Blockchain: Implications for the Banking and Insurance Industries

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January 15, 2019

Vermont State Legislature
House Committee on Commerce and Economic Development
Senate Committee on Economic Development, Housing, and General Affairs
115 State Street
Montpelier, VT 05633-5301

Re: Blockchain

Dear Legislators:

DFR staff members have worked diligently over the summer and fall to study the potential applications of blockchain technology within the banking and insurance industries. In accordance with Act No. 205 of 2018, I respectfully submit the attached report. The Department suggests a measured approach to blockchain-specific regulation, which includes a regulatory sandbox approach to innovative financial and insurance products and platforms based upon blockchain and other technologies.

Over a period of several months, Department staff members interviewed many of Vermont's domestic financial institutions and insurance companies, along with national players and tech-based startups. They reviewed existing literature related to blockchain, by scholars, information technology professionals, cryptocurrency devotees, U.S. and international government officials, and those individuals who are not yet convinced of blockchain's merits. This report attempts to provide a neutral overview of the technology, its virtues, and its risks. It recommends an approach that recognizes that, while blockchain technology could potentially change the way many firms do business, it is still very new and evolving, and has not yet been adopted broadly within either the banking or insurance industry.

I. Blockchain basics

Section I of the report provides an overview of distributed ledger and blockchain technology and smart contracts. It looks at the actions national and Vermont insurers are taking to understand, develop and/or implement the technology into their businesses. Though Vermont financial institutions and insurance companies are interested in blockchain and its potential applications, most have adopted a "wait and see" approach until the technology gains a broader foothold.

II. Blockchain obstacles

While many believe blockchain has the potential to transform the financial industry, some experts remain unconvinced of blockchain's merits outside the cryptocurrency realm. Section II of the report reviews some of the obstacles to broader industry adoption of blockchain. Impediments to implementation include the technological barriers of interoperability and scalability, energy consumption issues, and regulatory and legal uncertainty, particularly with respect to the privacy of consumer data. The high costs of new systems, data migration, and technology-specific staffing needs are significant practical barriers, particularly for smaller firms.

III. Banking applications

Section III of the report discusses some promising potential applications of blockchain in the banking industry, along with some of the benefits, risks, and regulatory hurdles associated with these applications. Payments processing and the clearing and settlement of securities transactions are two applications that are the focus of much attention, and blockchain might also prove beneficial in the management of consumer data in connection with federal know-your-customer regulations.

IV. Insurance applications

Section IV of the report presents insurance industry use cases. Parametric insurance, usage-based insurance, and P2P insurance are products that do not require blockchain but may benefit from the use of smart contracts. The report also discusses the possibility of recording land and vehicle titles on the blockchain, which could potentially reduce fraud and make transactions more efficient, but would require the buy-in of all parties involved. Finally, the report touches on blockchain applications being implemented by and for captive insurance companies, including a recently announced State of Vermont pilot program that will allow new captive insurance companies to register with the Secretary of the State using distributed ledger technology.

V. Regulatory considerations and recommendations

Section V of the report presents some general areas relating to blockchain where legislative or regulatory action may be warranted. While the report does not recommend any blockchain-specific legislation with respect to financial institutions or insurance companies, it does outline a regulatory sandbox approach to support and encourage innovation. By codifying the Commissioner's authority to grant variances or waivers on a case-by-case basis where new or emerging products or platforms are not permitted under existing statutes or rules, this approach would allow DFR to gain insight into innovative new products while continuing to protect Vermont consumers.

This report would not have been possible without the good and diligent work of Department staff members Gavin Boyles, Molly Dillon, Kevin Gaffney, Nicholas Marineau, Tom Palin, Ned Pike, David Provost, Amy Richardson, Christina Rouleau, and Jill Rickard, and Department interns Brendan Gordy (Champlain College), Sean Macdonald (Bowdoin College), Matt Phillips (Vermont Law School), and Joshua Sumner (Saint Michael's College). The Department would like to thank the financial institutions, insurance companies, and tech companies who participated in the interviews that form the backbone of this report.

I look forward to discussing the report with you. Please be in touch with any questions.

Sincerely,

Michael S. Pieciak
Commissioner

Introduction

Section 4 of Act No. 205, an act relating to blockchain business development, directs the Department of Financial Regulation ("DFR" or the "Department") to "review the potential application of blockchain technology to the provision of insurance and banking and consider areas for potential adoption and any necessary regulatory changes in Vermont" and submit, by January 15, 2019, a report of its findings and recommendations to the House Committee on Commerce and Economic Development and the Senate Committee on Economic Development, Housing and General Affairs.

The Commissioner of DFR has prepared this report in response to the Legislature's directive in Act 205. It consists of five parts:

- Section I presents an overview of distributed ledger and blockchain technology, including smart contracts, and a brief synopsis of industry activity and adoption to date;
- Section II contains a discussion of obstacles to the adoption and implementation of blockchain technology, including technological barriers, whether there is a problem for blockchain to solve in the banking and insurance industries, and practical issues;
- Section III sets forth a sample of banking industry use cases;
- Section IV sets forth a sample of insurance industry uses cases; and
- Section V presents regulatory considerations pertaining to blockchain technology and DFR's recommendations.

I. Blockchain basics

A. An overview of distributed ledger and blockchain technology

Blockchain is, in short, a system of record utilizing advanced encryption methods that is maintained by a decentralized network of computers. It is heralded as having the potential to improve the efficiency, security, and trustworthiness of a wide variety of transactions involving a wide variety of assets. It is currently being tested and/or utilized for the recording of things as varied as land records in South Burlington, Vermont, the cargo contents of massive container ships in international waters, and the provenance of diamonds. Proponents say that virtually anything of value may be recorded on the blockchain, whether "tangible (a house, a car, cash, land) or intangible (intellectual property, patents, copyrights, branding)"[1] while others argue that the usefulness of blockchain, outside of the cryptocurrency sphere, is overstated. This report references books, articles, websites, blog posts, and podcasts from a variety of authors knowledgeable about blockchain, as well as interviews with Vermont insurers and financial institutions, to provide an objective overview of the technology underlying distributed ledger and blockchain and its potential risks and rewards.

Blockchain is one type of distributed ledger technology ("DLT"). DLT is a relatively new, complex, and continually evolving technology and, though many people claim to be DLT or

[1] Guptaw, Manav. Blockchain for Dummies. 2nd IBM Lim. Ed. Hoboken, NJ: John Wiley & Sons, 2018.

blockchain experts, there are no generally accepted definitions of either DLT or blockchain. One leading technology company defines a distributed ledger as follows:

> A distributed ledger is a record of consensus with a cryptographic audit trail which is maintained and validated by several separate nodes. This cryptographically assured and synchronized data can be spread across multiple institutions. Distributed ledgers can be either decentralized, granting equal rights within the protocol to all participants or centralized, designating certain users particular rights. Actors typically employ distributed ledgers when they need a tool which permits the concurrent editing of a shared state while maintaining its unicity. The ledger's state is determined through a consensus algorithm, which can vary in its mechanics but ultimately serves to validate information from inputs to the network. [2]

Based on its association with the Bitcoin cryptocurrency, blockchain is the most well-known type of distributed ledger, though it is not the only one. Blockchain "organizes data into blocks, which are chained together in an append only mode" allowing for "global broadcast of data and large amounts of unrelated transactions to be confirmed at once."[3] While the public nature of blockchain makes it a useful system for Bitcoin, it may not be as useful for financial and other institutions that are required to keep data private. There are other types of distributed ledgers with different structures and assets, including one designed for the recording and automation of legal contracts and one designed for the recording and execution of transactions between machines in the Internet of Things. There remains, however, significant disagreement and confusion about the use of the terms DLT and blockchain, even among experts. The term "blockchain" is widely used to describe DLT more broadly and, though it may be imprecise, this report will also utilize the terms DLT and blockchain interchangeably.

Public, permissionless blockchains, such as the Bitcoin system, allow anyone to contribute data and for everyone in possession of the ledger to have identical copies of it. As opposed to traditional, centralized databases operated by known, trusted individuals, public blockchains are operated by pseudonymous, untrusted parties. For this reason, it is important for such parties ("nodes") to agree on rules for determining if and when data may be published to and/or edited on the blockchain. A consensus model known as "proof of work" is utilized by some public blockchains. This is a competitive process where nodes compete to earn the right to publish a new block by solving a complex mathematical puzzle in exchange for a small financial reward (commonly given in cryptocurrency). The more computing power an entity uses to solve the most puzzles the fastest, the more likely it is to succeed and "mine" cryptocurrency rewards. DLT may also be permissioned (or private), in which case companies or individuals may restrict viewing, publishing, and editing privileges to a specific set of authorized users.

Blockchains are permanent and append-only, meaning new data can be added but existing records essentially cannot be deleted. Using a blockchain for recordkeeping creates a

[2] Rutland, Emily. *Blockchain Byte*. R3 Research. https://www.finra.org/sites/default/files/2017_BC_Byte.pdf
[3] *Blockchain & Distributed Ledger Technology (DLT)*. World Bank. Apr. 12, 2018. https://www.worldbank.org/en/topic/financialsector/brief/blockchain-dlt

complete and permanent audit trail and therefore potentially reduces the risk of fraud. However, this quality of immutability could run afoul of state, federal, and/or international data privacy regulations applicable to financial institutions, such as the European Union's General Data Protection Regulation ("GDPR"), the Gramm-Leach-Bliley Act, and the Health Insurance Portability and Accountability Act ("HIPAA"). These laws require companies to ensure the confidentiality of consumer data by limiting access to, and knowing exactly who accesses and processes, such data, develop and implement internal security controls to protect consumer data against potential threats, and demonstrate compliance to regulators.

As discussed further in Section II, private distributed ledgers may allow companies to better comply with data privacy regulations. Private blockchains may also simplify and improve regulatory reporting and compliance if companies grant regulators permission to directly access their private blockchain transactions in real time. This direct access could reduce the time, effort, and cost of compliance and improve the quality and accuracy of the information provided to regulators. According to one consulting firm, "[t]he real benefit and power of [blockchain] technology is… around reducing costs, risks, error rates and reconciliation processes while allowing everyone to have a shared mutualized infrastructure. It frees up capital and aids with compliance and regulatory reporting."[4] However, as will be discussed in Section II, private blockchains may not be as efficient or practical for organizations as public blockchains.

Blockchains are distributed or decentralized nature, meaning they rely on consensus rather than a central point of control. They allow "non-trusted partners, with potential conflicts of interest, to collaborate and agree on the validity of transactions without anyone overseeing that process."[5] Most business transactions today rely on one or more "middlemen" to provide some function of processing or transaction management. These intermediaries serve to unite the interests of the parties and ensure a deal is done on agreed-upon terms, typically in return for a fee. Blockchain technology purports to eliminate the need for such middlemen, which could lead to increased efficiencies and reduced costs for consumers. However, regulators in the U.S. and around the world are understandably cautious of moving away from a system of financial and other transactions utilizing administrative intermediaries, as these institutions may also serve to ensure the stability of markets, prevent fraud, and protect consumers. To be successful, proponents of DLT seeking to eliminate certain core functions of banks and insurance companies must demonstrate consumers will remain as protected, transactions as efficient, and systems as stable as they are today.

B. Smart contracts

A smart contract is a programmable code-based contract stored in a blockchain that automatically executes upon the occurrence of predefined conditions. The parties to a smart

[4] *Smart Contracts in Financial Services: Getting from Hype to Reality*. Cagemini. Oct. 7, 2016. https://www.capgemini.com/at-de/resources/smart-contracts-in-financial-services-getting-from-hype-to-reality/

[5] Sarasola, Magda Ramada. "So Maybe You Figured out What Blockchain Is — but What Can You Do with It?" Willis Towers Watson. Jun. 29, 2018. https://www.willistowerswatson.com/en/insights/2018/06/emphasis-blockchain-use-in-insurance-from-theory-to-reality

contract agree in advance upon an event or a set of conditions (if…) that will trigger a transaction, such as the payment of money (then…). "Smart contracts can be programmed to do many things: release funds, communicate information, and record and embed data, all in a preprogrammed, self-executing, and autonomous manner. Furthermore, digital identities can be created for physical properties and intangible assets with the ownership of those controlled through smart contracts."[6] Though a smart contract is self-executing and "trustless," it must rely upon an external third-party source (known as an oracle) to verify the occurrence of the contractual conditions (thereby introducing a third party back into the equation).

Smart contracts could be beneficial in the financial services and insurance industries if they decrease reliance on physical documents, thereby reducing opportunities for errors and fraud, and eliminate the need for certain intermediaries, thereby increasing efficiency and reducing costs. However, simple, unambiguous contracts are best suited for translation into this form and reliance on third-party oracles may still be necessary in many cases. Among the potential uses of smart contracts: "property ownership could be transferred automatically upon receipt of cleared funds; credits under service level agreements could be automatically paid at the point of violation; and securities could be traded without the need for central securities depositories."[7] In the insurance industry, as discussed in Section IV, smart contracts are currently being tested or utilized in crop insurance, hurricane insurance, and flight delay insurance, among other straightforward parametric applications.

C. National and international industry activity

Though many institutions initially viewed blockchain as disruptive to traditional banking, there has recently been a push by large, established banks and insurance companies to study and potentially integrate the technology into their service models. Many have joined one or more national consortia to collaborate with other companies and move forward on blockchain initiatives.[8] Such consortia may focus on "set[ting] standards to enable the development of new infrastructures" and/or developing propriety blockchain platforms for specific industry purposes.[9]

According to David Furlonger, a vice president with the research firm Gartner, "There's a lot of proof of concept work being done in pretty much every industry and government, and the interest remains extremely high from all those participants… The focus is very much on

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[6] "Is Blockchain a Viable Technology For Industry 4.0?" Wired Focus. Jun. 4, 2018. http://www.wiredfocus.com/is-blockchain-a-viable-technology-for-industry-4-0/

[7] Hingley, Tom. "Blockchain and Contracts – a Smart New World." Freshfields. https://www.freshfields.com/en-us/our-thinking/campaigns/digital/fintech/blockchain-and-smart-contracts/

[8] *See, e.g.* https://www.hyperledger.org/; https://www.r3.com/; https://www.theinstitutes.org/guide/riskblock; https://b3i.tech/

[9] Gratzke, Peter, Eric Piscini, and David Schatsky. "Banding together for blockchain." Deloitte Insights. August 16, 2017. https://www2.deloitte.com/insights/us/en/focus/signals-for-strategists/emergence-of-blockchain-consortia.html

research and development work, not massive implementation."[10] The International Data Corporation has forecast that companies and governments will spend $2.1 billion on blockchains in 2018.[11] While this is a significant amount of money, it is a small fraction of the $3.6 trillion projected to be spent on information technology worldwide in 2018.[12] It is generally accepted that any broad scale, industry-wide implementation of blockchain is still years away.

D. Vermont industry activity

Although there has been much discussion and exploration of potential blockchain applications, few Vermont companies have implemented blockchain technology as part of their core businesses. DFR staff held a series of meetings over several months with Vermont domestic insurance companies, banks, and credit unions, regional and national insurance companies and banks, insurance and financial services trade organizations and advisors, blockchain professionals, and one Vermont-based insurance technology ("insurtech") company. DFR staff asked participating companies a standard set of questions, including the following:

- Does your company have staff dedicated to researching, understanding, and/or implementing emerging technologies such as blockchain?
- What do you see as the most likely or useful application of blockchain in your industry?
- What are the barriers to adoption and implementation of blockchain and other emerging technologies in your industry and your company in particular?
- Do you think your industry's data security systems and processes could be improved through use of blockchain technology?

Though all recognize its potential benefits, most Vermont organizations are choosing a "wait and see" approach with respect to blockchain technology. Most noted that they are exploring a variety of technologies, some of which (such as artificial intelligence and sensor technology in the insurance industry) may hold greater and more immediate promise than blockchain. One Vermont insurer told the Department that one of the most important changes in the insurance market recently has been the desire of clients to access insurance without ever leaving their space, so insurance companies are focusing on accessibility in order to remain competitive in the market, particularly with respect to the millennial generation. A large national insurer echoed this sentiment, saying consumers expect services on demand and to be able to interact digitally and seamlessly. Though blockchain might someday provide a platform for such digital interaction, it is not uniquely able to provide that function.

A key concern of both Vermont-based insurers and financial institutions remains the disruptive effects blockchain could have on existing business models and practices. Many

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[10] Shin, Laura. "Industries, Looking for Efficiency, Turn to Blockchains." *New York Times*. Jun. 27, 2018. https://www.nytimes.com/2018/06/27/business/dealbook/industries-blockchains-efficiency.html

[11] Popper, Nathaniel. "What Is the Blockchain? Explaining the Tech Behind Cryptocurrencies." *New York Times*. Jun. 27, 2018. https://www.nytimes.com/2018/06/27/business/dealbook/blockchains-guide-information.html?module=inline

[12] "Gartner Says Worldwide IT Spending Forecast to Grow 2.4 Percent in 2017." Gartner. Jul. 13, 2017. https://www.gartner.com/en/newsroom/press-releases/2017-07-13-gartner-says-worldwide-it-spending-forecast-to-grow-2-percent-in-2017

Vermont domestic companies also discussed changes in staffing needs and workplace dynamics, as the pace of innovation requires the hiring of specialists in coding, analytics, and data science. Feedback received from Vermont institutions will be discussed throughout this report.

II. Blockchain obstacles

Blockchain was developed to facilitate the electronic exchange of payment (in the form of Bitcoin) between two individuals directly, eliminating the need for a central bank or fiat currency. Blockchain technology is used to verify a person has the money they say they have, to pay for the item or service being provided, and ensure that the same money is not spent twice. Blockchain purports to solve the problem of digital trust by recording information and transactions on a ledger in a manner that is both transparent and verifiable.

Shortly after blockchain was developed for digital currency applications, it was suggested that it could also be useful in recording transactions unrelated to cryptocurrency. "Bitcoin showed that an item of value could be both digital and verifiably unique. Since nobody can alter the ledger and 'double-spend,' or duplicate, a Bitcoin, it can be conceived of as a unique 'thing' or asset. That means we can now represent any form of value—a property title or a music track, for example—as an entry in a blockchain transaction."[13] However, some experts are skeptical about the amount of value blockchain technology can add to non-payment applications. The author of a recent article in *The Guardian* frames the issue as one of hype versus hope:

> The question many are asking now is whether there is much to blockchain apart from hype and speculation. The technology is still too slow to be used on a large scale: Ethereum [(a type of distributed ledger)] can only process about 15 transactions per second compared, for instance, to Visa's 2,000. Mining, the verification process that keeps blockchains trudging on, is a carbon-generating disgrace – Iceland uses more electricity for mining bitcoin than it does in powering its households. And some wonder what exactly a blockchain does, that a centralised tamper-proof digital ledger – a decade-old technology – does not.[14]

In a recent Bloomberg Odd Ends podcast titled "Why Blockchain May Never Benefit Corporations," Angus Champion de Crespigny, a former blockchain advisor at Ernst & Young, said that blockchain technology is "inefficient and cumbersome" and designed to serve the very narrow Bitcoin use case. According to de Crespigny, when you send value, duplication matters. This is the niche computer science problem Bitcoin solved. To expand the solution from payments to data means to utilize a very inefficient technology where it is unnecessary to do so. This is because, in order to get to the point of using blockchain for data transfer, you must have a group of entities who trust each other and are able to coordinate in a centralized fashion. However, if you can get to this point, you've already solved most of the problem blockchain was designed to

[13] Casey, Michael J., and Paul Vigna. "In Blockchain We Trust." *Technology Review*. Apr. 9, 2018. https://www.technologyreview.com/s/610781/in-blockchain-we-trust/

[14] Volpicelli, Gian. "Does Blockchain Offer Hype or Hope?" *The Guardian*. Mar. 10, 2018. https://www.theguardian.com/technology/2018/mar/10/blockchain-music-imogen-heap-provenance-finance-voting-amir-taaki

solve. Because players on a private blockchain are already incentivized to cooperate, private blockchain applications become about time stamping or storing data in an unchangeable way. While this can be valuable, it can be done- and is already being done- in ways that are cheaper and less complicated.[15]

A. Impediments to implementation

Today's financial and insurance transactions are relatively secure, private, and swift. Financial institutions trust one another, and the public generally trusts financial institutions, to operate effectively, efficiently, and by the rules. Though they would clearly benefit from more efficient transactions and are exploring the potential of blockchain technology, neither banks nor insurance companies have implemented any broad-scale, industry-wide blockchain use cases.

In addition to questions of applicability outside of cryptocurrency, there are issues related to blockchain's interoperability, scalability, and sustainability. Regulatory uncertainty is also a large hurdle to adoption of DLT, particularly for financial institutions, which may be subject to multiple federal and state regulatory regimes. Even if the rules were clear, being an early adopter of any technology comes at a steep price. Many smaller Vermont institutions, such as community banks and mutual insurance companies, may not be in a position, at this early stage, to sufficiently analyze, develop, or integrate blockchain technology into their operations.

1. Technological barriers

One national bank with a Vermont presence that described itself as "bullish" on blockchain technology noted that the market is moving much slower to adoption than expected. This may largely be a result of three large-scale blockchain issues that have yet to be adequately addressed: interoperability; scalability; and energy consumption.

Blockchain interoperability is the capacity for distributed ledgers to recognize and interact with one another. Hundreds of public and private blockchains exist today, each operating independently from the others. However, to be useful on a global scale, these networks need to facilitate the seamless sharing of data and value. A number of platforms and "collaboration networks" are in development to address the issue of interoperability, but no solution has been introduced.

Blockchain scalability is the capability of DLT to grow, or scale, to accommodate an increasing number of transactions. Because many public blockchains utilize a "proof of work" consensus mechanism, every node must process every single transaction and maintain a copy of the entire ledger. Therefore, a blockchain is limited in the number of transactions it can process in a given amount of time. "In other words, as the size of the blockchain grows, the requirements for storage, bandwidth, and comput[ing] power required by fully participating in the network

[15] Weisenthal, Joe, and Tracy Alloway. "A Former Blockchain Believer Explains Why It Will Never Benefit Corporations." *Economics*. Nov. 19, 2018. https://www.bloomberg.com/news/articles/2018-11-19/a-former-blockchain-believer-explains-why-it-will-never-benefit-corporations

increases. At some point, it becomes unwieldy enough that it's only feasible for a few nodes to process a block—leading to the risk of centralization."[16]

Finally, the issue of energy consumption is one that cannot be ignored. The current global power consumption of the Bitcoin network's servers alone is estimated to be four times that of Google and approximately the same as the entire country of Ireland.[17] Mass adoption would require massive additional amounts of storage space and computing power to ensure the timely validation of data. The environmental impacts of this continued growth are concerning.

2. Regulatory and legal uncertainty

Federal and state regulators, including DFR, have largely declined to issue specific guidance regarding blockchain technology in the financial sector. The reasons for this may be twofold: "First, it can be argued that there is really nothing for them to oversee, as blockchain's financial applications have yet to reach a commercial level. Furthermore, it's not exactly clear how regulators can respond to such a disruptive and quickly-evolving technology."[18] To date, few financial or insurance entities have presented the Department with non-cryptocurrency blockchain-based products or platforms to approve or examine. Sections III and IV will discuss some of the regulatory uncertainties related to certain financial and insurance products utilizing blockchain technology. However, capital adequacy and data privacy are two fundamental regulatory issues that may affect banks' and insurance companies' ability to utilize DLT.

Although traditional insurance companies may attempt to use blockchain to potentially enhance or expand their product offerings, Vermont's capital and surplus requirements make it difficult to comprehend how pure blockchain companies could offer insurance products. To qualify for authority to transact insurance business in Vermont, 8 V.S.A. § 3304 requires companies to possess and maintain paid-in capital of at least $2 million. The purpose of this requirement is to ensure sufficient conservative, liquid reserves are available to pay claims as they come due. Cryptocurrency tends to be volatile and illiquid and as such is not an acceptable way to meet capitalization requriements; a blockchain company capitalized with cryptocurrency would present a significant risk to consumers.

There are also potential legal conflicts between blockchain technology and privacy regulations applicable to financial institutions, such as the United States Fair Credit Reporting Act ("FCRA"), the Gramm-Leach-Bliley Act, HIPAA, California's Consumer Privacy Act ("CCPA"), and the European Union's GDPR, all of which are intended to protect the security and privacy of personal data. For example, the FCRA, the Gramm-Leach-Bliley Act, and HIPAA are laws that require banks and/or insurers to safeguard the confidentiality of sensitive consumer information such as financial data and medical records. As such, these laws require nonpublic

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[16] Kasireddy, Preethi. "Blockchains Don't Scale. Not Today, at Least. But There's Hope." Hackernoon. Aug. 23, 2017. https://hackernoon.com/blockchains-dont-scale-not-today-at-least-but-there-s-hope-2cb43946551a

[17] "Why Bitcoin Uses So Much Energy." *Economist*. July 9, 2018. https://www.economist.com/the-economist-explains/2018/07/09/why-bitcoin-uses-so-much-energy

[18] Chawaga, Peter. "How Will Finance Approach the Regulation of Blockchain?" Apr. 4, 2017. https://www.nasdaq.com/article/how-will-finance-approach-the-regulation-of-blockchain-cm769389

consumer data to be easily redacted. However, once immortalized on the blockchain (even by mistake), inaccurate, fraudulent, or private consumer data can be nearly impossible to remove.[19] Moreover, the addition of blockchain to a company's internal data security procedures is unlikely to add significant security since other controls (strong passwords, data encryption, physical security, and the like) are already required by existing regulations.[20]

The GDPR "protects fundamental rights and freedoms of natural persons and in particular their right to the protection of personal data" and applies to any business, wherever located, that processes the data of EU citizens, including by offering goods or services in the EU.[21] The GDPR codifies EU citizens' "right to be forgotten," which is the right to erasure of their personal data. Businesses must also obtain the consent of any EU citizen before obtaining and processing their personal data. Though the right to be forgotten is not absolute, according to the regulation, such data must be erased: (1) immediately where it is no longer needed for its original purpose; or (2) if the data subject withdraws his or her consent or objects and there are no overriding legitimate grounds for continuing to process the data. CCPA, which becomes effective on January 1, 2020, contains similar protections for California residents.

There are several potential conflicts between blockchain technology and the GDPR and CCPA. First, with a public blockchain, it is difficult to identify a "data controller" responsible for the processing and erasure of data. With a private blockchain, this is less of an issue. Second, the immutable nature of blockchain records can make such erasure difficult or impossible. According to Michèle Finck, Oxford EU law lecturer and senior researcher at the Max Planck Institute:

> The GDPR was created for a world in which we have centralised data silos that collect, store and process data. Blockchains essentially decentralise all of those processes. So you certainly can't deny there's a tension between GDPR and blockchain, because they represent different visions of what the database is. As a result, it's very hard to figure out what a GDPR-compliant blockchain would be.[22]

Despite these potential conflicts, the EU remains open to the implementation of blockchain technology. On October 3, 2018, the European parliament passed a nonbinding resolution on blockchain technology that encourages the European Commission and other EU authorities to adopt an innovation-friendly regulatory approach to DLT "guided by the principles of technology neutrality and business-model neutrality," while acknowledging it is of the "utmost importance" that blockchain technologies comply with the GDPR.[23] This resolution

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[19] "Why Blockchain Technology Won't Replace Title Insurance." CATIC. June 2018. www.catic.com/Portals/0/PagePdfs/CATIC%20Blockchain%20White%20Paper.pdf

[20] Recently, one of the most well-known cryptocurrencies, Ethereum, was allegedly hacked in a manner that raises serious questions about the purportedly superior inherent security of blockchain technology generally. See https://www.wired.com/story/attack-on-ethereum-currency-highlights-crypto-weakness/

[21] https://gdpr-info.eu/

[22] Kelly, Jemima. "Immutable ledgers meet European data protection." *Financial Times*. Apr. 11, 2018. https://ftalphaville.ft.com/2018/04/12/1523503800000/Immutable-ledgers-meet-European-data-protection-/

[23] European Parliament. *European Parliament resolution of 3 October 2018 on distributed ledger technologies and blockchains: building trust with disintermediation.* Strasbourg, Oct. 3, 2018. Office for Official Publications of the European Communities.

signals a desire for EU legislators to find a solution allowing DLT-based innovation to develop under the GDPR.

One solution that has been suggested for blockchain privacy compliance is to store "immutable proofs that certain data exists" on the blockchain and the actual data records off-blockchain.[24] If a person were to request deletion of their data under the GDPR, the off-chain data and, possibly, the blockchain's referral link to such data could be erased. However, this approach seems to controvert some of the very benefits DLT is designed to provide, particularly efficiency and security. Off-chain data would be vulnerable to hacking, because it would not benefit from blockchain's encryption methods, and unauthorized access to such data would be less traceable. Because access rights may be restricted, permissioned blockchains are more likely to comply with privacy regulations. However, additional guidance may be necessary before firms, especially those that do business in the EU or with EU citizens, can safely implement blockchain technology.

3. Practical issues

While all of Vermont's domestic insurance companies are keenly interested in developments in blockchain technology, many do not have the resources to develop or implement blockchain-based technologies in house. Two Vermont domestic insurers described their companies as being in an "exploratory phase" or "observation mode." They are watching the blockchain space very closely and paying attention to how larger national insurers are utilizing the technology. They are interested in how blockchain might eventually be integrated into their business models but are not yet actively embracing it. At the other end of the spectrum, one large national insurer that is a member of a national blockchain consortium had a similar outlook, noting that companies need to stay on top of what's going on in terms of blockchain, but also need to make sure the technology really solves a customer need before implementing it in their business model.

There are high costs to implementing new systems, formatting and migrating existing data, and hiring or training staff to respond to complex issues. To many smaller institutions, these hurdles could be insurmountable and being a first mover may not be the most prudent course of action. Some domestic institutions expressed concern about the pace of technology putting smaller institutions at a disadvantage, while others noted that small institutions are nimble and can work quickly with technology providers to implement a package of products to remain competitive. One Vermont insurer noted that mutual insurance companies have an advantage because they are "market followers" that can adapt quickly to change. With any financial technology, institutions must adapt to remain relevant, but moving too quickly can present unintended consequences.

III. Banking applications

http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P8-TA-2018-0373&language=EN&ring=B8-2018-0397

[24] "On the Road to Reconciling GDPR and Blockchain." Nov. 2018. https://www.blankrome.com/publications/road-reconciling-gdpr-and-blockchain

Many believe blockchain technology has the potential to enhance transactional security and increase transparency in the financial services industry, thereby also reducing the potential for fraud. Since blockchain is decentralized, it could eliminate the need for many third-party intermediaries, and smart contracts could be used to automate many transactions. Automation, increased transparency, and a reduced risk of human error could lead to more efficient, less expensive transactions, including with respect to payments, clearing, and settlement processes, know-your-customer identity verification, and regulatory compliance. In addition, blockchain technology could support the introduction and growth of innovative financial services models and processes. However, because blockchain is distributed and reliant on consensus, transactions will necessarily take more time than those utilizing a centralized database. The relatively slow speed of DLT transactions may not suit certain transactions that require a very fast turnaround and, as noted above, blockchain is also far more resource-hungry than other forms of data storage.

Though consortia of banks have formed to explore the use of blockchain technology, there has not yet been widespread adoption. Financial institutions are typically not first movers with respect to nascent technologies. This is for good reason. A recent survey reported that only nine percent of responding chief information officers say their organizations have implemented blockchain-related projects or plan to do so within a year.[25] Most of the Vermont-based banks and credit unions interviewed by the Department believe mass adoption is still years away. One institution noted that their biggest fear with emerging technologies is adopting too early; blockchain technology hasn't matured enough at this point for it to be prudent for them to consider its implementation.

This section will discuss some of the most promising potential applications of blockchain in the banking industry, along with some of the benefits, risks, and regulatory hurdles associated with these applications.

A. Clearing and settlement of trades

Though buying and selling securities on a computerized trading platform takes seconds or less, most securities transactions require two to three days to settle. This is because settlement and clearing depend upon multiple intermediaries to manage the risk that one of the parties to the transaction will default, either by having insufficient funds or failing to fulfill its contractual obligations. Reliance on intermediaries is cumbersome and time-consuming, and the processes used by such intermediaries are often outdated. Utilizing blockchain to automate and decentralize securities transactions could reduce or eliminate liquidity risk, save individuals and institutions time and money, and enhance regulatory compliance. Goldman Sachs recently estimated that blockchain could save U.S. capital markets $2 billion and global capital markets $6 billion on an annual basis by streamlining securities clearing and settlement processes.[26] On the

[25] Schatsky, David, Amanpreet Arora, and Aniket Dongre. "Blockchain and the Five Vectors of Progress." Sept. 28, 2018. https://www2.deloitte.com/insights/us/en/focus/signals-for-strategists/value-of-blockchain-applications-interoperability.html, referencing David Furlonger and Rajesh Kandaswamy, "Blockchain status 2018: Market adoption reality." Gartner. Mar. 27, 2018.

[26] Rizzo, Pete. "Goldman Sachs: Blockchain Tech Could Save Capital Markets $6 Billion a Year." Coindesk. Updated May 25, 2016. https://www.coindesk.com/goldman-sachs-blockchain-tech-save-capital-markets-12-billion

other hand, blockchain's utility for settlement and clearing requires all major banks, clearinghouses, and exchanges to adopt the technology.

B. Payments processing

Many believe blockchain could play a transformative role in transfers of funds, particularly cross-border transfers. Cross-border transactions generated 40 percent of global payments transactional revenues in 2016, but the current system for cross-border payments is slow and expensive.[27] Over 11,000 banks utilize the Society for Worldwide Interbank Financial Telecommunications ("SWIFT") for international funds transfers. SWIFT has been facilitating cross-border transactions for 45 years and currently handles half the world's high-value cross-border payments. SWIFT relays messages through a series of correspondent banks before funds reach their final destinations. To reduce risk, banks on each side of a transaction must pre-fund accounts in native currency and many small and medium banks pay fees to rely upon other banks' pre-funded transactional accounts (which fees are often passed on to consumers). Because they require multiple steps, participants, validation procedures, and financial intermediaries, international bank transfers can be expensive and time-consuming—many such transfers require days to complete. In addition, lack of transparency makes it difficult to track progress and verify when funds have been received.[28]

Some companies, such as Ripple Labs, aim to compete with SWIFT by using blockchain and real-time messaging to settle cross-border payments in a matter of seconds.[29] Over 100 banks utilize Ripple's xCurrent system, which, according to the company, works by using blockchain technology to validate all accounts and balances prior to initiating a transaction, locking those funds in place, using cryptographic signatures to verify the availability of funds and the consent of the parties to the transaction, and then simultaneously releasing all funds.[30] However, xCurrent only works where the initial currency and the resulting currency are liquid, and 100 banks is a fairly low number of adopters. Ripple has developed a different system called xRapid for transfers to or from less liquid currencies. xRapid converts the originating funds into Ripple's cryptocurrency, XRP, and then into the destination currency. This eliminates the need for correspondent banks and liquidity providers to exchange fiat currency directly. However, since this system utilizes cryptocurrency, it is subject to fluctuations in XRP's liquidity and valuation and an uncertain U.S. and international regulatory environment.

Harry Newman, SWIFT's head of banking, is skeptical of blockchain's ability to provide a scalable solution, saying "[Blockchain technology] is not straightforward to scale and it is not yet appropriate to do so. All the announcements [by banks about their blockchain payments projects] made to date, they are either in-house or bilateral projects between banks. As you bring

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[27] [CSBS Research Brief: How Blockchain Could Disrupt Banking]

[28] Faden, Mike. "The Future of Cross-border Payments: Ripple versus SWIFT." American Express. https://www.americanexpress.com/us/foreign-exchange/articles/ripple-vs-swift-gpi-cross-border-payments/

[29] Ripple Labs is not currently licensed in Vermont as a money services business.

[30] Johnson, Kelly. "RippleNet Grows to More Than 100 Financial Institutions." Ripple. https://ripple.com/insights/ripplenet-grows-to-over-100-financial-institutions/

scale you get escalating complexity."[31] Again, this is an area where incumbent companies must adapt to changing circumstances, but it may not be necessary or wise to focus solely on blockchain technology.

C. Know your customer (KYC) and data management

To comply with the Bank Secrecy Act and related federal regulations intended to prevent and detect money laundering and other criminal acts, banks and other financial institutions are required to verify each customer's identity and assess the potential risks of doing business with that customer through a series of procedures known as "know your customer" or KYC.[32] Compliance with KYC requirements is expensive, with financial institutions spending an average of $48 million per year on KYC.[33] KYC requirements clearly serve an important function, but they can make the process of opening an account lengthy and complicated. Individuals may be required to provide multiple identity verification documents such as passports, utility bills, leases, and bank statements of account signatories.

One financial institution regulated by DFR explained that it is interested in technologies related to member identification and KYC because its clients are "rebelling against providing all of the personally identifiable information required for identification." Another regulated institution noted that blockchain technology has the potential to provide a "bold new way of managing data" and "quantum leaps in efficiencies." A number of enterprises have developed blockchain-based platforms intended to lower financial institutions' KYC costs and improve customer experience. In March 2018, a startup called Spring Labs used $14.75 million in seed funding to launch a blockchain-based network for the sharing of data by lenders and data providers.[34] Similarly, the Credit Union National Association is working on a project to evaluate the possibility of creating a blockchain with credit unions as nodes.[35] These models are based on the notion of "self-sovereign identity," or putting people in control of their own digital identities. Most people share their sensitive personal information with third parties on a daily basis by typing it into an internet browser, swiping a credit card, or using a smartphone app. In 2017, there were 16.7 million victims of identity theft.[36] In theory, if a person fully controlled and maintained his or her own digital identity, it would be more difficult to steal while simultaneously being easier for the consumer to provide to a bank for the bank's KYC purposes.

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[31] Arnold, Martin. "Ripple and Swift Slug It out over Cross-border Payments." *Financial Times*. Jun. 5, 2018. https://www.ft.com/content/631af8cc-47cc-11e8-8c77-ff51caedcde6

[32] Bank Secrecy Act (BSA). https://www.occ.treas.gov/topics/compliance-bsa/bsa/index-bsa.html

[33] Callahan, John. "Know Your Customer (KYC) Will Be A Great Thing When It Works." *Forbes*. Jul. 10, 2018. https://www.forbes.com/sites/forbestechcouncil/2018/07/10/know-your-customer-kyc-will-be-a-great-thing-when-it-works/#3a8ed9d28dbb

[34] Yurcan, Bryan. "Can Blockchain Ease Banks' Digital-identity Concerns?" *American Banker*. Mar. 27, 2018. https://www.americanbanker.com/news/can-blockchain-ease-banks-digital-identity-concerns

[35] Eha, Brian Patrick. "Credit Unions Look to Blockchain to Solve Digital Identity Crisis." *American Banker*. May 2, 2017. https://www.americanbanker.com/news/credit-unions-look-to-blockchain-to-solve-digital-identity-crisis

[36] "Facts + Statistics: Identity Theft and Cybercrime." Insurance Information Institute. https://www.iii.org/fact-statistic/facts-statistics-identity-theft-and-cybercrime

Third-party non-blockchain-based software platforms currently offer financial institutions an automated solution for KYC compliance. As state regulators, DFR would review banks' use of blockchain-based KYC platforms the same as it does the use of such other third-party data management platforms. However, as no federal guidance has been issued, it is unclear whether and how the blockchain-based platforms will comply with federal anti-money laundering regulations. Though technologies continue to evolve, financial institutions and their regulators must remain focused on safety and soundness, compliance, and risk management.

IV. Insurance applications

There are many possible uses of blockchain in the insurance industry. Smart contracts could automate key processes and enhance consumer experience; the secure, shared, and distributed nature of permissioned blockchains could permit real-time regulatory reporting; and distributed ledger technology could even enable new products and platforms. A significant potential benefit of blockchain in the insurance industry, particularly the property and casualty sector, is greater automation of the claims processing system. Gathering the data necessary to evaluate and process claims requires time, effort, and coordination between multiple parties and often results in errors. Some experts predict blockchain technology could transform the insurance industry by automating such processes and reducing "frictional costs" associated with human interaction.[37]

Because of its shared and distributed nature, blockchain may also help combat fraud in the insurance industry. Insurance fraud (excluding health insurance) in the U.S. costs an estimated $40 billion per year, which translates to $400 to $700 in increased premiums for a typical American family. Blockchain can provide a permanent audit trail to evaluate claims, possibly decreasing the potential for fraud, and the shared nature of blockchain could help insurers coordinate with each other to combat fraud and identify suspicious behavior.[38] One Vermont insurer noted that enhancements to the security of data are the most important reason to implement blockchain technology. However, like Vermont banks and credit unions, Vermont insurers tend to believe it is too early to implement blockchain-based applications. This section will discuss some examples of the potential insurance industry blockchain use cases, along with some of the associated benefits, risks, and regulatory hurdles.

A. Parametric insurance

Parametric insurance is not a new product but is increasingly gaining attention in light of smart contract technology. Parametric insurance has, traditionally, been largely confined to the

[37] Lerner, Matthew. "Insurance Ripe for Blockchain, Costs and Regulations Weigh: Fitch Panel." *Business Insurance*. May 2, 2018. https://www.businessinsurance.com/article/20180502/NEWS06/912321003/Insurance-ripe-for-blockchain-costs-and-regulations-weigh-Fitch-panel

[38] "How Blockchain Could Disrupt Insurance." CB Insights. Mar. 21, 2018. https://www.cbinsights.com/research/blockchain-insurance-disruption/

reinsurance space.[39] However, new technologies and increased access to extensive data about more granular risks may increase its use in the direct insurance markets. Parametric insurance lends itself well to smart contracts, because it involves rule-based, self-executing claims processing. With parametric insurance, "a benefit payable is determined in advance of the policy purchase by estimating the loss as accurately as possible, subject to certain conditions being satisfied."[40] For example, a parametric policy may cover risk from potentially catastrophic weather events, such as hurricanes. It would specify parameters for wind speed, an oracle to verify data (such as the National Oceanic and Atmospheric Administration ("NOAA")), and a payout. If NOAA were to confirm, after a hurricane, that a certain wind speeds were reached, then the parametric policy would automatically pay insureds the agreed-upon amount.

This product is useful in cases of well-defined risk, as it eliminates the need for claims adjusting and provides certainty of payout. Because the automated claims process eliminates the need for most intermediaries, paperwork, and claims investigations, it can make claims payouts predictable and fast, and potentially lower premiums. The risk, of course, is that insureds may receive benefits that are not fully in line with their actual losses.

Some European companies currently offer blockchain insurance applications to consumers outside the United States. For example, Etherisc, a Switzerland-based insurance start-up, and AXA, a major global insurer based in France, each sell blockchain-based parametric flight-delay insurance products that provide immediate compensation if a flight is delayed. Individuals purchase a policy for a particular flight; smart contract technology utilizes a global air traffic database as its oracle and pays a set amount automatically upon a predetermined delay.[41] Such short-term policies face hurdles in the U.S. since most states, including Vermont, have laws requiring insurers to provide advance notice (45 days in Vermont) to consumers before terminating or declining to renew a policy.[42] These laws are based on conventional one-year or six-month policies. While they serve an important consumer protection function in the traditional context, these notice requirements may also restrict such new products or methods that provide insurance on-demand for coverage periods of hours or days.

B. Usage-based insurance

The internet of things uses telematic sensors, mobile apps, and wearable fitness trackers to collect a massive amount of behavioral data from today's consumers. Insurers are increasingly using telematic data to more accurately calculate risk. Some auto insurance customers, for example, voluntarily install telematic devices in their vehicles to collect and transmit to the

[39] Hook, Lucy. "What Exactly is Parametric Insurance?" *Insurance Business America*. Jun. 19, 2018. https://www.insurancebusinessmag.com/us/news/risk-management/what-exactly-is-parametric-insurance-103672.aspx

[40] Der, Linda, and James Ridgeway. "Parametric Insurance: A New Spin on an Old Product." July 9, 2018. https://www.captive.com/news/2018/07/09/parametric-insurance-new-spin-old-product

[41] "Make Insurance Fair and Accessible." https://etherisc.com/#products; "AXA Goes Blockchain with Fizzy." September 13, 2017. https://group.axa.com/en/newsroom/news/axa-goes-blockchain-with-fizzy

[42] See 8 V.S.A. §§ 3879-3883, governing the termination of fire and casualty insurance, 8 V.S.A. §§ 4223-4226, governing the termination of automobile insurance, and 8 V.S.A. §§ 4711-4715, governing the termination of commercial risk insurance.

insurer data on how far, where, and when they drive, and how often they engage in behaviors such as rapid acceleration and hard braking. Whereas insurers rely on actuarial data to calculate traditional auto insurance premiums, with usage-based policies, such as Progressive's Snapshot program,[43] insurers use personalized data about a person's driving style to calculate their individual risk-based insurance premium.

There are potential privacy concerns related to the tracking and use of data and some states, like California, impose limitations on the data that may be tracked. Vermont has no express limitations on data tracking by insurers but does have laws governing the sharing of certain personally identifiable information. Vermont is an "opt-in" state, meaning a licensed entity may not share nonpublic consumer financial information with affiliates or third parties without the consumer's express consent.[44] For this reason, it may be difficult for insurers to provide such usage-based policies to Vermont consumers if doing so would require them to share such data with affiliates or third parties, such as actuaries or data scientists. In addition, the Department would closely examine the data sources used by insurers, to ensure they are objective and verifiable, and the sufficiency of data used to calculate a customer's premium, to ensure it provides a fair basis for determining risk.

Usage-based policies offer benefits such as giving "consumers the ability to control their premium costs by incenting them to reduce miles driven and adopt safer driving habits. Fewer miles and safer driving can also aid in reducing accidents, congestion, and vehicle emissions, which benefits society."[45] Some companies, such as MetroMile, use collected data to offer pay-per-mile policies in a few states (excluding Vermont) and charge a monthly base rate plus a per-mile fee.[46]

Large amounts of data are already being collected and used by many insurers. In the future companies may utilize DLT to store collected data about consumers in a secure, transparent manner that may be shared with regulators, and blockchain smart contracts to automatically trigger claims payments or repairs based on collected data.

C. Peer-to-peer Insurance

Peer-to-peer ("P2P") insurance "allows insureds to pool their capital, self-organize, and self-administer their own insurance. The core idea of P2P is that a set of like-minded people with mutual interests group their insurance policies together introducing a sense of control, trust, and

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[43] "Snapshot Means BIG Discounts for Good Drivers." https://www.progressive.com/auto/discounts/snapshot

[44] Nonpublic consumer financial information includes information a consumer provides to a licensee to obtain an insurance product or service from the licensee. *See* Regulation IH-2001-01: Privacy of Consumer Financial and Health Information. http://www.dfr.vermont.gov/reg-bul-ord/privacy-consumer-financial-and-health-information-regulation-0

[45] "Usage Based Insurance and Telematics." NAIC. https://www.naic.org/cipr_topics/topic_usage_based_insurance.htm

[46] While MetroMile is an approved insurer in Vermont, it has not issued any policies. *See* https://www.metromile.com/

transparency while at the same time reducing costs."[47] Like parametric insurance, P2P insurance is not a new concept, but one that could potentially be enhanced through use of blockchain technology. Many companies, such as Lemonade, have developed P2P insurance models that utilize blockchain technology.[48]

Blockchain smart contracts could simplify policy administration and execution by automating the claims and payment process. Essentially, "one could guarantee the payment from the investor [(who has agreed to provide a demanded insurance payout)] to the customer in case the event for which the customer posted their insurance demand happens. The smart contract is thus programmed as a traditional guarantee, but without the need of a bank… Besides that, the investors know their maximum exposure as the amount defined in the smart contract."[49]

One Vermont domestic insurer expressed concern about P2P companies' ability to address fraud given the speed of transactions. Given the large amount of fraud in the insurance industry, most incumbent companies devote a significant amount of time to investigating the validity of claims. The same company noted that they are not that concerned about the disruptive impact of P2P insurance because there are many obstacles to becoming a successful insurance company, including infrastructure and regulator relationships. However, this company also believes incumbent insurers should remain competitive by working with technology companies to enhance their operations. Another domestic told DFR that they believe the disruptive impact of P2P insurance will be very small, as there are currently too many impediments to the model. One such impediment is that P2P insurance would have difficulty meeting the legal requirements of Vermont and other states for insurance companies, particularly capitalization and solvency requirements, which exist to protect consumers and the marketplace. In a recent report, advisory firm Willis Towers Watson predicts the impact of P2P may not be felt for at least five to 10 years.[50] In this time, incumbent companies are focusing on adapting and improving existing systems to improve customer experience.

D. Land and vehicle titles

Much has been written about blockchain's potential effect on the title insurance industry. The president of a large Northeast title insurance agency wrote a post for Forbes in June 2018 titled, "Will the Power of Blockchain Mean the End of Title Insurance Companies in 20 Years?" The article sets forth compelling reasons why the answer, at least in the foreseeable future, is no.[51] However, blockchain does have appear to have potential to provide efficiencies and cost savings in the title and real estate industries. CATIC, a Vermont domestic title insurer, agrees. The

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[47] "Peer to Peer (P2P) Insurance. NAIC. https://www.naic.org/cipr_topics/topic_p2p_insurance.htm

[48] Lemonade is not currently licensed to provide insurance in Vermont.

[49] Rikken, Olivier. "Why Blockchain Could Enable a True P2P Insurance Model." Apr. 23, 2016. https://www.coindesk.com/blockchain-p2p-insurance-models

[50] Sarasola, Magda Ramada. "So Maybe You Figured out What Blockchain Is — but What Can You Do with It?" June 29, 2018. https://www.willistowerswatson.com/en/insights/2018/06/emphasis-blockchain-use-in-insurance-from-theory-to-reality

[51] Shaw, Marc. "Will the Power Of Blockchain Mean The End Of Title Insurance Companies In 20 Years?" *Forbes*. June 22, 2018. https://www.forbes.com/sites/forbesrealestatecouncil/2018/06/22/will-the-power-of-blockchain-mean-the-end-of-title-insurance-companies-in-20-years/#357e1b0e342a

company recently issued a report that identifies both the potential and the limitations of the technology for the title industry. CATIC believes that blockchain "will not replace title insurance; rather, it will ensure that the title insurance industry will endure."[52]

The success of blockchain for the title and real estate industries requires adoption by all parties, including land recorders throughout the country, title companies, and mortgage lenders. In much of the United States, including Vermont, property records are recorded at the local level and, while many county or town recorders allow electronic storage of title records, many others still rely on paper documents. Given many jurisdictions have not yet digitized land records, and the time and expense of entering all existing records, mass adoption of blockchain technology for property records seems quite far in the future.

Prior to closing, title companies perform an extensive review of property records, correct any known errors, and provide verification of clean and marketable title. The American Land Title Association, a national trade association for the title industry, reports that title problems are found and remedied by title companies prior to closing in 25 percent of residential real estate transactions.[53] However, not all title defects are found or corrected prior to closing. Therefore, title companies offer title insurance to protect owners and mortgage lenders against any undiscovered flaws in title affecting their interests in a property.

The enhanced security and immutability of the blockchain could provide significant benefits for land title and other public record systems in the form of increased efficiencies and lower costs. The append-only nature of blockchain could decrease the potential for fraud and tampering with land records. In a $31.8 trillion real estate industry where 30 percent of title insurance losses are fraud-related,[54] this could result in significant savings. In addition, recording real estate transactions on the blockchain could make title searches more efficient, thereby reducing costs to real estate purchasers. However, a challenge would be ensuring accuracy as historical records are added to the blockchain. Blockchain may make their jobs easier, but title professionals will continue to be required to ensure the authenticity and accuracy of data added to the blockchain, determine the legality and enforcement of documents on the blockchain, and identify and correct title issues.

Similar to land titles, vehicle titles could potentially be recorded on the blockchain. A potential benefit to this approach is streamlined registration and enhanced tracking of vehicle records by regulatory bodies, insurers, and financial institutions. Another benefit of doing so would be improved transparency in the used car market, potentially eliminating the market for "lemons". However, as with land title, success would require adoption by all relevant parties, including government registrars, vehicle sellers, and lenders.

E. Captive Insurance

[52] "Why Blockchain Technology Won't Replace Title Insurance." CATIC. June 2018. www.catic.com/Portals/0/PagePdfs/CATIC%20Blockchain%20White%20Paper.pdf

[53] Title Insurance: A Comprehensive Overview. American Land Title Association. https://www.alta.org/press/TitleInsuranceOverview.pdf

[54] "Why Blockchain Technology Won't Replace Title Insurance." CATIC. June 2018. www.catic.com/Portals/0/PagePdfs/CATIC%20Blockchain%20White%20Paper.pdf

Similar risks, rewards, and regulatory considerations apply to the use of blockchain by captives as apply to its use by traditional insurers. A few captive insurance and reinsurance companies have been early adopters of blockchain technology, for the streamlining of payment systems and enhanced regulatory compliance. Allianz Global Corporate & Specialty SE ("AGCS") partnered with Ernst & Young, digital agency Ginetta, and Citi Treasury and Trade Solutions to develop and implement "a blockchain prototype solution for the captive insurance program of a long-standing Allianz Risk Transfer customer with global risks."[55] The prototype facilitates cash transfers between countries by connecting the captive management, its global subsidiaries, and AGCS as fronting insurer and allowing them to share transactions and data entries in real time. In addition, American International Group ("AIG") partnered with IBM and Standard Chartered Bank P.L.C. "to create the first multinational, 'smart contract' based insurance policy using blockchain."[56] This solution addresses the problem of compliance with multiple local regulatory regimes:

> Working together, AIG, Standard Chartered and IBM converted a multinational, controlled master policy written in the UK, and three local policies in the US, Singapore and Kenya, into a "smart contract" that provides a shared view of policy data and documentation in real-time. This also allows visibility into coverage and premium payment at the local and master level as well as automated notifications to network participants following payment events. The pilot also demonstrates the ability to include third parties in the network, such as brokers, auditors and other stakeholders, giving them a customized view of policy and payment data and documentation.[57]

The State of Vermont is taking steps to test the integration of captive insurance and blockchain. On January 9, Secretary of State Jim Condos and Commissioner Pieciak entered into a memorandum of understanding to collaborate and explore blockchain technology and its use in the digital recordkeeping practices of the captive insurance industry. The two offices jointly issued a request for information to identify vendors to help the State launch a pilot program to allow new captive insurance companies to register with the Secretary of State using blockchain technology. The pilot program is designed to test the functionality of blockchain in state regulatory processes.

V. Regulatory considerations and recommendations

A recent research paper about the challenges of regulating in the current era of innovation notes that blockchain and other financial technologies raise "concerns about the ability of regulators to achieve three essential goals of financial regulation: the efficient allocation of capital, the protection of consumers, and the prevention of systemic risk. Each of these goals is

[55] Allianz Develops Blockchain Prototype for Captive Insurance Program." *Insurance Journal*. Nov. 7, 2017. https://www.insurancejournal.com/news/international/2017/11/07/470607.htm

[56] Gonzalez, Gloria. "Blockchain Could Offer Benefits for Captives." *Business Insurance*. Aug. 8, 2018. https://www.businessinsurance.com/article/20180808/NEWS06/912323243/Blockchain-could-offer-benefits-for-captive-insurers

[57] "AIG, IBM, Standard Chartered Deliver First Multinational Insurance Policy Powered by Blockchain." IBM. https://www-03.ibm.com/press/us/en/pressrelease/52607.wss

undermined by the Bitcoin era's defining features—a reliance on disembodied institutions, complex algorithms, and frequent adaptation to provide an evolving set of financial services to consumers."[58] Regulators must come up with new tools to identify, monitor, and sanction noncompliance. As stated in a recent post on captive.com, "[w]hile blockchain may be able to automate any number of insurance functions and eliminate the need for middlemen, the need to be able to audit these exchanges remains."[59]

Since many Vermont financial institutions and insurance companies are not yet in a position to adopt or integrate blockchain into their business models, a base question is whether regulation specific to blockchain is necessary or prudent at this point in time. It should be noted that blockchain is an enabling technology, one that may allow companies to improve their products and services. The Department does not regulate individual technologies, but rather the financial services companies that choose to adopt them. Whether or not regulated banks and insurance companies utilize technology like blockchain, DFR's role is to ensure they meet the requirements of existing statutes and rules, including with respect to audits and examinations, solvency and capitalization requirements, data security, and other consumer protections.

In an opinion piece for Coindesk, a blockchain media company, the director of Delaware's marketing initiative and the chair of the Wall Street Blockchain Alliance's Legal Working Group suggest states use caution in considering blockchain legislation:

> With the goal of permitting blockchain enabling legislation to be truly enabling and not inadvertently crippling or confusing, we suggest that states consider enacting blockchain enabling laws only where the failure to enact such legislation would perpetuate existing – or create new – ambiguity about whether the technology's use is permissible, or where the existing state laws preclude the deployment of the technology altogether.[60]

The Department does not believe Vermont law precludes the deployment of DLT. For that reason, blockchain-specific regulation or legislation is not currently needed with respect to DFR-regulated entities.

One area, outside of DFR's formal purview, where legislative action may be warranted is the legal effect given to records recorded on the blockchain. Vermont was an early mover in this area, enacting a law in June 2016 that affirms the evidentiary value of blockchain records:

> A digital record electronically registered in a blockchain shall be self-authenticating pursuant to Vermont Rule of Evidence 902, if it is accompanied by a written

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[58] Magnuson, William J. "Financial Regulation in the Bitcoin Era." Mar. 26, 2018. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3148036
"FinTech and Captive Insurance Revisited." Sept. 17, 2018. https://www.captive.com/news/2018/09/17/fintech-and-captive-insurance-revisited

[60] Tinianow, Andrea, and Joshua Ashley Klayman. "Enabling or Crippling? The Risks of State-by-State Blockchain Laws." Nov. 22, 2017. https://www.coindesk.com/enabling-crippling-risks-state-state-blockchain-laws

declaration of a qualified person, made under oath, stating the qualification of the person to make the certification and:

(A) the date and time the record entered the blockchain;
(B) the date and time the record was received from the blockchain;
(C) that the record was maintained in the blockchain as a regular conducted activity; and
(D) that the record was made by the regularly conducted activity as a regular practice.[61]

However, Vermont's law may not cover all transactions and does not specifically address whether blockchain records are recognized under Vermont's version of the Uniform Electronic Transactions Act ("UETA"). UETA holds that electronic records and signatures shall not be denied legal effect solely because of their electronic form. A transaction is defined under Vermont's UETA as "an action or set of actions occurring between two or more persons relating to the conduct of business, commercial, or governmental affairs."[62] Where a transaction does not conform to this definition (for example, when a single party registers data on the blockchain), it may not be given legal effect.[63]

In 2017 Arizona passed H.B. 2417, which deems records, signatures and smart contract terms secured by blockchain and governed under UCC Articles 2, 2A and 7 to be "electronic signatures" under Arizona's version of the UETA. Vermont could consider Arizona-like legislation to clarify any ambiguity about the treatment of blockchain-secured records. However, there is a possibility that such a change would be preempted by the federal Electronic Signatures in Global and National Commerce Act.[64]

Another broader issue to consider is what legal remedies are available to users of blockchain technology if things go wrong. What remedies does the affected individual have against a malicious, potentially anonymous actor, where should liability be placed in a blockchain, and which court has jurisdiction? These issues are beyond the scope of this report, but without a clear legal structure, and with nodes on a blockchain that can be located anywhere in the world, such questions may be difficult to answer. A recent publication by a large international law firm frames the issue as follows:

> In a conventional banking transaction, for example, if the bank is at fault then irrespective of the transacting mechanism or location, the bank can be sued and the applicable jurisdiction will most likely be contractually governed. However, in a decentralised environment, it may be difficult to identify the appropriate set of rules to apply… At its simplest level, every transaction could potentially fall

[61] 12 V.S.A. § 1913
[62] 9 V.S.A. § 271(17)
[63] Condos, James, William H. Sorrell, and Susan L. Donegan. "Blockchain Technology: Opportunities and Risks." Jan. 15, 2016. https://legislature.vermont.gov/assets/Legislative-Reports/blockchain-technology-report-final.pdf
[64] Svikhart, Riley T. "Blockchain's Big Hurdle." *Stanford Law Review*. 2017. https://www.stanfordlawreview.org/online/blockchains-big-hurdle/

under the jurisdiction(s) of the location of each and every node in the network. Clearly, this could result in the blockchain needing to be compliant with an unwieldy number of legal and regulatory regimes. In the event a fraudulent or erroneous transaction is made, pinpointing its location within the blockchain could be challenging.[65]

Although at this time, the Department does not recommend the adoption of blockchain-specific regulation or legislation for financial institutions or insurance companies, it does propose a regulatory sandbox-type approach to innovative platforms and products, which may include those utilizing blockchain. As discussed in Sections III and IV of this report, some new and emerging products and technologies that may be beneficial to consumers are not permitted under current Vermont statutes or regulations (for example, existing cancellation parameters for insurance policies may prevent certain short-term, usage-based products from being introduced). To support and encourage innovation in the marketplace, the Department would propose that the Legislature codify the Commissioner's authority to grant variances, waivers, or no action letters to applicants wishing to test certain product innovations that are not otherwise permitted. In connection with such a "sandbox," the Commissioner would grant waivers or variances on a case-by-case basis with respect to specific laws or regulations, which would be effective for a limited period of time. Some important laws and regulations, such as solvency and capitalization requirements, would not be subject to waiver. If the Commissioner were to grant a waiver or variance, DFR would actively engage with the entity testing the new product or platform to ensure the protection of Vermont consumers. This approach would allow the Department to gain insight into how new products serve consumer needs and what changes, if any, should be made to existing regulatory frameworks.

Since technology tends to evolve quickly, the Department understands the importance of continuing to engage on this topic with its regulated entities as well as technology companies and DLT experts. To continue studying the challenges and opportunities presented by blockchain, the Department has joined a working group with the Attorney General's Office, the Secretary of State, and the Agency of Commerce and Community Development. The working group plans to begin meeting this month and will engage stakeholders and interested industry experts on blockchain to determine how best to engage with a technology that may represent a new business sector.

Blockchain technology may hold enormous potential. However, whether it will transform the financial and insurance industries remains to be seen. Most Vermont banks and insurance companies are interested enough to actively investigate and learn about DLT, but cautious enough to wait until they see proven, large-scale use cases that are not associated with cryptocurrency. Based on the research, analysis, and industry viewpoints

[65] McKinlay, John, Duncan Pithouse, John McGonagle, and Jessica Sanders. "Blockchain: Background, Challenges and Legal Issues." Feb. 2, 2018. https://www.dlapiper.com/en/us/insights/publications/2017/06/blockchain-background-challenges-legal-issues/

discussed in this report, the Department recommends the same measured approach to blockchain be taken by the Vermont Legislature as well as State regulatory bodies.