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OVERVIEW OF BLOCKCHAIN LEGISLATION AND ADOPTION: STATUS AND CHALLENGES

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ABSTRACT

Blockchain is hailed as the technology that will disrupt the way assets of value are transacted. According to World Economic Forum (2018), "Blockchain is a foundational emerging technology of the Fourth Industrial Revolution, much like the internet was for the previous (or third) industrial revolution" (p.1). The purpose of this paper is twofold. First, it identifies how US states/US federal legislature are creating legislation to support blockchain. Second, it identifies the challenges to blockchain adoption. This paper, which utilizes reviews of relevant literature and legislations introduced by US federal and state legislatures, identifies some of the reasons why blockchain has not yet gained widespread adoption. Some US states have taken steps to extend existing electronic transaction regulations to include transactions executed on blockchain technology. However, most states as well as the US federal government still need to begin the process of adopting regulations to facilitate the widespread use of blockchain technology. Federal and state regulators need to consider that regulatory uncertainty is one of the reasons blockchain has not yet gained widespread adoption.

Keywords: Blockchain, Blockchain Legislation, Blockchain Adoption

INTRODUCTION

In recent years, blockchain has become a popular topic in technology conferences, workplace conversations, and even in news stories. Proponents of blockchain present it as the solution for just about every problem. Detractors, however, state that everything blockchain solves has been effectively and efficiently solved by other technological solutions. Such polarized debates might have contributed to the lack of clarity around what the technology is, which problems it solves, and an honest discussion about its limitations.

Despite the ongoing debates about the technology and its applications, governments around the world have been considering how blockchain technology may be adopted. For example, governments such as the United Arab Emirates (particularly the Emirate of Dubai) have plans to move all government documents to blockchain by 2020 (Smart Dubai Initiative, 2016). Estonia has already moved all its healthcare records to a blockchain-based application (Rutschman, 2018). The government of Georgia deployed a land registry application using blockchain (Exonum, n/d). In the United States, the State of West Virginia utilized blockchain as a mobile voting solution to increase accessibility to voting during a federal primary and midterm elections (State of West Virginia, 2018). Most government bodies, however, seem to be trying to make sense of what the technology is or are choosing to wait and learn from early adopters.

What is blockchain? According to Woodside, Augustine, and Giberson, "Blockchain is a digitized decentralized ledger to allow record keeping of all peer-peer transactions without the need for a centralized authority" (2017, p. 66). Similarly, Potts, Ellie, and Jake (2017) explain that "Blockchains are distributed, in that they use a combination of encryption and peer-to-peer technology to update a common and immutable record to show when a transaction has occurred. All nodes within the system will synchronize to display the outcome" (p. 3). In sum, blockchain is a decentralized database. This means that data in a blockchain is stored in decentralized databases that are distributed across multiple networks. Each block is linked to another block through a chain; hence, the name blockchain. Another key concept to define at this point is Smart Contracts. Smart contracts also referred to as scripts or stored procedures are codes that run in a series of steps only when the requirements for their execution are met. According to Reyes (2018), the term smart contract "at a basic level is routinely used to refer only to "a computer protocol-an algorithm-that can self-execute, self-enforce, self-verify, and self-constrain the performance of its instructions" (p.284). Further, Potts et al., (2017) state, "Programmable blockchains such as Ethereum perform automated agreements, carrying pre-determined actions when conditions (as enshrined in the code) are met" (p. 3). In relational database architectures,

smart contracts are called stored procedures. Reyes (2018) concludes that the key elements that make these verifiable scripts both unique and powerful "lie in their autonomous, self-sufficient, distributed nature" (p. 285).

CURRENT STATUS OF STATES AND FEDERAL BLOCKCHAIN LEGISLATION/BILLS IN THE USA

One of the purposes of this paper is to investigate what various US states are doing to regulate blockchain technology. It is also the goal of this paper to help understand if the bills introduced are facilitating adoption of the technology or if new/existing laws are inhibiting blockchain adoption. A summary of blockchain legislation from the National Conference of State Legislatures is utilized for this analysis. The analysis focused on:

- Identifying how many US states have introduced, adopted, and/or passed laws on blockchain or distributed ledger technology.
- Identifying how many introduced blockchain bills have been passed and adopted.
- Summarizing the provision of the bills introduced, adopted, and/or passed legislature on blockchain or distributed ledger technology.
- Identifying blockchain legislation passed by the federal government.

State Legislation/Bill Summary by Status

For the 2015 – 2018 legislative year, 21 US states out of 50 have introduced bills on blockchain or distributed ledger technology. These states are Arizona, California, Colorado, Connecticut, Delaware, Florida, Hawaii, Illinois, Maine, Maryland, Michigan, Missouri, Nebraska, New Jersey, New York, Nevada, Ohio, Tennessee, Vermont, Virginia, and Wyoming. A total of 52 bills have been introduced in both their respective state houses (assemblies) and state Senates. Table 1 below summarizes the status of the bills.

Table 1. State Legislation/Bill Summary by Status

Bill Status	Number	Bill
Introduced	24	Connecticut- S.B. 513; Illinois - H.R. 120; Maine- L.D. 950; Maryland- H.B. 1100; Maryland- S.B. 893; Michigan- H.B. 6257; Michigan- H.B. 6258; Missouri- H.B. 1256; Nebraska- L.B. 691; Nebraska- L.B. 694; Nebraska- L.B. 695; New Jersey- A.B. 3613; S.B. 2297; New Jersey- A.B. 3768; S.B. 2462; New York- A.B. 8780; S.B. 8858; New York- A.B. 8792; New York- A.B. 8793; New York- A.B. 10854; Ohio- S.B. 300; Vermont- H.B. 765; Vermont-H.B. 737; Virginia- H.J.R. 153
Passed Assembly/House	3	California- A.B. 2658; Illinois- H.B. 5553; Hawaii - H.B. 1481
Passed Senate	1	California- S.B. 838
Postponed indefinitely	2	Colorado-S.B. 29; Colorado- S.B. 279
Passed both chambers	4	Delaware-S.B. 182; Delaware-S.B. 183; Delaware-S.B. 194; Ohio-S.B. 220
Died on calendar	1	Florida- H.B. 1357
Signed by governors	15	Arizona- H.B. 2602; Arizona- H.B. 2603; Arizona - H.B. 2216; Arizona - H.B. 2417; Colorado- S.B. 86; Connecticut- S.B. 443; Delaware - S.B. 69; Nevada - S.B. 398; Tennessee- S.B. 1662; Vermont- S.B. 269; Vermont- H.B. 868; Vermont- S.B. 138; Wyoming- H.B. 1; Wyoming- H.B. 70; Wyoming- H.B. 101
Substituted	1	Tennessee- H.B. 1507 substituted by S.B. 1662. S.B. 1662-Signed by governor 3/22/18, Public Chapter 591
Adopted	1	Illinois - H.J.R. 25

Summary by the Provisions

Blockchain jurisdiction. Arizona, Illinois, Nebraska, and Nevada introduced bills to establish the jurisdiction of the state to regulate blockchain. In other words, units of local government, such as cities, villages and counties, do not have authority to regulate blockchain (Arizona), or to implement specified restrictions on the use of blockchain technology (Illinois), or to tax or otherwise regulate the use of distributed ledger technology (Nebraska and Nevada). Two of these bills (Arizona and Nevada) have been signed by their respective governors; one has passed the House (Illinois); and one has been introduced (Nebraska).

Blockchain taskforce. California, Connecticut, Hawaii, Illinois, New Jersey, New York, Vermont, Virginia, and Wyoming introduced bills to establish a blockchain taskforce. The purpose of the taskforce is to investigate potential uses, risks, and benefits of blockchain technology (California, Connecticut, Hawaii, New Jersey, Virginia, and New York). Wyoming's blockchain taskforce is aimed at identifying governance issues related to blockchain technology and developing appropriate legislation to be recommended to one or more appropriate legislative committees for consideration. Most of these bills have either passed or have been signed by their respective governors. Three of these bills are still in "introduced" status (New Jersey, New York, and Virginia).

Legality of blockchain artifacts. Arizona, California, Florida, Nebraska, New York, Nevada, Ohio, Tennessee, Vermont, and Wyoming introduced bills to establish the legality of blockchain artifacts, such as electronic transactions, electronic signatures, and smart contracts. Specifically, these bills clarify and/or confirm that the definition of electronic transactions has been broadened to include transactions executed on blockchain technologies (Arizona, Nebraska, New York, Nevada, and Ohio). These bills also established that electronic records and/or electronic signatures and smart contracts have legal effect or enforceability (Arizona, California, Florida, Tennessee, New York, and Vermont). Further, these bills allow entities to record, share, and synchronize transactions in their respective electronic ledgers or databases. A total of 16 bills have been introduced by Arizona, California, Connecticut, Florida, Nebraska, Nevada, New York, Ohio, Tennessee, Ohio, Vermont, and Wyoming to recognize the legal authority to use blockchain technology and smart contracts in electronic transactions. Of the 16 bills, seven have been

signed by their respective governors (Arizona, Nevada, Tennessee, Vermont, and Wyoming); two of the bills (California, Ohio) have passed the assembly/both chambers. The Florida bill died on calendar.

Record keeping. Most of the bills introduced by different states are to either investigate or authorize the provisions around using blockchain technology for record keeping. Some of the bills provide blanket provisions permitting corporations to use blockchain technology for certain recordkeeping requirements (New Jersey), while others provided provisions for blockchain technology to be used in the creation or maintenance of corporate records, security records, etc. Wyoming included provisions authorizing corporations to accept shareholder votes if signed by a network signature that corresponds to a network address. There are provisions in some of the legislations authorizing use of blockchain to save government records and/or transactions such as business licensing records (Colorado and New York). Of the bills introduced for this purpose, those from California, Colorado, Delaware, and Wyoming either have been signed by their respective governor or have passed in their respective Houses.

Tracking. Colorado introduced bills authorizing blockchain technology to be used for tracking purposes. Colorado's bill explores the use of blockchain to track marijuana. Arizona and Missouri introduced bills prohibiting, with specified exceptions, the usage of blockchain to electronically track firearms. The bill from Colorado has been postponed indefinitely; the bill from Arizona has been signed by the governor. The status of the Missouri bill is 'Reported Do Pass".

General. Illinois and Vermont introduced bills authorizing blockchain technology to be used for most transactions, to implement strategies in relation to blockchain, cryptocurrency, and financial technology.

Expand existing penal codes. Michigan and Nebraska introduced bills expanding existing penal codes related to crimes involving forgery, counterfeiting, money laundering, etc., to include blockchain-based solutions, applications, mechanisms, etc.

Elections. New York introduced a bill directing the State Board of Elections to study and evaluate the use of blockchain technology to protect voter records and election results. Maine introduced a bill to study using blockchain technology in conjunction with paper ballots.

Cybersecurity: Ohio introduced a bill to provide a legal safe harbor to covered entities that implement a specified cybersecurity program. This bill passed both chambers.

Casino: Ohio introduced a bill to alter the definition of "key employee" under the Casino Gaming Law – Ohio. This bill passed both chambers.

US FEDERAL GOVERNMENT LEGISLATION/BILLS

The US federal government for all legislative years introduced 17 bills in total with regards to blockchain technology. The summary of the provisions is given below.

Safe harbor for blockchain developers and providers of blockchain services. H.R.528 (2019) and H.R.6974 (2018) were introduced to protect blockchain developers. Specifically: no blockchain developer or provider of a blockchain service shall be treated as a money transmitter, money services business, financial institution, or any other State or Federal legal designation requiring licensing or registration as a condition to acting as a blockchain developer or provider of a blockchain service, unless the developer or provider has, in the regular course of business, control over digital currency to which a user is entitled under the blockchain service or the software created, maintained, or disseminated by the blockchain developer.

Establish workgroups/taskforces. H. R. 6913 (2018), H.R.41 (2019), and H.R.7225 (2018) were introduced to establish workgroups or taskforces to study blockchain and make recommendations on the technology's potential for the financial sector, government services, and promoting United States competitiveness in the evolving global virtual currency marketplace.

Expressing support for blockchain technology. H.Res.1102 (2018), H.Res.1108 (2018), and H.Res.835 (2016) were introduced to expresses support for the accelerated development of applications and processes that utilize blockchain technology and support for blockchain research.

Legality of blockchain artifacts. H.R.7002 (2018) was introduced to establish the legality of blockchain artifacts, such as electronic transactions, electronic signatures, and smart contracts.

Cybersecurity. S. Amdt.1055 (2017), H.R.2810 (2017) and H.R.2825 (2017) were introduced to understand the potential of offensive and defensive cyber applications of blockchain technology and other distributed database technologies. Two similar bills. H.R.7321(2018) and S.3758 (2018), were introduced to report on how Iran plans to hack applications developed with blockchain by forking an existing blockchain, creating a new blockchain, or opening/closing the blockchain.

Database for clinical research and scientific studies. H.R.6562 (2018) explores the potential of blockchain technology for hospital data security for coccidioidomycosis (commonly referred to as "valley fever") research.

Market Protection. H.R.5892 (2015) and H.R.5777 (2014) prohibit, for a five-year moratorium period beginning June 1, 2015, federal, state, and local governments from imposing statutory restrictions or regulations specifically identifying and governing the creation, use, exploitation, possession, or transfer of any algorithmic protocols governing the operation of any virtual, non-physical algorithm or computer source code-based medium for exchange (cryptocurrency).

ADOPTION

Gartner Inc. identifies blockchain as one of the Top 10 Strategic Technology Trends for 2019 (Gartner, 2018, n/p). Blockchain ranks with genome editing, artificial intelligence and automation, quantum information science, and brain/augmented reality as one of the five emerging technologies that will potentially transform society (GAO-18-396SP). The World Economic Forum predicts distributed ledger technology such as blockchain could boost trade by more than $1 trillion in the next 10 years (The World Economic Forum, 2018, n/p). Despite these predictions, there hasn't been much traction for blockchain adoption outside of the financial sector. It is also unclear at which stage of the technology adoption curve blockchain is positioned. Woodside et al., (2017) indicate, "it is difficult to determine the exact location of blockchain technology on the diffusion of innovation adoption curve" (p. 69). Similarly, Stratopoulos and Wang (2018) believe, "blockchain diffusion is primarily limited to innovators and early adopters" (p. 15). Below are some of the possible reasons for lack of enthusiasm for a widescale blockchain adoption.

Lack of clarity about the technology. There seems to be lack of clarity on the difference between cryptocurrency and blockchain technology. It might be difficult at times to separate the two, since bitcoin is the primary reason blockchain exists. Prominent economists and heads of state have been very critical of bitcoin. For instance, Joseph Stiglitz, a Nobel Memorial Prize recipient and the former head of the World Bank, spoke of bitcoin in an unflattering manner when he stated, "it ought to be outlawed" (Costelloe, 2017, n/p). Former Israeli Prime Minister Ehud Barak echoed the same sentiment about bitcoin when he said "Cryptocurrencies—bitcoin and all the others—that's a Ponzi scheme" (Chang, 2018, n/p). However, he separated the baby from the bathwater when he explained, "Whoever has the patience and understands blockchain deeply can find a lot of uses for it, from keeping sensitive medical information through to contracts." Moreover, though there is a lot of discussion about the use cases that could be realized using blockchain, there aren't many successful deployment and full-scale production applications to date to serve as evidence of the solution(s) blockchain technology provides.

Interoperability. Another important factor to consider is the interoperability of blockchain with the company's existing portfolio of tools and applications. For instance, how easy is it to transition from mainframe-based large databases to blockchain? Some organizations might be waiting for answers to these and similar questions before deciding whether to adopt blockchain. Hileman and Rauchs (2017) conducted a study to baseline the current state of

both enterprise and public-sector use of blockchain and distributed ledger technology (DLT). They identified interoperability to be the major challenge to blockchain adoption.

Technology compatibility with use cases. Certain use cases could utilize unique features of blockchain, such as immutability, validity, consensus, and traceability. Blockchain could effectively and efficiently realize use cases that deal with digital assets, where there is a need to remove intermediaries, to create immutable records (Mulligan et al., 2018). It is important to be clear on what blockchain technology solves and what it does not. For instance, blockchain is promoted as a fraud-free technology. However, based on the portfolio of existing technological solutions, while blockchain could make fraud less possible, it is not certain that the technology will eliminate fraud completely. Information technology in general and blockchain in particular cannot make fraudulent people or organizations honest. Similarly, blockchain technology is advertised as the tool that will bring democratization to all. Despots and dictators have been part and parcel of human existence since the days of the first governments, and they probably will continue to be, even with blockchain.

Risk aversion, perceived usefulness, and the perceived ease of use. Diffusion of innovation (DoI) is one of the major theories usually used to explain the rate of adoption of new technology or innovation. DoI identifies five types of adopters: innovators, early adopters, early majority, late majority, and laggards (Stratopoulos and Wang, 2018, p. 3). Each group/category has its own characteristics, with the level of tolerance to risk serving as the major differentiator between each group. Stathopoulos and Wang (2018) indicate that blockchain will become mainstream when around one third of potential adopters enter the early majority group. Technology acceptance model (TAM) is another theory used to understand why and how organizations adopt new technology. TAM indicates that an individual's or organization's attitude toward new technology is influenced by perceived usefulness and the perceived ease of use (Ozgen and Turan, 2017). A similar perspective is presented by Information Technology Infrastructure Library (ITIL)'s guiding principles. One guiding principle, "focus on value," is defined as follows:

> Everything the service provider does needs to map, directly or indirectly, to value for the customer and/or the organization. It is the customer who determines what is of value to them, not the service provider. A service can deliver value to a customer only if it has utility (is fit for purpose) and warranty (is fit for use) (2016, pp. 12 – 13).

Consequently, according to these theories, any technology—including blockchain—will be adopted when the customer perceives the technology as fit for purpose (utility-perceived usefulness) and fit for use (warranty-perceived ease of use). Hence, companies that do not perceive the utility and warranty blockchain provides will be hesitant to adopt the technology.

Governance. The challenge to blockchain adoption on a public network is the lack of governance. Hilman (2017) indicates that the main "key challenges to broader Distributed Ledger Technology (DLT) adoption remain: unclear regulatory environment and legal risks are most often mentioned as key challenges; study participants consider privacy and confidentiality to be more of an issue than scalability and performance concerns" (p. 8).

Regulation. A PwC study of "600 international business executives spread across 15 different countries . . . found that regulation of blockchain technology is an issue that must be overcome before the technology can enjoy widespread acceptance" (Cullinan, 2018, n/p). According to Fenwick, Kaal, Vermeulen (2017), "The law—and other regulations—can often prohibit, or otherwise limit, commercial exploitation of, and public access to, new technology" (p. 4). Most US states either have not expanded existing legislation or have not introduced bills to recognize the legality of smart contracts and usage of blockchain technology in electronic transactions. Out of the 16 bills introduced to establish the legality of blockchain artifacts, such as electronic transactions, electronic signatures, and smart contracts, only seven are signed by their respective governors (Arizona, Nevada, Tennessee, Vermont, and Wyoming). Two of the bills passed their respective Assemblies/both chambers (California, Ohio). The Florida bill died on calendar. The one bill introduced by the US federal government has not yet been passed. An explanation for this might be, as Fenwick, Kaal, Vermeulen (2017) stated, "regulation is always premised on a selection of relevant facts about a particular technology. Crucially, the selected facts are those that are seen as relevant by the regulators in deciding what, when, and how they should make a regulatory intervention" (p. 7). They add, "relevant facts that form the basis of regulation are never going to be obvious or settled. The regulation of any disruptive new technology is always going to be reactive and based on an uncertain and politicized factual basis" (p. 9).

CONCLUSION

Blockchain is a technology with great potential for industries that transact assets of value. In many forums and discussions, blockchain is being compared with the internet and is speculated to transform industries that transact assets of value the same way the internet transformed the dissemination of information. Blockchain is believed to be more effective and efficient in realizing use cases in which assets of value are being transacted, in which it is crucial to increase the trust around those transactions, and in which there is a need to create immutable records.

Like any new disruptive technology, blockchain is not yet widely adopted. Challenges to blockchain adoption include a lack of clarity about the technology, existing investment in other major technology, interoperability, technology compatibility with use cases, and lack of governance and regulatory uncertainty.

Legislations/bills are being introduced by the US federal government and US states to harness the potential of blockchain. The provisions of the bills, though diverse, may be summarized as follows: establishing blockchain taskforces; confirming or clarifying the legality of blockchain artifacts; exploring the user of blockchain for corporate and government record keeping; tracking/tracing transactions; elections; and databases for clinical research and scientific studies. These bills also included provisions to create safe harbor for blockchain developers and providers of blockchain services.

The legislations/bills introduced thus far seem to be favorable to the adoption of blockchain technology. For instance, the US federal government and the Ohio blockchain legislations/bills include provisions to create safe harbor for blockchain developers and providers of blockchain services. The only prohibitive laws to date are the bills introduced by Arizona and Missouri on their prohibition on using blockchain to electronically track firearms.

Blockchain regulations, much like the application of the technology itself, are more exploratory in nature. The regulations around blockchain will mature as the technology matures and eventually gets widely adopted. Moreover, as Raskin (2017) pointed out, “Innovative technology does not necessitate innovative jurisprudence, and traditional legal analysis can help craft simple rules as a framework for this complex phenomenon” (p. 306). A possible approach for US states/the US federal legislature to utilize could be to establish blockchain taskforces similar to the Illinois Blockchain and Distributed Ledger Task Force, which was required to present a report on “how current state laws could be modified to support this technology” (State of Illinois, 2018, p. 5).

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