, as more countries are taking the risk of moving forward, blockchain has the potential to be a world-changing technology. The United States must examine how to institute blockchain effectively— if not through real property recording, then some other application— to keep the United States at the helm of innovating technology and business in today's quickly-changing world.