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BLOCKCHAIN TECHNOLOGY – SCOPE OF LEGAL REGULATIONS

Under the Guidance and Supervision of

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<u>CERTIFICATE</u>

This is to certify that **Mr. ALLEN P ALEX, REG NO: LM0219010,** has submitted his Dissertation titled "**BLOCKCHAIN TECHNOLOGY – SCOPE OF LEGAL REGULATIONS**" in partial fulfilment of the requirement for the award of the Degree of Masters of Laws in International Trade Law to the National University of Advanced Legal Studies, Kochi under my guidance and supervision. It is also affirmed that the dissertation submitted by him is original, bona fide and genuine.

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I declare that this Dissertation titled "**Blockchain Technology – Scope Of Legal Regulations**" is researched and submitted by me to the National University of Advanced Legal Studies, Kochi in partial fulfilment of the requirement for the award of the Degree of Master of Laws in International Trade Law, under the guidance and supervision of Dr. Athira P. S., Assistant Professor, and is an original, bona fide and legitimate work and it has been pursued for an academic interest. This work or any type thereof has not been submitted by me or anyone else for the award of another degree of either this University or any other University.

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ABBREVIATIONS

AER	American Economic Review
AI	Artificial Intelligence
ARPANET	The Advanced Research Projects Agency Network
BAJ	British Actuarial Journal
BIALL	British and Irish Association of Law Librarians
CNIL	Commission Nationale de l'Informatique et des Libertés
CUP	Cambridge University Press
DLT	Distributed Ledger Technologies
EJRR	European Journal of Risk Regulation
EU	European Union
Fin Tech	Financial Technology
FINMA	Swiss Financial Market Supervisory Authority
FTC	Federal Trade Commission
GDPR	General Data Protection Regulation
GLJ	German Law Journal
GPI	Global Payments Innovation
GSN	Global Solutions Network
HBR	Harvard Business Review
HBSP	Harvard Business School Press
IBM	International Business Machines Corporation
ICANN	Internet Corporation for Assigned Names and Numbers
ICO	Initial Coin Offerings
IoT	Internet of Things
MAS	Monetary Authority of Singapore
MIT Press	Massachusetts Institute of Technology Press

NIST	National Institutes of Standards and Technology
PoC	Proof of Concept
PoW	Proof of Work
SEC	United States Securities and Exchange Commission
SSRN	Social Science Research Network
STANFORD L. REV	Stanford Law Review
SWIFT	Society for Worldwide Interbank Financial Telecommunication
TNeGA	Tamil Nadu e-Governance Agency
U.S.	United States
UK	United Kingdom
UNIV. OF BRISTOL L. SCH. BLOG	University of Bristol Law School Blog
UPI	Unified Payments Interface
WALL ST. J.	Wall Street Journal
WEF	World Economic Forum
WWW	World Wide Web

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CHAPTER I

<u>BLOCKCHAIN TECHNOLOGY – INTRODUCTION</u>

<u>INTRODUCTION</u>

The invention of a revolutionary encoding or cryptographic technology known as 'Blockchain' is already central to a significant proportion of business-to-business (B2B) and business-to-consumer (B2G) commerce, legal products and processes. From online purchasing to medical data sharing of cross-jurisdictional criminal records to possibly even management of entire countries' registers and notarisations, this technology has huge potential.

However, with this potential to develop in as yet undefined ways and into various unregulated areas, is the risk that ethical boundaries defining our basic rights to ownership, privacy and access to justice may be crossed. At the core of this ethical challenge is not the technology itself, but the speed at which it is being taken up and used. We need to pause, identify the spread of blockchain's applications and regulate accordingly.

Blockchain is a chronological database of transactions recorded by a network of computers. Through a decentralised public ledger and cryptographic mechanism, blockchain facilities transactions that are sufficiently secure between two parties. Every new transaction carries an unforgettable record of the entire history of the chain and all previous transactions. In turn, it is a ledger to which anyone can add a transaction but not one user can remove any information.

In a blockchain, each set of transactions is encrypted and organized into smaller datasets called 'blocks'. Every 'block' contains data about the relevant transaction, references to the preceding purchases, that form the block in the chain and an answer to a complex mathematical puzzle, which is used to validate the data associated with the particular block. To ensure that only authentic transactions are recorded as a block, the network-that is all the other devices that hold the same version of the block-must confirm that any new transactions are valid, and therefore do not invalidate any former transactions.

The new block is added to the end of the existing series of blocks only after the network of computers and/or devices reach consensus (i.e., 51%) as to the validity of the transaction, thereby can proceed in forming a blockchain. Once a block has been successfully added to a blockchain, it can no longer be deleted and becomes a permanent and immutable record of the transactions contained within it. This can be accessed and verified by everyone on the network.

Applications of Blockchain Technology – Blockchain has already been used to make cryptographic tokens. These are a kind of electronic key that may be used in place of, or in addition to, a password, and can represent property or ownership, censorship-resistant communications and file sharing systems, decentralised domain name management systems (DNS) and fraud-resistant digital vomiting platforms.

Blockchain technology may also be used in 'Smart contracts' - i.e., computer protocols that facilitate, performance of a contract, or that make a contractual clause unnecessary. These may be used for capital markets trading, insurance claims processing, energy grid management etc.. It can also pave way to design the systems for music business, artists' rights management and their royalty payments together. Then there are digital currencies like the 'Bitcoin' which is a virtual currency that relies on blockchain.

Although, the technology is fast progressing around the world, there is a clear lacune in this sphere when it comes to regulations. Moreover, the pace of the new technologies and its applications always outsmarts the pace at which regulations are put in place. However, countries like Estonia, Australia have endorsed this technology so much that most of their governmental services are done through this technology. In the European Union, the General Data Protection Regulations recently came into being which is presently one of the best regulations in the world which provides regulations for the disruptive technologies like Blockchain and AI along with other conventional laws.

Blockchain in India is still in a budding stage where the country still fears to accept Crypto currencies as valid. However, many states in India have been exploring more into this technology along with a host of startups which are dedicated to develop applications which are more secure, encrypted, easy to use and cost-efficient. But,

even which this development we are yet to formulate a regulation for Blockchain and other novel technologies.

STATEMENT OF PROBLEM

Though blockchain technology has immense potential in dealing problems relating to anonymity, link with artificial intelligence, internet of things (IoT) and Cloud computing, it may have many repercussions on individual rights and freedoms and privacy as well as on security and use of data of individuals and other entities. Currently, there is a clear absence of any regulatory control or validation of the use of block chain technology in India, unlike systems such as USA, UK, Qatar, Japan etc. wherein they have incorporated this technology into Fintech (Financial Technology), Stock marketing and other business enterprises.

SCOPE OF STUDY

The study seeks to analyze the applications as well as potential uses of blockchain technology, in various sectors such as finance, banking, securities markets, intellectual property rights, algorithmic governments, insurance, e-commerce etc. The scope of legal regulation of the technology as well as potential models of such regulation shall be ascertained, especially from a comparative perspective.

RESEARCH QUESTIONS

1. What may be the applications of and benefits from use of blockchain technology?
2. Whether the use of blockchain technology may potentially improve the standards of provision of services such as internet, technological services, insurance, banking, governance etc.?
3. Whether such technology should be regulated by law?
4. What may be the appropriate standards of such regulation?
5. How is this technology presently regulated in different countries around the world and what is the position of India in terms of coming up with regulations?

RESEARCH OBJECTIVES

1. To ascertain the potential application of and benefits from use of blockchain technology.
2. To verify whether such technology needs to be regulated by law.
3. To prescribe the standards of such regulation, so as to maximize the potential of this technology.
4. To comparatively assess the present standards of such regulation as well as to suggest regulatory framework of use of blockchain technology in India.

HYPOTHESIS

1. Block chain technology has immense potential in sectors such as finance, banking, governance as well as other major facets of human existence.

2. Such technology, while may be beneficial, must be legally contained and regulated.

RESEARCH METHODOLOGY

In the present study the researcher is using Doctrinal or Non-empirical legal research. The researcher has made an attempt to analyze the existing laws and regulations in India and has also taken the measures and regulations adopted but other countries in the international platform to regulate blockchain. For this purpose the researcher had gone through various primary and secondary sources.

The primary sources comprise of the regulations and laws in different countries and in India. The secondary sources include books, articles, research papers, recognized reports and journals on Blockchain technology.

CHAPTERISATION

The first chapter deals with meaning, scope and relevance of Blockchain technology. The history and development of Blockchain would be explained along with the structure and working of a Blockchain. The components of the Blockchain will also be described to understand about the different characteristics of Blockchain. The second chapter deals with the various applications and process of Blockchain. This

chapter deals with the application of Blockchain in individual areas and explains how the tools in Blockchain help to address the needs of those areas.

The third chapter deals with the regulation, processes and types of Blockchain. In this chapter the different types of regulations and control over the Blockchain is explained giving a clear picture as to what is to be regulated and what should be dealt carefully. The fourth chapter extensively covers the different Blockchain models available in the world. This chapter takes the examples of China, Europe, and India among others in a comparative perspective giving a clear picture as to the scale of development of Blockchain in these countries.

The fifth and the final chapter deals with the conclusions and suggestion regarding the regulations that can be formed to regulate Blockchain without hindering the normal process of Blockchain.

CHAPTER II

BLOCKCHAIN TECHNOLOGY – MEANING, SCOPE AND RELEVANCE

INTRODUCTION

Fifty years have passed since the dawn of the Internet, which was a collaboration between academic, industry, and government partners,[1] which expanded the frontiers of technology and science, much beyond immediate US military requirements. The Internet, of the present time, was an outcome of constructive competition between the USA and Russia.[2] The ARPANET (predecessor to Internet) was purportedly conceived and made to regain the technological lead in the arms race and protect the US against a space-based nuclear attack from Russia[3]. The Internet of information, for the past four decades, improved the data flow within and among firms and people. It never envisaged transforming how people do business as the Internet was designed to move information and not value from person to person. The growth of the Internet got facilitated by the confluence of many technologies and owed its existence to the shared vision of many visionary technologists like Vannevar Bush, Norbert Wiener, and others.[4] In the early 1980s, inventors were tirelessly trying to solve the Internet's problems of privacy, security and inclusion with cryptography.[5]

The Internet exploded after 1990, urging the US government to open it to the world on April 30, 1993, as 'World Wide Web'. It grew exponentially with the development and adoption of cutting edge technologies like Digital marketing, Customer Relationship Management, Internet of Things, Artificial Intelligence, Machine Learning, Robotics, and the like.[6] It improved the productivity and quality of life. During the advent of the Internet, people trusted each other better,[7] but gradually the

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[1] SRINIVAS MAHANKALI, BLOCKCHAIN THE UNTOLD STORY 1 – 3 (2d Ed. 2019).

[2] Barry M. Leiner, Vinton G. Cerf, et al., *Brief history of the Internet*, Internet Society, (Feb. 19, 2020, 09:30 AM), https://www.internetsociety.org/internet/history-internet/brief-history-internet/.

[3] Id.

[4] Nick Szabo, *The God Protocols, 1997*, SATOSHI NAKAMOTO INSTITUTE, (Feb. 17, 2020, 11:00 AM), https://nakamotoinstitute.org/the-god-protocols/.

[5] *Id.*

[6] Barry, *supra* 2.

[7] *Id.*

'Trust factor' went out of the picture and gave rise to several side effects that intruded into the privacy of other people and also threatened the security of the digitally influenced lifestyles.[8]

THE TRUST PROTOCOL FACTOR

In 1993, David Chaum, a mathematician came up with the idea of 'eCash, a digital payment system made as a technically perfect product, which made it possible to safely and anonymously pay over the Internet.[9] It was ideally suited for sending electronic pennies, nickels, and dimes over the Internet, and many big players like Microsoft were interested in including eCash as a feature in their software. However, the online shoppers did not care about factors like privacy and security online back then, and eventually, Chaum's company DigiCash went bankrupt in 1998.[10]

Contemporaneously , Nick Szabo, one of Chaum's associates, wrote a short paper entitled "The God Protocol," where he mused about the creation of a 'Be-all-end-all technology protocol'; the one which he designated God as the trusted third party in the middle of all transactions. His idea was that all the parties would send their inputs to God, and God would determine the results and return the outputs. He believed that no party would learn anything more about the other parties' inputs than they could learn from their inputs and the output.[11]

In 2008, the global financial industry crashed, and a pseudonymous person or a group named Satoshi Nakamoto put forth a new protocol for a peer-to-peer electronic cash system using a cryptocurrency called bitcoin.[12] Efforts to identify this individual or group of individuals have remained unsuccessful, adding a strong aura of mystery to this information communication technology (ICT).[13] This protocol came with an established set of rules in the form of distributed computations that ensured the

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[8] Don Tapscott, *Blockchain: the ledger that will record everything of value*, The World Economic Forum, (Feb. 17, 2020, 1:10 PM), https://www.weforum.org/agenda/2017/07/blockchain-the-ledger-that-will-record-everything-of-value/.

[9] Nick Szabo, *supra* 4.

[10] Id.

[11] Id.

[12] Don Tapscott, *supra* 8.

[13] See Taylor and Francis, *Bitcoin and Beyond*, RIPE Series in Global Political Economy 1 – 2, See also De Filippi and Loveluck (2016).

integrity of the data exchanged among billions of devices <u>going through a trusted third party</u>.[14] This protocol laid the foundation of a growing number of global distributed ledgers called 'Blockchain.'

THE BEGINNING

Blockchain came into existence on January 3, 2009, through the launch of the cryptocurrency by the name bitcoin.[15] The original conceptual framework behind Blockchain was put forward by a group of researchers back in 1991. Their idea intended for time-stamping digital documents, as backdating them would not be possible after that.[16] However, the idea went mostly unused until one anonymous person or a group by the name 'Satoshi Nakamoto' again mentioned it in his white paper "Bitcoin: A Peer-to-Peer Electronic Cash System".[17] Satoshi Nakamoto was the one who designed cryptocurrency, bitcoin and created its original reference implementation. The first Blockchain database, as part of the implementation, was also devised by them.[18]

Bitcoin became popular along with its underlying technology in the subsequent years, but it took a while when people realized the difference between Bitcoin and Blockchain as people were only looking into the Bitcoin aspect. They failed to notice the possibilities in the underlying technology in the initial years, and when the actual concept of Blockchain started portraying its real potential, people were busy trying to connect it with the bitcoin terms, and that ended in total misconception and misunderstanding.

The technology went on to shake the basis of convention and centralisation, being mystical, though building trust, being process-driven, though boosting entrepreneurial culture, being mostly limited to 'Transactions and States' though impacting every possible business one can think of, not being run by any 'owner' but still creating enormous value and economic activity.[19] The revolutionary encoding or cryptographic

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[14] Don Tapscott, *supra* 8.
[15] DON TAPSCOTT & ALLEN TAPSCOTT, BLOCKCHAIN REVOLUTION 2, (2d Ed. 2018).
[16] *Id.* at 3.
[17] CYBROSYS TECHNOLOGIES (Limited Edition), BLOCKCHAIN E-BOOK 11, Blockchain Expert E, (Apr. 14, 2020, 4:00 PM) https://www.blockchainexpert.uk/book/blockchain-book.pdf/.
[18] *Id.*
[19] SRINIVAS MAHANKALI, BLOCKCHAIN THE UNTOLD STORY 1 – 3, (2d Ed. 2019).

technology 'Blockchain' is already central to a significant proportion of business-to-business (B2B) and business-to-consumer (B2G) commerce, licensed products and procedures.[20] From virtual purchases to medical data and prescription administration, data exchange of cross-jurisdictional criminal data to even manage an entire country's registers and notarizations, this technology has immense potential.[21]

WHAT IS BLOCKCHAIN TECHNOLOGY?

There exists no universally accepted definition to 'Blockchain' till date to the knowledge of the researcher. According to International Business Machines Corporation (IBM), 'Blockchain is a shared, distributed ledger technology which aids the process of recording transactions and keeping track of assets in a network.'[22] The said asset can be a tangible asset like property, house, vehicle, or an intangible asset like digital currency, intellectual property rights, and the like. Blockchain enables transactions through a decentralized public ledger and a unique cryptographic mechanism that is sufficiently secure between two parties. The National Institute of Standards and Technology (NIST), in its report, states that 'A Blockchain is fundamentally a decentralized ledger that keeps transaction records on numerous computers simultaneously, and once a group or a block of records is added into the ledger, the block's information is linked mathematically to the other blocks, forming a chain of records.'[23]

Blockchains are digital sequences of numbers coded into computer software that allows the secured transfer, recording, and broadcasting of transactions between individuals working anywhere in the world with Internet access.[24] Blockchains integrate digital encryption technologies that cover, to varying levels, the specific

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[20] Jane Ellis, Anurag Bana & Christian Decle, *Blockchain technology: Is it building a brighter future?*, International Bar Association, (Feb. 17, 2020, 2:00 PM) https://www.ibanet.org/Document/Default.aspx?DocumentUid=65FF920A-DE95-4848-B994-361260A7429E.

[21] James Burnie & Andrew Henderson, *Blockchain: Mitigating or Aggravating Regulatory Risk?,* 5 Journal of International Banking and Financial Law 293 (2016).

[22] SRINIVAS, *supra* note 19 at 5.

[23] *NIST Report on Blockchain Technology Aims to Go Beyond the Hype*, National Institutes of Standards and Technology, (Feb. 18, 2020), https://www.nist.gov/news-events/news/2018/01/nist-report-blockchain-technology-aims-go-beyond-hype.

[24] Taylor and Francis, *Bitcoin and Beyond*, RIPE Series in Global Political Economy 1 (Open Access).

content exchanged as well as the identities of individual users.[25] Algorithms[26]are also used in cracking complex mathematical equations and arriving at a consensus on the validity of transactions within networks of users. Time-stamping technologies then periodically bundle verified transactions into datasets, or 'blocks'. Linked together sequentially, these 'blocks' form 'chains' that makes up larger 'blockchain' databases of transactions that broadcast a permanent record of transactions while maintaining the anonymity of users and specific content exchanged.[27] Blockchains are to be maintained by all users in manners meant to be immutable unless users arrive at a clear consensus to undertake changes.[28]

WHAT MAKES BLOCKCHAIN UNIQUE?
There are certain unique traits which set Blockchain or Distributed Ledger Technologies apart from the existing technologies.

- Provides a single source of Truth[29] – It facilitates the transfer of value digitally without the requirement of a centralised authority, which usually acts as an intermediary. This intermediary usually collects value from these transactions, which are detrimental to the end-users.
- Smart contracts based on the Blockchain can make the business logic automatic[30] – It is capable of diminishing operational frictions and costs and thereby improving business procedure efficiency.

Single Source of Truth:[31]   This characteristic has the following characteristics:

- Distributed – The evaluated and verified data is disseminated to the users on the blockchain network, thereby giving multiple parties the copy of the same record. It clears the issue of data stored in silos and takes away the requirement for reconciliation between different parties.
- Decentralised – Besides disseminating the data to and kept by multiple participants, there has to be the maintenance of the network which includes

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[25] *Id.* at 2.
[26] Precoded series of step-by-step guidelines.
[27] Cybrosys, *supra* 17 at 13.
[28] Id.
[29] D. Popovic, C. Avis, M. Byrne, et al., *Understanding Blockchain for Insurance Use Cases*, 25 BAJ 13, 1–23 (2020).
[30] *Id.*
[31] Buterin, V., *A next-generation smart contract and decentralized application platform*, Dec. 2013, (May 10, 2020, 9:00 PM), https://github.com/ethereum/wiki/wiki/White-Paper.

data verification, and this does not rely on the centralised authority and removes a central point of failure.

- Tamper-resistant – The certified or verified data are cryptographically protected, making it resistant to malicious alterations by any unauthorised person, providing a heightened degree of data integrity and immutability.

- Transparent – Blockchains are fully auditable by those with access to the same. The conventional, tried-and-true database solutions might also have the same characteristics, but what makes this technology unique is that it is designed and improved from the ground level keeping all these principles in mind.[32]

Smart Contracts:[33]   The self-executing code deployed on the Blockchain is widely referred to as Smart contracts, which are analogous to the software that runs on a computing platform. Smart contracts execute a fixed set of business logic as agreed by the involved participants when its pre-defined criteria are met. However, they may not necessarily be "contracts" in the legal sense, but they can make the automatic execution of an agreement or legal contract.

Smart contracts act on reliable data within the Blockchain (on-chain data)[34]. When some data is not available of a blockchain, off-chain data from other external sources called the "oracles" could be utilized to trigger the predefined actions – for instance, the market data provider for financial contracts and weather data provider for weather-related insured events. Smart contracts extend the functionalities of Blockchain as a shared database to that of a platform for making a wide range of applications.

CRYPTOGRAPHY – THE CONFIDENTIALITY AND INTEGRITY PROBLEM

Data has to be rendered useless for unintended receivers of the data through Cryptography which provides techniques for transformation of the data. The idea of

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[32] *Id.*
[33] *Id.*
[34] D. Popovic, C. Avis, M. Byrne, et al., *Understanding Blockchain for Insurance Use Cases*, 25 BAJ 13, 1–23 (2020).

rendering the data useless can be prevented through thwarting of two actions; extracting information from the data and injecting false data or altering the data, also called the confidentiality- and the integrity- problem, respectively.[35] Sometimes the sender tends to deny the sending of an encrypted message. Through another cryptographic goal - Non-repudiation, the sender will not be able to deny having sent specific data plausibly.[36]

Data encryptions are of three types; unkeyed, symmetric-key, and asymmetric-key[37]. Unkeyed primitives are functions that do not use a key to encrypt a message, e.g. arbitrary length hashing and permutations. Symmetric-key primitives use the same key for encryption and decryption whereas asymmetric-key cryptography uses the system of a public key and a private key (different from each other) which are both required for encryption and decryption.[38]

Each Blockchain transaction is secured through cryptography, and later all the transactions are grouped and stored as blocks of data. These blocks are linked together with cryptography and secured from modification. A new block is added to the end of an existing block series after the network of computers, or devices, or both reach consensus (i.e., 51 per cent) on the validity of the transaction, and proceeds to form a blockchain.[39] The whole process creates an unforgettable and immutable record of the transactions that happened across the network. Also, these blocks of records are copied to every participating computer in the network, making it equally accessible to everyone. Since there is a mathematical relationship between the blocks, the information in a particular block cannot be altered without changing all subsequent blocks in the chain and creating a discrepancy that other record-keepers in the network would immediately notice.[40] Blockchain technology produces a dependable ledger without requiring record-keepers to know or trust one another, which

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[35] *Id.*

[36] A. Menezes, P. van Oorschot & S. Vanstone, *Handbook of Applied Cryptography,* Alfred J. Menezes, (1996).

[37] Jane Ellis, Anurag Bana & Christian Decle, *Blockchain technology: Is it building a brighter future?*, International Bar Association, (Feb. 17, 2020, 2:00 PM) https://www.ibanet.org/Document/Default.aspx?DocumentUid=65FF920A-DE95-4848-B994-361260A7429E.

[38] *Id.*

[39] *supra* 37.

[40] *Id.*

eliminates the dangers that come with data being kept in a central location by a single owner.[41]

There are no constraints to Blockchain concerning the data it can store. It can store any asset, the details and history of its ownership, location of assets in the network, be it digital currency bitcoin, or any other digital assets like a certificate, personal information, a contract, title of ownership of IP, and even the real-world objects. Through Blockchain, anyone can create a shared reality across non-trusting entities. The participating nodes in the network need not be necessarily knowing or trusting each other because each person can monitor and validate a chain for them. The concept of Blockchain revolves around the mutual distrust of participants, and that ensures that the Blockchain stays secure and verified.[42]

SECURITY

Blockchain changed the aspect of placing trust on a centralised authority and replaced it by the trust of underlying cryptography and consensus mechanism, which is made for that particular purpose.[43] There are a few known security issues with blockchain technology that needs to be considered:

- The immutability characteristic of Blockchain could potentially be a double-edged sword; fraud/hacks/mistakes on the Blockchain can in no way be reversed without drastic measure, that is "hard-forking" the Blockchain,[44] i.e., permanently creating divergence in the Blockchain, and erring the new and old records of the Blockchain incompatible.

- Software vulnerability, for instance, the codes of a Smart contract could be poorly written and exploited just like typical computer programmes.[45] The infamous hard-fork, that is, the "Decentralised Autonomous Organisation (DAO) fork" of the Ethereum blockchain in July 2016 should be kept as a

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[41] *NIST Report on Blockchain Technology Aims to Go Beyond the Hype*, National Institutes of Standards and Technology, (Feb. 18, 2020), https://www.nist.gov/news-events/news/2018/01/nist-report-blockchain-technology-aims-go-beyond-hype.
[42] *Id.*
[43] Rauchs, M., Glidden, A., Gordon, B., Pieters, G., Recanatini, M., Rostand, F. & Zhang, B., *Distributed ledger technology systems: A conceptual framework*, 2018, (May 24, 2020, 3:00 PM), https://www.jbs.cam.ac.uk/faculty-research/centres/ alternativefinance/publications/distributed-ledger-technology-systems/#.XX48iZNKh0s.
[44] Buterin, V., *A next-generation smart contract and decentralized application platform*, Dec. 2013, (May 10, 2020, 9:00 PM), https://github.com/ethereum/wiki/wiki/White-Paper.
[45] *Id.*

cautionary tale. The DAO was a blockchain-based venture capital fund built on the Ethereum blockchain. Hackers were able to siphon a substantial amount of Ether (the token native to the Ethereum blockchain, worth more than USD 50 million at the time) by exploiting vulnerabilities in the DAO smart contracts.

- Data stored on the Blockchain is not inherently trustworthy unless the data is native to the Blockchain (i.e. "on-chain" data created within the Blockchain). Mainly, Smart contracts rely on external data feed (i.e. off-chain data) from sources known as "oracles",[46] and presents a new obstacle widely known as the "Oracle Problem", whereby the execution of smart contracts could be compromised by unreliable external data feeds.[47] It is one of the major obstacles hindering the mainstream adoption of blockchain and smart contracts.

DISRUPTIVE INNOVATION AND BLOCKCHAIN

Professor Christensen used the term 'Disruptive Innovation' for the first time in his critically acclaimed book, *The Innovator's Dilemma*.[48] It is a term that –

> Describes a process by which a product or service takes root initially in simple applications at the bottom of a market and then relentlessly moves upmarket, eventually displacing established competitors.[49]

Professor Christensen theorised that there are two types of technical innovations: sustaining innovations and disruptive innovations.[50] Such technologies 'can be discontinuous or radical in character, while others are incremental'.[51] 'As companies tend to innovate faster than their customers' needs evolve, most organisations eventually end up producing products or services that are too sophisticated, too

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[46] Popper, N., A *hacking of more than $50 million dashes hopes in the world of virtual currency*, Jun. 2016 (May 25, 2020, 10:00 AM) https://www.nytimes.com/2016/06/18/business/dealbook/hacker-may-have-removed-more-than-50-million-fromexperimental-cybercurrency-project.html.
[47] Id.
[48] Clayton Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*, 1997 H.B.S.P.
[49] Clayton Christensen, *Disruptive Innovation,* 2015, (Oct. 19, 2019, 3:00 PM) https://www.claytonchristensen.com/key-concepts.
[50] Christensen, *supra 49*.
[51] Id at 19, See also *'Times are a-changin': disruptive innovation and the legal profession*, IBA Legal Policy & Research Unit, May 2016.

expensive and too complicated for many customers in the market'.[52] These circumstances induce a gap in the market, catering to those customers who may be unwilling or unable or both to afford these more 'sophisticated' or 'complicated' products or services and this gap fuels the development of innovations that transform a product or service to serve those consumers on the fringes of the market which might be overshot or underserved by the sophisticated or complicated product offerings, non-consumers.[53]

Blockchain is hailed as one of the most disruptive technologies in decades and provides a new way of managing trust and makes organisations transparent and decentralised. It is at the heart of the shift from centralised server-based internet system to a transparent cryptographic network.[54] With Blockchain technology, one can look forward to a world of human transactions without the traditional intermediaries such as credit card companies and banks to validate and transactions.[55] The mutual distrust among participant is the thing which keeps the Blockchain secure and verified.[56]

Blockchain is a potentially disruptive technology, and it might not make sense commercially to be the first one to adopt this technology for the following reasons[57]:

- Blockchain is still in the nascent stage, and its standards/platforms are gradually evolving.[58] The current hype is ahead of development, and it will take time for this technology to mature to become cost-effective for mass adoption and prominently, it is to be tested under real-world adversarial conditions. Companies across the insurance industry piloted proof-of-concept

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[52] Id (Christensen, n 19). See also Raymond H Brescia et al, 'Embracing Disruption: How Technological Change in the Delivery of Legal Services Can Improve Access to Justice' [2015] 78.2 Alb Law Rev 553, P.557

[53] Id. See also Ray Worthy Campbell, 'Rethinking Regulation and Innovation in the U.S. Legal Services Market' (2012) 9 (1) NYU J L & Bus., p.11.

[54] SRINIVAS MAHANKALI, BLOCKCHAIN THE UNTOLD STORY 11, (2d Ed. 2019).

[55] Venkatesh C.R., *4 Things that made Blockchain the most disruptive tech in Decades*, INC42, (May 16, 2020, 12:30 PM), https://inc42.com/resources/4-things-that-made-blockchain-the-most-disruptive-tech-in-decades/.

[56] *Id.*

[57] Rauchs, *supra* 43.

[58] Mike Hearn, Richard Gendal Brown, *Corda: A distributed ledger*, Aug. 20, 2019, (May 24, 2020, 11:10 AM), https://www.r3.com/wp-content/uploads/2019/08/corda-technical-whitepaper-August-29-2019.pdf.

(PoC), but most of these failed to move to the production stage[59]. One notable exception is a catastrophe excess of loss (Cat XoL) reinsurance application launched by an industry blockchain consortium after two years of trial and development.

- Solution development for Blockchain is an area where cryptography, maths, economics, computer science and data structure skills overlap. It is difficult to find experienced developers who take care of everything smoothly, and it is even more daunting to find business subject matter experts in the insurance industry will all these skill sets.

- In the case of permissionless blockchains, mass collaboration and adoption (i.e. network effect) is required to reap the full benefit. Currently, only cryptocurrencies as a use case have this level of scale, while other use cases receive little adoption.[60] In the case of permissioned blockchains, intellectual property (IP) might be owned by a select few (e.g. the founding member firms) which might deter new entrants from joining the network, thus hampering adoption.[61] A real-world example is the case of a blockchain-based marine insurance solution co-developed by a container shipping company. Other major marine cargo carriers had reservations about participating in the blockchain solution over concerns that they did not own the IP.

DATA STRUCTURE AND DISTRIBUTION IN BLOCKCHAIN

Each block would comprise of three fields[62]:

1. Data: Stores the Data
2. Previous Hash: Stores the hash of the previous block[63]
3. Hash: Contains the hash value for the current block which is used to refer to this block

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[59] Mike Hearn, *supra* 58.
[60] *Id.*
[61] *Id.*
[62] CYBROSYS TECHNOLOGIES (Limited Edition), BLOCKCHAIN E-BOOK 11, Blockchain Expert E, (Apr. 16, 2020, 4:00 PM) https://www.blockchainexpert.uk/book/blockchain-book.pdf/.
[63] *Id.*

The Data field, according to the user, is the most crucial thing, wherein the actual data, like the transaction details, and asset details are stored in the field.[64] The hash values of the previous blocks are stored in the previous hash, which acts as a link to the previous block connected through this value.[65] A hash function is a one-way function which is used in unkeyed cryptography which maps an arbitrary length binary string into a fixed-length binary string. It takes limited computational resources to calculate it, but an enormous effort, most likely an impossible amount, to retrieve the inverse of the function and hence, it is a one-way function.[66] The hash function has an output length of usually n = 256 or 512, which is one of the most crucial characteristics as the longer the hash gets, the more possibilities there are for outputs. One another characteristic I that there are no or few collisions when both x and y produce the same output $h(x) = h(y)$. The hash function should also be deterministic, that is, the same input produces the same output every time, and it is considered as the safest and the most difficult to reverse or in any way alter the contents, and is not susceptible to length-extension attacks.[67] Apart from this, there is symmetric key cryptography and asymmetric key cryptography which uses different methods of encryption algorithms.

Blockchain does not follow the widely adopted client-server model as Data storage structure, but instead, it uses the Peer to Peer model (P2P model). The unfettered approach of Blockchain can be explained through the P2P distribution approach, where there is no central authority to control the data distribution.[68] Unlike Client-server model, data is stored in the participant nodes in the P2P network, and all individual nodes will have a copy of the entire 'Blocks', and any change in a block would be updated in all the nodes. The validation process and consensus mechanism of the Blockchain network make up for not having a Database to store the data.[69]

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[64] *Id.*
[65] *Id.* at 14.
[66] DON TAPSCOTT & ALLEN TAPSCOTT, BLOCKCHAIN REVOLUTION 15, (2d Ed. 2018).
[67] *Id.*
[68] *Id.* at 16.
[69] *Id.*

BLOCK VALIDATION

In a blockchain, new blocks are added to the Blockchain after validation, and this is called the process of finding block hash. Whenever a transaction takes place in the Blockchain, it will be added to a block; sometimes one transaction per block and sometimes several transactions per block. It depends on the block size and the nature of the network. When a transaction is added to the block, it must undergo a validation process before it is being added to the Blockchain as a valid block. The hash value for the block can be calculated using some algorithms (like sha 256). The hash value has specific properties too. The main thing is that the hash value should be collision-free, i.e., no two blocks should have the same hash value, and the hash value should be irreversible, i.e., the block data could not be retrievable from the hash value.

BLOCK VALIDATORS AND THE CONSENSUS MECHANISM

Block validators are the nodes which participate in the process of block validation.[70] The validators are rewarded for their effort, for their computational power spent. Different blockchain protocols adopt different methodologies for selecting the validator from the available pool of nodes. Some of the methods are described below.

1. PoW (Proof of Work) – In PoW, the mining challenge is open to all, and all the miners compete with each other to add the next block.[71] A fixed reward is given to the miner, who finds the solution first. Usually, the node with more computational power wins the race. Bitcoin uses the PoW algorithm.

2. PoS (Proof of Stake) – It is a common alternative to PoW, wherein the validators are chosen based on the fraction of coins they own in the system.[72] The nodes with more number of coins have more chance to be selected than the node with a lesser number of coins. In PoS the reward is in the form of the transaction fee, new coins are not created for paying the validators. Presently, Blackcoin, NXT, and Peercoin blockchains use the PoS algorithm.

3. Proof of Activity – PoA is a hybrid approach, and it is introduced to overcome some of the problems in PoS and PoW. In this method, the mining begins with

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[70] Buterin, V., *A next-generation smart contract and decentralized application platform*, Dec. 2013, (May 10, 2020, 9:00 PM), https://github.com/ethereum/wiki/wiki/White-Paper.
[71] *Id.*
[72] *Id.*

PoW and some point the process is switched PoS. Presently, 'Decred' is the only coin that is using a variation of PoA.

4. Proof of Elapsed Time – The network uses lottery functions for implementing consensus. A lottery algorithm is used for finding the leaders from a set of nodes.[73] So the validators are selected randomly from the pool. Hyperledger Sawtooth blockchain uses PoET method.

5. Proof of Burn - The aspiring validators increase their stake in the system by sending their coins to an irretrievable location (thus the name burn). The validators are selected randomly, but those who have more stakes in the system have a high probability to get selected. Over time the earned stake decays and the nodes have to burn more currency to increase their stake. The only coin that uses proof of burn mechanism is 'Slimcoin'.[74]

BLOCKCHAIN AFTER BITCOIN

The Bitcoin was rebuilt by abstracting some of its properties into the 'Blockchain Technology' or 'Distributed Ledger Technology'. The new blockchains still retain the main properties of Bitcoin, but besides that, they offer more flexibility in their applications. A lot of new approaches and applications are being published frequently, most frequently through white papers published by start-ups or a group of corporate researchers. Still, the ideals of Blockchain remain intact – distributed, time-stamped database with consensus-establishing peers. The following traits characterise blockchain technology:[75]

- Distributed: Nodes are considered equal in the sense that they all have a full copy of the entire history of the database. There can also be less equal nodes, also called lightweight nodes, which only have a couple of the last blocks stored locally.[76] Generally, communication between nodes is done over the Internet with private-key cryptography.

- Time-stamped: Since every block of transactions is hashed into all the subsequent blocks, it becomes increasingly difficult to change history the

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[73] *Id.*
[74] *Id.*
[75] CYBROSYS TECHNOLOGIES, *supra* 62.
[76] *Id.*

further away in time the current block is. The Blockchain at hand becomes a provably correct auditing tool.[77]

- Consensus: Nodes establish one truth about which version of the database is the correct one through a consensus-algorithm, and serves to validate transactions as well as to discourage, for instance, double-spending attacks.[78] The type of consensus-algorithm being used is highly dependent on the structure and purpose of the Blockchain.

PERMISSIONS AND SPECIALISATION

As the development of blockchain technology progressed past Bitcoin, two different options developed as to who should be allowed to participate in the validation and observing of the network. Blockchain is a convergence of a variety of disciplines, which includes information security, programming, distributed systems, cryptography and peer-to-peer networks.[79] The dichotomy is essentially between Permissioned and Permissionless blockchains, although there is in some cases some flexibility for hybrid solutions to be implemented. A blockchain which exists openly on the Internet is called Permissionless blockchains; for instance, Bitcoin and Ethereum.[80] However, when more actions are allowed, the Blockchain becomes more susceptible to be hacked, and the same was witnessed during the infamous DAO-hack where approximately USD50 million were siphoned from an ether fund. (Buterin, 2016). Also, since the data on the Blockchain is open to anyone who wishes to join the network, data has to be kept wholly anonymised if it is necessary to keep it private.[81] However, in some cases, it is not possible to anonymise all the data, or it is merely not desirable that everyone can participate in a network, and this led to the development of Permissioned blockchains.[82]

In Permissioned blockchains, there is a regulation of who is allowed to join and participate in the network. A consortium of companies can do this, governmental

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[77] *Id.*

[78] James Burnie & Andrew Henderson, *Blockchain: Mitigating or Aggravating Regulatory Risk?,* 5 Journal of International Banking and Financial Law 293 (2016).

[79] D. Popovic, C. Avis, M. Byrne, et al., *Understanding Blockchain for Insurance Use Cases*, 25 BAJ 13, 1–23 (2020).

[80] *Id.*

[81] D. Popovic, *supra* 79.

[82] *Id.*

agencies or other organisations, either by inviting new members one by one or by pre-defining a set of criteria. Besides the increase in privacy, the benefits include the potential for more flexibility in adapting the network, better scalability and faster transactions. Sometimes, depending on the consensus algorithm at play, Permissioned blockchains can be more susceptible to unintended changes in its history. In other words, the speed, privacy and scalability are sometimes being traded for immutability and censorship-resistance,[83] because a Permissioned blockchain does not necessarily require a Proof of Work (PoW)-consensus algorithm, but can use one with less resource expenditure, thus making the process of concurrency easier.

Blockchains can also be created more or less flexible, or specific, in what actions are permitted on them. For example, Bitcoin and most coins is an example of highly specialised chains with one purpose – to safely transmit the tokens of the cryptocurrency, while Ethereum has a virtual machine built-in, as well as the possibility to deploy smart contracts in a turning-complete manner. Ethereum was explicitly created to allow for the creation of decentralised applications (DApps) and has 3,445 applications listed on http://dapps.ethercasts.com/.[84] Ethereum is, however, permissionless and is not the right platform for all DApps. A generalised blockchain is one which is not optimised for performing one specific task, in opposition to a specialised one that is. Both Ethereum and Bitcoin are permissionless, but the former is a general-purpose one and the latter a specialised one.[85]

THE TRADE-OFF BETWEEN PERMISSIONED AND PERMISSIONLESS BLOCKCHAINS

The disparities between Permissioned and Permissionless Blockchains come from the opinions in design and trade-offs that prefer particular features over the other, and this might give one platform a slight edge over the other in certain use cases.[86] The prime trade-offs between Permissionless and permissioned Blockchain are between privacy and access. Permissionless blockchains offer frictionless access, i.e., any person can take part in the network, contrary to the requirements to set up governance around the

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[83] DON TAPSCOTT, *supra* 66.
[84] State of the Dapps, (May 30, 2020, 8:00 PM), https://www.stateofthedapps.com/.
[85] SRINIVAS, *supra* 54 at 31.
[86] Amsden, Z., Arora, R., Bano, S., Baudet, M., Blackshear, S., Bothra, A. & Dill, D. L., *The Libra Blockchain*, 2019, (May 24, 2020, 12:30 PM) https://developers.libra.org/docs/assets/papers/the-libra-blockchain.pdf.

rules of participation in a Permissioned blockchain. Moreover, any person could create applications on Permissionless blockchains, theoretically increasing the speed of innovation.[87] However, any changes or transactions that happen to the database are visible to all other participants, and that might not be favourable in business use cases which root for confidentiality.

The other significant design trade-offs include:

- Decentralisation versus scalability/speed[88] – To maximise the benefits of decentralisation (i.e. where the ownership and maintenance of the network, including data verification, does not depend on a trusted centralised authority), scalability/speed of the network needs to be sacrificed in favour of a robust decentralised consensus mechanism;
- Scalability/speed versus security[89] – To maximise throughput (i.e. the number and speed of transactions), certain design sacrifices need to be made to the rules that determine how data are verified and added to the shared database, potentially introducing vulnerabilities;
- Development flexibility versus security[90] – To maximise the flexibility in developing applications, restrictions on smart contracts may need to be minimised, potentially allowing malicious actors to exploit software bugs in smart contracts.

CONCLUSION

Invented in 2008 by Satoshi Nakamoto, Blockchain has become a symbol of resistance against platforms and central authorities, particularly after the financial crisis. Cryptocurrencies and in particular Bitcoin, remain the most popular and successful application of Blockchain.[91] Blockchain technology has changed the financial sector, allowed individuals to become millionaires overnight with bitcoins, but it is also profoundly distrusted by financial regulators. Indeed, Blockchain has not

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[87] Id.

[88] Buterin V., *supra* 70.

[89] *Id.*

[90] Id.

[91] Sofia Ranchordas, *Introduction to the symposium on Blockchain governance and regulation*, 10 E.J.R.R. 243–244 (2019).

remained immune to criticism. In the last two years, many sceptics have argued that this technology has not delivered what the blockchain evangelists had promised. It is a good sign, in a way, as many supporters of blockchain technology promised a blockchain-world without any intermediaries, yet without discussing the risks of abolishing intermediation.

Apart from better data management, the capacity to evaluate assets held on-ledger is a unique innovation not offered by any traditional databases presently used.[92] For instance, escrow of the digital assets could diminish the risk in collateral management, and real-time calculation of the underlying asset risk could facilitate more accurate pricing of asset-backed securities. Though the centralised solutions have tried to solve these issues in the past, the decentralised trust of blockchain technology might prove to be elusive key for market adoption. Blockchain's impact might eventually remould the market structure, product capabilities and the client experience, to ultimately have a lasting influence on the global economic system.[93]

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[92] J.P. Morgan, *Unlocking Economic advantage with Blockchain – A guide for Asset Managers*, Oliver Wyman, (May 29, 2020, 06:30 PM), https://www.oliverwyman.com/content/dam/oliver-wyman/global/en/2016...
[93] *Id.*

CHAPTER III

BLOCKCHAIN TECHNOLOGY – PROCESSES AND APPLICATIONS

INTRODUCTION

Although the aspect of Blockchain might sound novel, the underlying fundamental technology is not new. It is the combination of established, existing technologies: peer-to-peer networking, asymmetric cryptography and cryptographic hashing. It was Bitcoin that combined these technologies, by offering the ability to transfer value, while simultaneously preventing double-spending in the trustless, pseudonymous, publicly accessible system.[94] When compared to Bitcoin, blockchain applications in capital markets and wholesale banking are pursuing to maintain the decentralised nature of the network and immutability of the underlying ledger, while reinstating accountability and governance models that permit legal recourse and back existing regulatory frameworks. There is much promise for distributed ledgers within a permissioned environment of known participants who can do transactions in private among one another, while selectively allowing visibility of their data to third parties and regulators, such as analytics providers.

The potential of Blockchain is most appreciated in facilitating the rise of digital currencies over the past several years and rightly so regarding the success and widespread usage of cryptocurrencies, but there are other non-cryptocurrency uses for this technology. Some blockchain proponents believe that in terms of its overall impact, the real potential of Blockchain is only just now being discovered and that the technology could far outpace cryptocurrencies themselves.[95] In the coming years, its highly likely in the investment world that financial advisors and many others will experience much more blockchain technology, irrespective of its relation to any particular cryptocurrency or its use in any number of other applications. The most

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[94] J.P. Morgan, *supra* 92.
[95] *Id.*

exciting and widespread use cases likely to bring Blockchain further into the world of mainstream business and finance include:[96]

1) Cross-Border Payments

2) Bank Usage

3) Cryptocurrency

4) Property Records Use

5) Insurance

6) Smart Contracts

7) Identity Management

8) Supply Chain

9) Legal Technology

10) Decentralisation of Corporate and Political governance systems

CROSS-BORDER PAYMENTS

According to research by Deloitte, the transfer of value has traditionally been both expensive and slow, particularly for payments taking place across international frontiers.[97] One primary reason is that the transfer process involving multiple currencies generally requires multiple banks in numerous locations to transfer the amount to the intended recipient so that he/she can collect the money. There are some existent services, which help to facilitate this process in a faster way, but those services require deep pockets.

Blockchain technology can offer a much quicker, economical and affordable alternative to traditional cross-border methods of payment. For instance, usually, money remittance costs might go as high as 20% of the transfer amount, but Blockchain may reduce the costs to as low as 2%, along with guaranteed and real-time transaction processing speeds.[98] Even though this is one of the most widely accepted and talked about areas in blockchain technology application, the inclusion of various regulations of cryptocurrencies in different parts of the worlds and other security concerns were hurdles that are yet to be passed.

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[96] DON TAPSCOTT & ALLEN TAPSCOTT, BLOCKCHAIN REVOLUTION 88, (2d Ed. 2018).
[97] *Id.*
[98] SRINIVAS MAHANKALI, BLOCKCHAIN THE UNTOLD STORY 236, (2d Ed. 2019).

The Global payments system is the lifeblood of commerce in the financial services sector; nevertheless, the system is bloated, slow, and costly.[99] For instance, cheques drawn on a financial institution in a country and deposited to another financial institution in a different country can take weeks to clear or to be rejected. At the centre of this global payments scheme is the Society for Worldwide Interbank Financial Telecommunication (SWIFT) network. It is a member-owned international cooperative wherein the customers are its owners. It was the world's leading provider of protected financial messaging services and became the world's most trusted network when Blockchain came along.[100] However, SWIFT does not transfer money; instead, it processes highly protected text messages about money.

In 2017, SWIFT went on to state that DLTs were not mature enough then to be widely used on cross-border payments, but could provide solutions for the associated account reconciliation.[101] It also announced a blockchain pilot project in which it would leverage assets as its strong governance, its expertise in liquidity standards, bank code identity framework, and public key infrastructure security scheme, referring to the 'roles, procedures and policies that SWIFT creates, manages, distributes, uses, and stores' to ensure security.[102] It wanted to bring DLT in line with the financial industry's requirements to deliver a distinctive DLT Proof-of-Concept (PoC) platform for the benefit of its community.[103]

Bob Tapscott, in his research on payments, also discovered various other initiatives.[104] SWIFT is participating in the new prestigious International Organization for Standardization (ISO) technical committees which meet on standards crucial to open blockchain-based payments, including reference architecture, ontology and taxonomy; privacy and security; use cases; identity; and smart contracts.[105] Parallelly SWIFT is also demonstrating the profits of DLT by making a standard settlement training

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[99] *Id.*

[100] *Id.*

[101] SWIFT global payments innovation, *Delivering the Future of Cross-Border Payments, Today*, SOCIETY FOR WORLDWIDE INTERBANK FINANCIAL TELECOMMUNICATION, SWIFT SCRL, Jan. 2017, (Jun. 24, 2020, 03:15 PM) www.swift. com/file/31751/download?token=BK_pC-m9.

[102] *Id.*

[103] *Id.*

[104] Bob Tapscott, *Reinventing International Clearing and Settlement*, White Paper, Don Tapscott, Blockchain Research Institute, The Tapscott Group, Jan. 16 2018.

[105] Those include ISO/TC 307 SG1 reference architecture, taxonomy, and ontology; ISO/TC 307/SG 2 use cases; ISO/TC 307/SG 3 security and privacy; ISO/TC 307/SG 4 identity; and ISO/TC 307/SG 5 smart contracts.

database for over-the-counter versions markets in a reference data context in which there are no data privacy concerns. The PoC may emphasise interoperability and backward compatibility with present systems.

SWIFT is also working with various central securities depositories on principles for DLT management of securities. The participants include consulting firm Ernst & Young, the Moscow Exchange Group, the Canadian Depository for Securities Limited, the Russian National Settlement Depository, South Africa's State, Switzerland's SIX Securities Services, Nasdaq Nordic, and Chile's Deposito Central de Valores. SWIFT also has a project for a bond life cycle PoC, which is a sensible market because of its big size and the relative simplicity of issuance and maturity. As part of its *global payments innovation roadmap*, SWIFT also launched a PoC in 2017 to see whether DLT could assist in the reconciliation of Nostro ("ours with you") accounts more efficiently. For the banks, to get the funds out of the customers' accounts in the original ten countries, and then clearing the payments (i.e., making these funds available) in the eleventh is risky, slow and cumbersome.[106]

BANKS USAGE

Blockchain Technology is being embedded into the Financial Technology (Fintech), and in the banking sector, this could lead to reduced costs, improved service delivery and streamlined digital processes. This is done through its feature of being a decentralized DLR and its ability to remove the intermediaries, allowing the parties to do transactions much quicker. This could post a significant threat to any financial institutions that are slow to adapt.[107]

The banking sector will benefit the most from integrating Blockchain into its business operations.[108] All financial institutions operate only during the business hours for five days in a week, and if a person tries to deposit a cheque at 6 p.m. on a Friday, he/she has to wait until Monday morning to see that particular amount reflected in their

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[106] SWIFT gpi, *SWIFT Tests Show Blockchain Has Potential for Global Liquidity Optimization*, SOCIETY FOR WORLDWIDE INTERBANK FINANCIAL TELECOMMUNICATION, SWIFT SCRL, Oct. 13 2017, (May 30, 2020), www.swift.com/news-events/press-releases/swift-tests-show-blockchain-has-potential-for-global-liquidity-optimisation.

[107] DON TAPSCOTT, *supra* 96 at 90.

[108] SRINIVAS, *supra* 98, at 236.

account. Nonetheless, even if one does make the cheque deposit during the business hours, the transaction is likely to take one to three days to finish the procedures due to the massive volume of transactions that banks need to process. On the other hand, Blockchain never sleeps, and by incorporating this technology into banks, consumers can get their transactions processed within 10 minutes, which is only the time it takes to add a new block to the Blockchain, regardless of the time or day of the week.[109]

Blockchain also allows the bank to exchange funds between various institutions more quickly and securely, which especially in the case of a stock trading business is a great boon as the settlement and clearing process might take up to three days or more (in international transactions) to complete, and during that time the money involved would stay frozen. Considering the size of the money involved, those few days of in transit can carry typically high costs and risks for the banks. Santander, a European bank, estimates the potential savings to $20 billion a year while, Capgemini, a French consultancy, estimates that each year the consumers can save up to $16 billion in banking and insurance fees through blockchain-based applications.[110] All around the world, the ball has been set rolling by international players, and in India, a lot of financial institutions have shown interest in developing proper platforms based on this technology. Many of them have already invested millions of dollars in developing and testing blockchain technology to incorporate it into their e-commerce and crypto-currency strategies. Leading banks in the world like the UBS Deutsche, Santander, BNY Mellon and many others have joined the feat of developing blockchain-based banking platforms.[111]

CRYPTOCURRENCY

Blockchain forms the foundation of Bitcoin and other cryptocurrencies. In the case of currencies like the US Dollar, there will be a central authority, like the bank or government, to regulate and verify currencies.[112] Data and currency of a person under

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[109] I*d.* at 237.
[110] Alex Tapscott & Don Tapscott, *How Blockchain is changing Finance*, HARWARD BUSINESS REVIEW, Mar. 1, 2017, (May 29, 2020, 11:30 AM), https://hbr.org/2017/03/how-blockchain-is-changing-finance.
[111] *Id.*
[112] Satoshi Nakamuto, *Bitcoin: A Peer-to-Peer Electronic Cash System* 1 – 5, (Mar. 13, 2020, 07:30 PM), https://bitcoin.org/bitcoin.pdf.

the central authority scheme are technically at the discretion of their bank or government. Bitcoin was borne when users realised that the value of the currency would be at risk if the user's bank suffers a bankruptcy or they reside in a country with an unstable government.[113] In the present world, most countries function on fiat currencies issued by the government as money, and these currencies need a central regulatory body to govern them as the value is derived abstractly from the sovereign authority of the State.[114] Such a system suffers from the intrinsic weaknesses of the trust-based model, which depends on the financial institutions to process payments.[115] Cryptocurrencies offer 'crypto proof' as an alternative to trust and allow two parties to transact with each other securely, without a need for a trusted third party. The value of such currency is not derived from government fiat or gold but is based on the value that people assign it.[116]

Blockchain creates independence from the central authority, which allows Bitcoin and other cryptocurrencies to operate without the need for a centralised authority by spreading and distributing its operations across a network of computers. This decentralisation significantly reduces the processing and transaction fees and reduces the risk of the centralised authority by a great extent. Moreover, Blockchain gives the countries having an unstable currency with a more strengthened and stable currency with more applications and a much more extensive network of individuals and institutions to do business with, both domestically and internationally.[117]

There are two critical features for cryptocurrencies – (i) decentralisation and (ii) absence of intermediaries.[118] The advantage of using bitcoin cryptocurrencies is that they function entirely on the basic principle of demand and supply, having no intrinsic value and no reserves.[119] As a result, they offer a nearly perfect mechanism to transact, with transparency and anonymity simultaneously. Nonetheless, there is also

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[113] *Id.*

[114] Abba P. Lerner, *Money as a Creature of State*, 37 THE AMERICAN ECONOMIC REVIEW 2 (1947).

[115] Satoshi Nakamuto, *supra* 112.

[116] JERRY BRITO & ANDREA CASTILLO, BITCOIN: A PRIMER FOR POLICYMAKERS 29 (4d Ed., 2013).

[117] International Monetary Fund, *Virtual Currencies and Beyond: Initial Considerations*, (Mar. 25, 2020), https://www.imf.org/external/pubs/ft/sdn/2016/sdn1603.pdf.

[118] *Id.*

[119] *Id.*

an inherent risk where some users could exploit the very same qualities that make bitcoin attractive to evade taxes, launder money, and also trade illegal goods.[120]

THE BITCOIN CRYPTOCURRENCY AND ITS USAGE

Bitcoins are computer files comprising of data, similar to media or a text file, which are generated through a process called 'mining'.[121] Here, a miner uses software running on specialised hardware to process the transactions.[122] Bitcoin is like a hidden gem, which needs to be quarried for its value to be acquired and utilised. In that context, the 'mining' of bitcoins is akin to ascertaining new bitcoins. In order to track transactions using this currency, bitcoins rely on a peer to peer network, wherein a node should transmit every activity to its neighbours in the network.[123]

When the user does a transaction, the receiving node verifies the authenticity of the transaction, and subsequently, it attempts to authorise the problem by solving a puzzle, which is inverting the hash function (in cryptography terms).[124] After authorisation, proof of transaction is sent to the other nodes in the network, and this process of verifying the bitcoin transactions' ingenuity is termed as mining.[125] Each node receives a reward for authorising the transaction of particular bitcoins, the amount of which is predetermined.

Mining is a mathematical process, with each corresponding process more complicated than the former.[126] Bitcoins are not unlimited by design, and the total number of bitcoins expected to be created overall is twenty-one million.[127] Finding prime numbers from among a set of rational numbers is a similar process, where finding smaller prime numbers are easy, and it gets increasingly difficult as we move towards finding more significant prime numbers, which require more efforts. The supply of

[120] JERRY & ANDREA, *supra* 116, at ¶2.
[121] The Economist, *How Bitcoin Mining Works*, Jan. 20, 2015, (Apr. 26, 2020, 08:20 PM), https://www.economist.com/blogs/economist-explains/2015/01/economist-explains-11.
[122] *See* Allison Berke, *How Safe Are Blockchains? It Depends*, Mar. 7, 2017, (Apr. 26, 2020, 09:15 PM), https://hbr.org/2017/03/how-safe-are-blockchains-it-depends.
[123] Moshe Babaioff, *On Bitcoin and Red Balloons*, Feb. 2012, (Apr. 3, 2020, 09:30 AM) https://www.microsoft.com/en-us/research/wp-content/uploads/2012/06/bitcoin.pdf.
[124] *Id.*
[125] Bitcoin, *Frequently Asked Questions*, BITCOIN, (Apr. 6, 2020, 07:20 PM), https://bitcoin.org/en/faq#what-is-bitcoin.
[126] DAVID LEE KUO CHUEN, HANDBOOK OF DIGITAL CURRENCY - BITCOIN, INNOVATION, FINANCIAL INSTRUMENTS, AND BIG DATA 29 (6th Ed., 2015).
[127] *Id.*

bitcoins is assumed to be constant, as there is a rising rate of difficulty in mining bitcoins and a static timescale (all bitcoins would be mined in the next ninety-five years approximately).[128] The constant supply and growing demand made the price of Bitcoin to gradually goes up, and on September 1, 2017, the exchange rate of bitcoin to the US Dollar was around USD 4900.[129]

RESOLVING USAGE ISSUES

There are two main issues in standard currencies which are privacy and counterfeiting.[130] The privacy issue in bitcoin is resolved by using public-key encryption, a technique where two mathematically connected keys, known as 'public key' and a 'private key', are used to encrypt or decrypt transactions.[131] 'Public key' which is available in the public domain is used by a transacting party transferring bitcoins from their source address to the destination address to encode the payments which can only be decoded by the recipient's private key. After that, the payer uses their private key to approve and verify any transfers happening through his wallet.

The transacting party can create as many pseudonymous bitcoin addresses as necessary to use them is various bitcoin transactions. Even though all such transactions are public, there will not be anything that connects individuals/organisations to the bitcoin address used in doing such transactions, thereby ensuring the user's anonymity.[132] Maintaining a non-modifiable public ledger by using the time-stamping server and subsequent publication of the hash on the Blockchain can help resolve the issue of counterfeiting.[133] As opposed to public blockchains, private blockchains offer their owners control over who could verify, submit or access transactions entered on such ledgers.[134]

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[128] Venzen Khaosan, *What Affects the Bitcoin Price?*, Sept. 25, 2014, (Apr. 1, 2020, 10:15 AM), https://www.cryptocoinsnews.com/affects-bitcoin-price.
[129] *Id.*
[130] Satoshi Nakamuto, *supra* 112.
[131] The Economist, *Bits and Bob*, Jun. 13, 2011, (Apr. 24, 2020, 05:05 PM), https://www.economist.com/blogs/babbage/2011/06/virtual-currency.
[132] Satoshi Nakamuto, *supra* 112.
[133] Venzen Khaosan, *supra* 128.
[134] Praveen Jayachandran, *The Difference between Public and Private Blockchain*, May 31, 2017, (Apr. 26, 2020, 03:30 PM) https://www.ibm.com/blogs/blockchain/2017/05/the-difference-between-public-and-private-blockchain/.

PROPERTY RECORDS USE

The current process of recording of property rights in our respective Sub-Registrar's/Recorder's office is both burdensome and inefficient. For a person to register his/her property, primarily, a physical deed has to be submitted to a government employee at the local registrar office, where the records are entered into the county's central database and public index manually. When there is a property dispute, the ownership of the property must be reconciled with the public index.[135]

This process is much susceptible to human error, where each minor inaccuracy makes the tracing of property ownership less efficient, and the manual work makes it not just costly but also time-consuming.[136] Blockchain is equipped with immense potential to eliminate the need for tracking down physical files in a local Registrar's office because initially at the time of the entry of these records, each data will be appropriately filtered and verified before storing it within the network and the owner' can trust that their deed will stay accurate and permanent.[137]

HEALTH CARE

Health care providers can leverage Blockchain to store their patients' medical records securely. The typical medical record of a patient signed and generated by a hospital can be written into the Blockchain, which provides the patients with the trust and proof that the said record cannot be altered in any way. These personal health records could be programmed and encrypted before storing it on the Blockchain with a private key and time-stamp, so that the records are accessible to specific individuals, thereby ensuring privacy.[138]

THE ESTONIAN MODEL

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[135] DON TAPSCOTT, *supra* 96 at 105.
[136] Praveen Jayachandran, *supra* 134.
[137] Medicalchain–Whitepaper 2.1, (Feb. 21, 2020, 04:50 PM), https://medicalchain.com/en/whitepaper/.
[138] *Id.*

Estonia, one of the world's smallest countries,[139] having a population of roughly 13.3 lakhs (in 2020) has digitised medical records of all its population and the same are uploaded onto the Blockchain on a live basis. Estonia became the first country to dabble in using blockchain technology for healthcare on a national scale. The Estonian E-health Foundation in 2016, launched a development project based on blockchain technology aimed at safeguarding patient health records and archiving related activity logs.[140]

> "We are using Blockchain as an additional layer of security to help us ensure the integrity of health records. Privacy and integrity of healthcare information are a top priority for the government, and we are happy to work with innovative technologies like Blockchain to make sure our records are kept safe,"[141] said Artur Novek, the foundation's Implementation Manager and Architect.

This model enables doctors to have verifiable, tamper-evident medical records of the patients with the entire history of diagnostic tests, and the like, to offer the right prescription.[142] It is not the health records which are encrypted using Blockchain, but the log files which document all the data processing activities carried out on those records.[143] The securement from prying eyes of such intensely private health records is only part of the goal.

Every person visiting a doctor in Estonia will have their details updated in an e-Health record which can be monitored online.[144] The health information, which is identified by the electronic ID-card, is kept entirely secure while being open to approved

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[139] Wim Olivier, *Estonia – the Leader of the E-Pack*, Dec. 1, 2017, CRYPTOSLATE, (Feb. 21, 2020, 02:15 PM), https://cryptoslate.com/estonia-leader-e-pack/.
[140] Estonia Blockchain Government, DTN Staff, May 7, 2018, CRYPTO COINS INFO CLUB, (Feb. 21, 2020, 10:15 AM) https://cryptocoinsinfoclub.com/ethereum/estonia-blockchain-government.
[141] Taavi Einaste (Head of Digital Healthcare at Nortal), *Blockchain and Healthcare: The Estonian Experience*, Feb. 21, 2018, (Feb. 21, 2020, 02:45 PM) https://nortal.com/blog/blockchain-healthcare-estonia/.
[142] *Id.*
[143] *Id.*
[144] Estonia Government, *Healthcare – E-Estonia*, (Feb. 21, 2020, 03:30 PM), https://e-estonia.com/solutions/healthcare/.

persons at the same time. KSI Blockchain technology is used for the system to maintain data integrity and prevent internal data risks.[145]

MEDICALCHAIN

Medicalchain is a decentralised platform which uses blockchain technology to facilitate the secure, fast and transparent exchange of medical data and their usage to develop a user-focused online health record and preserve a single authentic version of the user data.[146] Medicalchain allows users to provide preferential access to various health care providers such as physicians, hospitals, pharmacists, laboratories and insurers to communicate with each other as and when they see fit.[147]

The interaction of various health care providers with the user's medical data is auditable, open and secure and will be documented as a transaction on the distributed ledger of Medicalchain. The privacy of the patient is always secured during the whole process. Medicalchain is designed on the permission-based model of Hyperledger Fabric that provides different levels of access, and the users can manage the persons who can view their medical records, how much of information each person can see and for what duration is the access granted.[148]

<u>INSURANCE</u>

In the context of insurance, Blockchain can be used to evaluate the claim history and preventing multiple claims from arising out of the same incident. Besides, using the Internet of things (IoT) to integrate insured items into the Blockchain could provide an involuntary transfer of cash from an insurer for repairs when the item is broken.[149] Decentralisation could see massive reductions in fraudulent claims, and could also aid in identifying instances of fraud, through the institution of a public, tamper-proof database to track ownership and transfer of valuable property and assets.[150]

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[145] *Id.*
[146] Medicalchain, *supra* 137.
[147] *Id.*
[148] *Id.* at 6
[149] Alex Tapscott, *supra* 110.
[150] *Id.*

By forming a digital history of assets, both insurers, and insurance companies could see noteworthy savings in the payments of premiums and claims. For instance, the company Everledger uses blockchain technology to provide a permanent ledger for the certification and transaction history of individual diamonds.[151] The users of Everledger can know about the owner of each diamond and its location at any stage. It can also track the movement of diamonds across platforms such as Amazon or eBay while coordinating with insurers, and organisations like Europol and Interpol when the diamonds become stolen locally, and crossed borders or entered into the black market.[152]

HEALTH INSURANCE

The Singapore Government has implemented blockchain-based medical insurance for a specific segment of its population as a pilot.[153] An Ethereum platform based private Blockchain is implemented to connect with the health insurance providers, hospitals and banks. When a patient in risk category signs up for an insurance plan, the details of the concerned are recorded on the Blockchain.[154] In case the patient needs to avail of the insurance and undergoes the corresponding procedures, the smart contract gets triggered, and the money is transferred from the insurance company to the hospital within 24 hours to clear the bills raised on the patient. It has substantially eased the pain points of patients who at many times are not sure about the recoverability and settlement of their claims.

The following are some of the use cases emerging in the insurance domain:[155]

- Automated, comprehensive background and authenticity verification of all things insured.
- Automated claim handling and settlement.
- Eliminate insurance fraud due to transparent recording and immutable data sets registered on the Blockchain that removes the propensity to defraud the insurance companies with inflated and multiple claims.

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[151] DON TAPSCOTT, *supra* 96.
[152] *Id.*
[153] Medicalchain, *supra* 137.
[154] SRINIVAS, *supra* 98, at 222.
[155] *Id.*, at 223

- Automated settlement of insurance for all Internet of Things (IoT) devices, and active tracking on the blockchain network through smart contracts which gets triggered on impacting events.

SMART CONTRACTS

Smart contracts are a significant and useful application of Blockchain technology. They are simple logic related contracts that are published on a blockchain, which can receive or perform transactions like any address, and that can act as an immutable agreement.[156] The said transactions may be rejected or require individual arguments to function. These are computer program based contracts that can manage all facets of an agreement starting from facilitation to execution.[157] Smart contracts can be wholly self-executing and self-enforcing when the conditions are met.[158] Nick Szabo, a cryptographer, highlighted that, Smart Contracts, not only can they capture an enormous arrangement of information (like nonlinguistic sensory data) but they are dynamic and can transmit data and execute certain kinds of decisions.[159] Nick Szabo in 1994, coined the phrase 'Smart Contract', and envisaged it as follows:

> "A smart contract is a computerised transaction protocol that performs the terms of a contract. The basic objectives of smart contract design include satisfying of common contractual conditions (such as payment terms, liens, confidentiality, and enforcement), minimising exceptions both malicious and accidental, and minimising the requirement for trusted intermediaries. Other financial goals include lowering loss due to fraud, arbitration and enforcement costs, and other transaction costs."[160]

According to Szabo, digital media can perform calculations, operate machinery directly, and work more efficiently than humans through certain varieties of

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[156] DON TAPSCOTT, *supra* 96 at 190.
[157] *Id.*
[158] SRINIVAS, *supra* 98 at 211.
[159] Nick Szabo, *Smart Contracts*, (May 25, 2020, 10:20 PM) http://szabo.best.vwh.net/smart.contracts.html.
[160] *Id.*

reasoning."[161] The basic idea, and source of contract-part in the name, is that certain parts of contracts can be included in software in such a way that the breach of them is either expensive or impossible. According to Szabo, contracts need to have a couple of characteristics to be defined as actual smart contracts. These characteristics are <u>visibility, online enforceability, verifiability and privity.</u>[162]

Visibility means that the participants in the contract should be able to see each other's performance of the terms of the contract or to be able to prove the fulfilment of their terms to other participants.[163] It is referring to the visibility of actions taken by logic in the contract; a Point-of-Sale screen showing the amount to be paid to the customer but omitting the fact that data is being saved from the credit card is an example of such hidden action. Online enforcement means ensuring compliance with contractual terms, and there are various steps which are used to achieve this and are categorised as <u>proactive and reactive measures.</u>[164] Proactive measures aim to make it technically impossible to breach the terms of a contract or allow any party to drop out of the contract if there happens to be a legitimate breach on the other part.[165] Reactive measures prevent malicious behaviour by reputation or execution, but also by the recovery of potential assets following a contractual breach. Smart contracts need to be verifiable or auditable if there is a conflict. Lastly, smart contracts should be as private as possible, meaning that the knowledge and control of data involved in a smart contract should only be available to participants if necessary.[166]

For instance, 'X' uses a smart contract to rent 'Y' his apartment. They enter into terms with each other and agree to give the door code to the apartment at the moment the security deposit is paid. They both send their part of the deal to the particular smart contract, which would retain the door code and would automatically exchange the code upon remittance of the security deposit on the mutually agreed rental date. However, if 'X' fails to pass on the door code by the rental date, the smart contract

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[161] Nick Szabo, *Formalizing and Securing Relationships on Public Networks*, (May 25, 2020, 10:20 PM) http://szabo.best.vwh.net/formalize.html.
[162] TAPSCOTT & TAPSCOTT, BLOCKCHAIN REVOLUTION – HOW THE TECHNOLOGY BEHIND BITCOIN AND OTHER CRYPTOCURRENCIES IS CHANGING THE WORLD 101, (2018 Ed.).
[163] *Id.* at 102.
[164] *Id.*
[165] *Id.*
[166] Nick Szabo, *supra* 159.

automatically refunds your security deposit, and that would eliminate the fees that generally accompanies while using a notary or third-party mediator.[167]

Potential smart contract technology applications are virtually limitless and could extend to almost any business area in which contract law may generally apply. Smart contracts, of course, though highly prized, are not a complete substitute for old-fashioned diligence.[168] The Decentralized Autonomous Organization (DAO) case is a great lesson and a warning to the investors not to presume that smart contracts are any better than the data and organisation a person puts into them.[169] Smart contracts, however, remain one of the fascinating ways that blockchain technology has already expanded beyond the space of cryptocurrency and into the broader business world.

IDENTITY MANAGEMENT

One of the killer applications of Blockchain is the self-sovereign identity secured by the Blockchain. The transformations through this application would empower citizens from all over the world to control their identities, access citizen services, and retain their privacy.[170] Presently, individual identification and personal data are highly fragmented and owned by third parties like governments, banks, and companies like Google and Facebook.[171] It is problematic as individuals cannot monetise their data and thieves could hack into their identity indicators and attestations.

Identity security has been one of the most problematic results of the internet age. Currently, to establish trust and verify identity in a financial transaction, we rely on powerful intermediaries and these intermediaries act as the ultimate arbiters for access to essential financial services, such as bank accounts and loans.[172] Blockchain significantly reduces and sometimes eliminates the trust factor in specific

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[167] The Banking & Finance, *This is how Blockchain will change Finance in the next five years*, May 4, 2019, (Feb. 21, 2020, 05:50 PM), https://bfsi.eletsonline.com/this-is-how-blockchain-will-change-finance-in-next-five-years/.

[168] *Id.*

[169] *Id.*

[170] Don Tapscott, *Blockchain Regulation Roundtable – Addressing the regulatory challenges of Disruptive Innovation*, August 2018, BLOCKCHAIN RESEARCH INSTITUTE.

[171] *Id.*

[172] DON TAPSCOTT, *supra* 96 at 61.

transactions, and the technology will allow peers to establish an identity that is verifiable, robust and cryptographically secure to establish trust when it is needed.[173]

Blockchain assures a new model, wherein individuals have a digital self with complete sovereignty over their data. These identities can be checked by trusted parties with whom the individuals already have an established relationship, allowing a third party, such as a rental company, to ping our identity to validate a needed detail, such as age. Both incumbents and others would have tremendous savings through this method. The idea of a portable, citizen identity in a black box, owned individually by a person, on one of the most fundamental concepts of data protection of our time. It enables each of us to keep our data and repatriate our identities so that we can manage them responsibly and effectively, use this data to manage our lives better and secure our privacy.[174]

Even though many users and organisations are diligent in maintaining their online identities and protecting private data, the threat from nefarious people trying to steal this information is imminent. The application of blockchain technology to transform the way the users' online identity is handled has shown great potential. Courtesy of the independent verification processes[175] that happen throughout member computers on a blockchain network, there are tremendous levels of security on offer. This verification is used to verify and approve transactions in digital currency cases before they are appended to the chain. This process could be easily applied to different types of verification procedures, including identity verification and various other applications as well.

SUPPLY CHAIN MANAGEMENT

Blockchain technology is leveraged by suppliers to record the whereabouts of materials that they have purchased. The authenticity of their products can be verified by the company, along with health and ethics labels like "Organic," "Local," and

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[173] The Banking & Finance, *supra* 167.
[174] *Id.*
[175] *Id.*

"Fair Trade."[176] The following are some of the use cases being actively pursued by the Supply Chain Industry:[177]

- Tracking the movement of automobile spare parts to ensure their originality at the service station.

- Testing the purity of diamonds by tracking their movement across the supply chain from source to the ultimate consumer.

- Ensuring the authenticity of medicines at the ultimate retail point during the time of purchase by a consumer by recording in a verifiable manner, movement of medicine from the manufacturer to the chemist shop.

- Farm to fork tracking of agricultural produce to ensure optimal conditions for transportation and also traceability in case of any quality issues.

- Tracking of refrigerated goods by recoding the temperature across the value chain with the help of IoT devices to ensure they are not spoiled on the way, and for various other utilities.

BLOCKCHAIN TECHNOLOGY IN LEGAL INDUSTRY

Technology is already being used across the legal industry, and a plethora of opportunities to expand its application bubble under the surface is under progress, waiting to break into the present market.[178] However, given its infallible potential, the technology which by its intrinsic design, should give rise to trust[179], is shrouded in uncertainty. Jurisdictional questions, accountability, protection and privacy have not been dealt within the law, leaving a dangerous vacuum in the legislation on the subject. Logistic barriers also stand in the way of widespread adoption of Blockchain.

Blockchain is recognised worldwide as the Legal technology's future. In the desire to be a global leader in Distributed Ledger Technologies, the EU has acknowledged this

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[176] SRINIVAS, *supra* 98, at 223.

[177] *Id.*

[178] Kimberly Rust, *Block-chain Reaction: Why Development of Blockchain is at the Heart of the Legal Technology of Tomorrow*, 19 BRITISH AND IRISH ASSOCIATION OF LAW LIBRARIANS 58 – 60 (2019), Legal Information Management.

[179] A to Z Forex, *Blockchain regulation and the future of the industry*, May 08 2017, (May 25, 2020, 06:10 AM), https://atozmarkets.com/news/blockchain-regulation-industryfuture; See also Fin Extra, *How will regulation impact the development of blockchain technology?*, May 6, 2017, (May 25, 2020, 06:10 AM), https://www.finextra.com/ blogposting/14054/how-will-regulation-impact-the-development-of-blockchain-technology-.

innate importance.[180] The Law Society has similarly acknowledged that and envisioned innovative blockchain applications hold the capacity to revolutionise the legal industry, through reduction of time, risk and cost[181] in customer service provision. DLT already manifests in a variety of technologies, including smart contracts, cryptocurrencies and protection of intellectual property; and other developing ideas like blockchain mechanisms of governance and mapping.[182]

BLOCKCHAIN DIFFERS FROM OTHER TECHNOLOGY

Application of Artificial Intelligence (AI) in adapting to previously efficient time-intensive works such as due diligence or data storage and exchange has changed the everyday role of the lawyer and job trends in companies.[183] In comparison, Blockchain transforms infrastructure of exchanges enabling parties to communicate directly to one another. Blockchain also allows exchanges to move from between parties digitally, without an intermediary. Such innovations are used in smart contracts, being digitally accepted in compliance with the requirements. There are other forms of exchange which include IBM's TRADE, which stands for Trusted Anonymous Data Exchange.[184] This uses Blockchain to make a record of anonymous data shared on a private thread, with the help of smart contracts to guarantee appropriate anonymity, reputation and extent of access authorisations of parties.[185]

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[180] The European Parliament resolution, Oct. 3, 2018, *Distributed Ledger Technologies And Blockchains: Building Trust With Disintermediation,* 2017/2772(RSP); see also H. Eddis & S. Treacy, *European Parliament Calls For Progressive Regulation On Blockchain Technology*, LINKLATERS, Oct. 15 2018, https://www.linklaters.com/en/insights/blogs/fintechlinks/2018/october/europeanparliament-calls-for-progressive-regulation-on-blockchain-technology.

[181] Blockchain, The Legal Implications of Distributed Systems 7, THE LAW SOCIETY, Aug 2017, (May 10, 2020, 12:20 PM), https://www.lawsociety.org.uk/topics/research/blockchain.

[182] Origin Energy Limited won the 2017 Best Use of Technology Global Award for this, in their use of blockchain through application "BoardRoom"which provides a complete blockchain governance platform. See G. Lygoyris, BoardRoom's Innovative App wins 2017 Global Award, BoardRoom, 28 April, 2017, (May 10, 2020, 12:40 PM) https://boardroomlimited.com.au/posts/2017/04/28/boardroomsinnovative-app-wins-2017-global-award/.

[183] Sheffield University, *Internationalisation of the Legal profession 2018 Report*, (May 11, 2020, 03:10 PM) https://www.sheffield.ac.uk/law/exchange/internationalisationlegalprofession.

[184] S. Muppidi,, *TRusted Anonymous Date Exchange (TRADE) Threat Intelligence Sharing with Blockchain, Security Intelligence*, Sept. 26 2018, (May 11, 2020, 11:30 AM), https://security intelligence.com/trusted-anonymous-data-exchange-trade-threat-intelligence-sharing-withblockchain/.

[185] *Id.*

AI hence requests us to utilise both man and machine to consider what constitutes a 'good advocate'[186] and provide that to the customers. Blockchain demands us to consider how man and machine can be used to change the manner in which law is practiced. This technology not only makes practice more efficient but also revolutionises the subtleties of the legal world, introducing greater independence for customers and incorporating confidence and transparency into the depths of law which have long yearned for this.[187]

CHALLENGES TO LEGAL TECHNOLOGY

The greatest barrier to Blockchain's development is the deficiency in regulatory clarity.[188] It has significant conflicts with privacy law, worries over the cybersecurity laws, and doubts of liability remain as the prime obstacles which aggravate the industry's ambiguity and equivocality, inciting firms, legislators and developers to stumble on the side of caution and elude from investing in the development of blockchain applications. The principles of irrevocability and immutability of records are found to be contradictory to the privacy law aspects, especially the right to be forgotten brought up though the GDPR and other upcoming legislations.[189]

Since the digital identity of the party is published in the chain, it would progressively become important, to maintain anonymity along with transparency. The fears over money laundering and other fraudulent activities are reasonable. However, the nature of a real-time[190] (In reality there is an approximate delay of ten-minutes for updating of data between the time of exchange and the time at which this record appears, which is a restraining factor in fast-paced exchanges like those on the stock market) record should assist in finding out anomalous changes to the chain, and despite a successful

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[186] Patrick Alexander Hum, *Artificial Intelligence and the Legal Industry: Making Sense of AI for Aspiring Lawyers*, May 18 2018, (May 12, 2020, 12:10 PM), https://www.justis.com/artificial-intelligence-and-the-legal-industry/.

[187] Stephen Foley, *Battle is on to make bonds more transparent*, Stephen Foley, Financial Times, May 1, 2013, (May 12, 2020, 12:10 PM), https://www.ft.com/content/66874224-b206-11e2-9315-00144feabdc0.

[188] Regulatory uncertainty and trust are barriers to blockchain adoption amongst businesses, PWC, Aug. 28 2018, (May 12, 2020, 1:10 PM), https://www.pwc.co.uk/press-room/press-releases/regulatory-uncertainty-trust-barriers-to-blockchain.html.

[189] ARTICLE 17, GDPR, Regulation (EU) 2016/679 of the European Parliament and of the Council of Apr 27, 2016; See also D.Steinbeck, *How New EU Privacy Laws Will Impact Blockchain: Expert Take, Cointelegraph*, Mar. 30, 2018, https://cointelegraph.com/news/how-new-eu-privacy-laws-will-impact-blockchain-expert-take.

[190] A. Berke, *How Safe Are Blockchains? It Depends., Harvard Business Review*, Mar. 07, 2017, (May 12, 2020, 2:10 PM), https://hbr.org/2017/03/how-safe-are-blockchains-it-depends).

penalisation of fraudulent acts in ICOs,[191] the reality that a critical majority of actors could alter the records of a blockchain, despite the accuracy and precision of the freshly added information cannot be set aside. This still remains as a concern which is yet to be addressed.

The acknowledgement of liability remains ambiguous. However, some people state that the liability is not likely to be attributed to daily users, but might be enforced reasonably against particular users and developers.[192] Moreover, regulatory silence on the position of law has directed even those people associated with the promotion of blockchain technologies to be careful, with Google and Facebook hesitant to allow publication of cryptocurrency adverts.[193] For the legitimisation of Blockchain, regulation is central. A lack of regulation as a result of desires to promotes unrestricted innovation[194] strangles the confidence, and industry actors dare not to invest in Blockchain centred progress.

DECENTRALISATION OF CORPORATE AND POLITICAL GOVERNANCE SYSTEMS

Centralised systems of governments which manage the functions of our daily lives are further centralised structures functioning in business or public sector-central financial institutions, service and food supply chains, utilities, legislation and the judiciary, taxation or centres of learning. Each organisation keeps a series of ledgers that control the 'in' and 'out' flow of information on the law, wealth or property or both which includes everything from the calculation of votes to collecting taxes and preserving

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[191] *SEC v. Jeffre James* (No. 2:18-mc-00135 (C.D. Cal. filed October 5, 2018) for example; see also https://www.linklaters.com/en/insights/blogs/fintechlinks/2018/october/us-sec-successfully-halts-fraudulent-ico.

[192] Anderson Z., *US Commodities Regulator Suggests Potential Liability for Derivatives Smart Contracts Developers*, LINKLATERS, Oct. 31, 2018, (May 13, 2020, 9:00 PM), https://www.linklaters.com/en/insights/blogs/fintechlinks/2018/october/us-commodities-regulator-suggestspotential-liability-for-derivatives-smart-contract-developers.

[193] Anderson Z., *Google Eases ban on crypto ads in US and Japan*, LINKLATERS, Oct. 11 2018, (May 13, 2020, 9:50 PM), https://www.linklaters.com/en/insights/blogs/fintechlinks/2018/october/google-eases-ban-on-crypto-ads-in-us-and-japan

[194] European Parliament, *supra* 175 at Para 65.

property registries[195] and is the democratic practice of distributing and redistributing wealth and maintaining law and order.[196] In the centralised approach, to improve efficiency, organisations are only able to vertically and horizontally integrated, which is a cynical drawback as it further consolidates markets and generates even more significant accumulation of power, usually at the individual's expense.[197]

Public sector expansion of Blockchain-based governance concept could make small and large communities to reach consensus easier in overcoming the coordination problems within the large-scale democratic voting. Better encryption methods could empower digital public voting to be practically viable at a national level, or be equally scaled down to deal with local issues, for instance, casting votes on council budgets can be done via mobile devices or other wearable technology,[198] and local participants could disclose their position instantly or provide feedback directly. In the case of the budget, for instance, once the budget is approved, the allocated funds could immediately be released to the relevant departments using smart contracts.[199]

DECENTRALISATION ISSUES: Blockchains increase the systematic risk as they pose a threat to replace the centralised systems that play the role of shock-absorbers in a time of crisis, which blockchains as decentralised ledgers cannot perform.[200] Other challenges like the 'discovery problem', in commodity-based transactions, on an individual level, where the parties are unaware of each other's identity means that if one party is aggrieved about some aspect of the execution of the contract (e.g., misrepresentation or fraud), they may not necessarily have any redress for the said matter in the courts. Customer protection, the applicability of domestic legislation

[195] Jane Ellis, Anurag Bana and Christian Decle, Blockchain technology: Is it building a brighter future?, International Bar Association https://www.ibanet.org/Document/Default.aspx?DocumentUid=65FF920A-DE95-4848-B994-361260A7429E.

[196] Id.

[197] Aaron Wright and Primavera De Filippi, 'Dencentralised Blockchain technology and the rise of lex Cryptographia by Aaron Wright, Primavera de Filippi: SSRN' (SSRN, 20 March 2015) <http://papers.ssrn.com/sol3/papersxfm?abstract_id=2580664>

[198] Blockchain technology: Is it building a brighter future? by Jane Ellis, Anurag Bana and Christian Decle. International Bar Association https://www.ibanet.org/Document/Default.aspx?DocumentUid=65FF920A-DE95-4848-B994-361260A7429E.

[199] ASX Selects Digital Asset to Develop Distributed Ledger Technology For The Australian Equity Market, (ASX Media Release, 22 January 2016) <www.asx.com.au/documents/about/ASX-Selects-Digital-Asset-to-Develop-Distributed-Ledger-Technology-Solutions.pdf.>

[200] Jane, Anurag & Christian, *supra* 195.

versus international transaction rules, jurisdictional conflicts and conflict of legislation are some of the conflicts that need to be addressed.[201]

CONCLUSION

Blockchain Technology can be used for E-payments, IoT, voting, government registrations, medical records and the like, and the biggest positive comes when people shouldn't always be affluent with using Blockchain technology to use these services. This technology can be utilised to collect data from the individuals' regarding birth certificates, passport details, national insurance numbers, driver's license and other information required for creating a Legal Entity Identifier (LEI).[202] This was done in Estonia, where they permit people to prove their identity instantly, and that would help in the better enforceability of electronic signatures and would make the signing-up for financial products more direct. This is being portrayed as an advantage of blockchain technology, which is good for business, good for consumer and good for the government.

There are various other socio-economic benefits apart from the above mentioned like getting the unbanked people 'banked'. This is seen as a solution to the ever-increasing issue of immigration, wherein the immigrants are housed, into work and incorporated into the society by providing bank accounts and also adding them into the government registry. It also gives an individual a way to secure their personal Blockchain to prove their individual identity. BlockCrushr Labs had presented a method using this technology to ensure that the funds could be given to buy meals and other necessary items to serve this particular group of the 'unbanked'.[203]

Blockchain has immense potential to change and help in the advancement of technology in the legal front; however, the current developments are in the prenatal stage of a DLT-revolution. Blockchain technology is not perfect, and there are indeed barriers to the development of this technology. Theoretically, the massive energy consumption for the transactions and the absence of technical knowledge hinders with

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[201] *Id.*

[202] *Id.*

[203] SRINIVAS, *supra* 98 at 201.

the evolution of DLT. The energy needs have attained mind-boggling levels, with some researchers hinting that the bitcoin mining requires a comparable amount of electrical energy consumed by Ireland in whole.[204] This not only bothers the cost of blockchain-supported technology, but makes this technology susceptible to energy fluctuations, and the nodes likely located in jurisdictions with favourable energy prices, defeating the concept of decentralisation.[205] Blockchain has a relative novelty which meant that there is a general lack of expertise to develop this technology and evolve viable applications in different fields.

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[204] Karl J. O'Dwyer & David Malone, *Bitcoin Mining and its Energy Footprint*, HAMILTON INSTITUTE, National University of Ireland Maynooth, 2014.
[205] A. Berke, *supra* 190.

CHAPTER IV

REGULATION OF BLOCKCHAIN TECHNOLOGY – STRATEGIES, PRINCIPLES, AND TYPES

INTRODUCTION

Blockchain or distributed ledger technology (DLT) and smart contracts have no shortage of potential uses. The World Economic Forum suggested that they could be used in improving global payments, syndicated credit, collateral management, proxy voting, securities issuance, and regulatory and compliance activities.[206] For instance, syndicates of lenders could be formed using smart contracts, and smart contracts could perform funding and servicing activities for the syndicates.[207] Various Central banks are exploring the viability of issuing digital currencies, using blockchain technology[208] (noting that Sweden's central bank is debating issuing digital currency). Smart contracts can monitor collateral posted for transactions, and facilitate the clearing and settlement of collateral transactions.[209]

Legislation and regulation have generally not caught up with developments in the blockchain space.[210] It is unclear whether smart contracts would be recognised as a formal legal contract. Similarly, it is not immediately obvious, under which legislation or regulation cryptoassets fall. Jurisdictions around the world recognise the need to address this legal uncertainty. In November 2019, the UK Jurisdiction Taskforce (one of the six taskforces of the Law Tech Delivery Panel, which is an industry-led group that is tasked with supporting digital transformation of the UK legal services sector) published its legal statement on the status of smart contracts and cryptoassets under English and Welsh law. The landmark statement concludes that smart contracts are legally enforceable and that cryptoassets should be treated as property.[211]

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[206] Reggie O'Shields, *Smart Contracts: Legal Agreements for the Blockchain*, 21 NC. Banking Inst. 177 (2017).

[207] World Economic Forum, *The Future of Financial Infrastructure: An Ambitious Look at how Blockchain can reshape Financial* Services 41, 29 WEF (2016).

[208] Richard Milne, *Sweden's Riksbank Eyes Digital Currency*, FINANCIAL TIMES (Nov. 15, 2016).

[209] WEF, *supra* 207 at 42.

[210] *Id*.

[211] D. Popovic, C. Avis, M. Byrne, et al., *Understanding Blockchain for insurance use cases* 1 - 23, 25 BAJ (2020), e13.

With the development of Blockchain, lawyers encounter challenges which consist of identifying the legal, policy and strategic implications of blockchain technology.[212] Many of these aspects will crystallize as the technology develops, and its use cases shall continue to unfold. The precise future of Blockchain is hard to predict, and the policy-makers are mostly asked to regulate uncertainty. However, it is not premature to map the regulatory and governance challenges that have already emerged and ponder over possible solutions. Although the technology in itself is neutral, it is not usually utilized neutrally; instead, distributed ledgers or shared ledgers can be used for both good and malicious ends.[213]

Blockchain presents itself with the capacity to regulate self and others and also hinges on a stable regulatory framework. The development of blockchain technology will in mostly depend on the regulatory framework within which it occurs. However, a heavy regulatory hand ought to regulate the technology thoroughly, and instead, flexible and open approaches are needed. As technology develops, so must law.[214] A co-regulatory method justifying for the specific elements of the technology should be arranged to build the certainty and solidity required to sophisticate and mature blockchains while respecting the public interest objectives regulators are intended to safeguard.[215] It not only provides better guidance to those concerned with blockchain regulation but also more broadly stimulate debates on the relationship between law and technological innovation.[216] In this era, where new applications emerge with increased frequency and pace, this question is indeed one of general application.

REGULATING DISTRIBUTED LEDGER TECHNOLOGY

Distributed ledgers or shared ledger technologies are still in their early stages, and regulators around the globe have been brainstorming about the legal, policy, and strategic implications of this new technology. There is already an established typology of approaches described below that regulators have already been adopted. Further,

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[212] Michele Finck, *Blockchain Regulation And Governance In Europe*, CAMBRIDGE UNIVERSITY PRESS, 2018 (CUP).
[213] *Id.*
[214] *Id.*
[215] Michèle Finck, *Blockchains: Regulating the Unknown, Law & the new Economy*, GERMAN LAW JOURNAL, 19 GLJ 4, 667.
[216] I*d.*

there are several guiding principles that regulators should abide by while engaging with the technology in these nascent and ambiguous stages of its development.

TYPOLOGY OF REGULATORY STRATEGIES

Regulators across the globe have adopted various regulatory strategies, and are grouped into distinct typologies in order to emphasize the divergences in modern approaches as well as their distinguishing features.

1. WAIT AND SEE

Regulators use the 'Wait and See' approach to understand how the technology unfolds while continuing to apply existing legal frameworks. The principle of this approach is to "educate, do not regulate.[217]" In this approach, a novel phenomenon is permitted to be disclosed before concrete guidelines and rules are formulated. This is described as a mainstream regulatory approach at this moment in time, as it allows regulators to witness how blockchains evolve sans the need to make clear pronouncements on that context.

'Wait and see' approach has been widely adopted in context, and is also followed by the European Commission in various other domains of their digital innovation, especially in the platform economy.[218] The Commission has been "actively monitoring" related developments in Blockchain Technology,[219] and includes, for instance, the organization of workshops related to that matter as well as financing of pilot projects.[220] Further, it is essential to emphasize that the 'Wait and See' approach does not equal passivity. Even though no new regulation is issued and longstanding legal principles continue to apply, a regulator in parallel actively accumulates information and acquires knowledge and information through consultations of stakeholders and experts, while regularly evaluating developments in other jurisdictions. This information-gathering process consequently paves the way to

[217] Michèle Finck, *supra* 215.
[218] *A European Agenda for the Collaborative Economy*, COM (2016) 356 final (June 2, 2016).
[219] Luke Parker, *European Commission "Actively Monitoring" Blockchain Developments*, BRAVE NEW COIN, Feb 17, 2017, (May 13, 2020, 10:30 PM), https://bravenewcoin.com/news/european-commission-actively-monitoring-blockchain-developments/.
[220] Chuan Tian, *European Commission Hosts Blockchain Summit with Industry Focus*, COINDESK, July 18, 2017, (May 14, 2020, 9:00 AM), http://www.coindesk.com/european-commission-hosts-blockchain-workshop-industry-focus/.

different approaches as, in the light of the evidence gathered, a regulator might assert that prevailing rules should continue to be applied or, some new guiding principles are required.

A different conclusion can also be reached, where further experimentation can be vouched for and also embrace a sandboxing solution, or any other experimentation regulatory strategies.[221] The popularity and acceptance of 'Wait and See' approach points that Blockchain still remains an immature technology which is subject to evolution and its practical effects remain mostly speculative at this stage and also echoes its fast-paced development. Regulators would also face the risk of an increasing need for an amendment if they were to adopt hard-binding rules.

It is important to note that, as regulators track the advancement of technology, established legal standards continue to apply to the blockchain-based operation, and can be clearly understood from the case of Silk Road, the now inactive underground online market for illicit products and services that depended on Bitcoin as payment.[222] The site was closed in 2013, and the founder was subsequently sentenced to life imprisonment without parole.[223] This example shows that the criminal activity happening on the Blockchain is no less criminal than its analogue counterpart.

An exercise in legal classification is mandatory to determine whether existing legal frameworks apply while a regulator observes its wait-and-see approach.[224] Such Legal classification has allowed the US Internal Revenue Service to determine that Bitcoin is more identifiable as a property rather than a currency and consequently is subject to the current property law regime.[225] However, Legal classification is, often far from an easy undertaking. Moreover, regulators around the world have been struggling to qualify Initial Coin Offerings (ICOs) and decide whether the tokens issued in this context fall under securities,[226] and that indicates the disadvantages of 'Wait and See' approach. Until classification has taken place, innovators are encountered with a lack

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[221] *Id.*

[222] Andy Greenberg, *Silk Road Creator Ross Ulbricht Loses Life Sentence Appeal*, WIRED, May 31, 2017, (May 14, 2020, 9:00 AM), https://www.wired.com/2017/05/silk-road-creator-ross-ulbricht-loses-life-sentence-appeal/.

[223] *Id.*

[224] Michèle Finck, *supra* 215 at 670.

[225] IRS Virtual Currency Guidance: *Virtual Currency is Treated as Property for U.S. Federal Tax Purposes; General Rules for Property Transactions Apply*, IRS, Mar. 25, 2014, (May 14, 2020, 10:00 AM), https://www.irs.gov/uac/newsroom/irs-virtual-currency-guidance.

[226] An ICO is a means to raise capital for a new cryptocurrency venture.

of legal certainty, which can lead to negative consequences for the industry, as building up a business in the midst of regulatory uncertainty is like building on quicksand.[227] Regulators may choose to give guidance to these actors in order to limit such negative consequences.

2. ISSUE NARROWING OR BROADENING GUIDANCE

If regulators have gained initial insights from their evaluation of distributed ledgers, they may agree to provide informal guidance on the applicability of established legal frameworks. In addition, these definitions may be restricted or loosely applied.[228] This should not be confused with new laws, but should instead involve the application of existing legal frameworks, giving stakeholders guidance on how to interpret them and, most importantly, evaluating whether their activities are affected by the laws at issue, in the context of the regulations.

Recently, the U.S. Securities and Exchange Commission clarified that coins or tokens could be classified as securities if the current legal requirement is extended to ICOs.[229] The business may, in this sense, also force regulators' hands in placing pressure on them to act. These may include lobbying campaigns, media coverage, or even proactive litigation tactics. While such guidance will often remove the lack of certainty faced by innovators, guidelines are disadvantaged because they are not hard binding rules, but simple guidelines, and can, for instance, be overlooked by courts with a varied and often contrary approach.[230]

This occurred within the platform economy where ECJ's Advocate-General Szpunar was not impressed by the guidelines of the European Commission on whether a platform should be seen as a simple intermediary or as a service provider.[231] Regulatory sandboxing is a newer approach which still allows regulators to practise and learn before they establish binding rules, but also provide better legal certainty to innovators.

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[227] IRS Virtual Currency Guidance, *supra* 225.
[228] Michèle Finck, *Blockchain Regulation and Governance In Europe*, Cambridge University Press, 2018.
[229] Investor Alerts and Bulletins, *Investor Bulletin: Initial Coin Offerings,* U.S. SECURITIES AND EXCHANGE COMMISSION, (May 14, 2020, 11:10 AM), https://www.sec.gov/oiea/investor-alerts-and-bulletins/ib_coinofferings.
[230] *Id.*
[231] *Asociación Profesional Elite Taxi v. Uber Systems Spain*, C-434/15 (Dec. 20, 2017), http://curia.europa.eu/.

3. SANDBOXING

Once initial findings and implementations of blockchain technology are reached, a regulator might feel that it is too early to reform the law, as the resultant lacunae of legal certainty could adversely influence the blockchain industry and prevent them from engaging into a particular venture or leaving competence for friendly reasons.[232] Jurisdictions wishing to retain or attract blockchain operators without wishing to create binding laws that generally apply; increasingly adopt a "sandboxing" approach to prevent such results.

A regulatory sandbox is a set of rules that allows the innovators to test their products or business models in a particular environment that temporarily exempts them from blindly following some or all legal requirements in place.[233] In exchange, these innovator-actors are usually obliged to make their business model operational in a restricted manner, through a restricted number of clients or risk exposure, which is under close regulatory supervision. The strategy is structured to gain regulators from each other and to reduce regulatory confusion.[234] The former, in turn, hope to encourage innovation and legal experimentation. This approach has its application mainly in the FinTech sector and also constitutes an intriguing example of how a change in technology affects the regulation as well. Sandboxing is considered to be a key to carry the innovations to market more quickly while safeguarding public interest considerations.

This approach was pioneered by the United Kingdom in 2015 and approved the first sandboxed FinTech services in 2016.[235]The British system under tight supervision and over a fixed time span allowed the innovators, to evaluate the latest technology in a loosely yet strictly controlled setting.[236] Subsequently, this technology spread rapidly to other jurisdictions. A new licensing category for innovative companies was developed by the Swiss Financial Markets Supervisory Authority, which includes a

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[232] Michèle Finck, *supra* 215 at 675.
[233] The terminology is a play on the term development sandbox that denotes a safe environment for developers to work on software.
[234] Michèle Finck, *supra* 215 at 675.
[235] *Regulatory Sandbox*, FINANCIAL CONDUCT AUTHORITY, Feb. 14, 2018, (May 14, 2020, 11:30 AM) https://www.fca.org.uk/firms/regulatory-sandbox.
[236] *Id.*

sandbox with license exemption.[237] Singapore is one country which has a regulatory sandbox.[238] A regulation-based sandbox initiative was also launched by the Canada Securities Administration[239] , and Australia opened a research centre recently on blockchain technology and planned to open a regulatory sandbox that will enable firms to test their products[240].

Regulatory sandboxing offers its own set of advantages and disadvantages. Black boxes that do not have transparency can be termed as Sandboxes.[241] Another concern is about equality in a sandbox setting wherein individual economic operators benefit from advantages which are not available to others. This risk was seen as incompatible with the rule of law and various judicial review proceedings were also initiated against some of these schemes. The selectivity of entry to the sandbox further underlines the technological and business model balanced problems for such structures.

It also raises challenges regarding onboarding and off-Boarding, because of actors transition from a general legal regime for everyone to selective and privileged regime available only to the few.[242] For instance, what about customers who used a specific service before the firm entered the sandbox, assuming that their dealings would be immune to the general rule; however, they would no longer be. Also, the data available to determine the intricacies of the transition from the privileged to the general regime are still not enough. Therefore, in the EU, the Member States are restricted on what they can do within the framework of sandboxes as this superiority of EU law is an obstacle to sandboxes which breach EU law.[243] In addition, at least in their present form, regulatory sandboxes are limited to a single jurisdiction which can create significant difficulties for transnational providers of services.

[237] FINMA, *FINMA Reduces Obstacles to FinTech*, SWISS FINANCIAL MARKET SUPERVISORY AUTHORITY, (May 14, 2020, 11:50 AM), https://www.finma.ch/en/news/2016/03/20160317-mm-fintech/.

[238] MAS, *FinTech Regulatory Sandbox,* MONETARY AUTHORITY OF SINGAPORE, (May 14, 2020, 12:15 PM), http://www.mas.gov.sg/Singapore-Financial-Centre/Smart-Financial-Centre/FinTech-Regulatory-Sandbox.aspx.

[239] *The Canadian Securities Administrators Launches a Regulatory Sandbox Initiative*, CANADIAN SECURITIES ADMINISTRATORS, (May 14, 2020, 3:05 PM), https://nssc.novascotia.ca/sites/default/files/docs/Feb.%2023,%202017%20CSA%20RegSandbox-press%20release-Final.pdf.

[240] Stan Higgins, *Australian Finance Regulator Unveils Blockchain Research Effort*, COINDESK, (May 14, 2020, 03:25 PM) https://www.coindesk.com/australian-finance-regulator-launches-blockchain-research-effort/.

[241] *Id.*

[242] FINMA, *supra* 237.

[243] *Id.*

The advantage of sandboxing is that it helps regulators buy time to keep observing and understanding from the technologies and associated early ventures while also promoting innovation by providing legal certainty and formal avenues for discussion between the regulated and the regulating.[244] Certain regulators are taking a specific strategy for issuing blockchain regulation, at this point.

4. INTRODUCTION OF NEW POLICIES AND LEGISLATIONS

A number of jurisdictions have already taken steps to enact new laws in spite of the early phases of technology development. Although this gives the advantage that jurisdiction is portrayed as a progressive, Blockchain technology-friendly venue in order to drawn Blockchain innovation, it also risks becoming premature. Nonetheless, the legislative zeal might well have adverse long-term implications as the technology progresses further, which could contribute earlier rather than later to the need for statutory reform. As Walch also notes, the terminology around blockchains remains unresolved, which can also lead to complications in the application of such a legislative framework.[245]

In March 2017 Arizona introduced state legislation to qualify signatures secured and obtained through Smart contracts and Blockchain as electronic signatures.[246] Russia created a legislative basis for the regulation of ICOs.[247] Vermont has proposed laws in effect that allows blockchain data admissible evidence in the courts.[248] France has approved debt-based crowd funding on the blockchain.[249] Delaware proposed legally

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[244] MAS, *supra* 238.

[245] Angela Walch, *The Path of the Blockchain Lexicon (and the Law)*, 36 REV. OF BANKING AND FIN. L. 2018, (May 15, 2020, 09:30 AM) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2940335.

[246] Stan Higgins, *Arizona Governor Signs Blockchain Bill into Law*, COINDESK, (May 15, 2020, 09:50 AM) https://www.coindesk.com/arizona-governor-signs-blockchain-bill-law/.

[247] ALTCOIN TODAY, *Russia is Creating a Regulatory Framework to Legalize ICOs*, (May 15, 2020, 09:50 AM) http://www.altcointoday.com/russia-legalize-icos/.

[248] Stan Higgins, *Vermont is Close to Passing a Law That Would Make Blockchain Records Admissible in Court*, COINDESK, (May 15, 2020, 10:20 AM) http://www.coindesk.com/vermont-blockchain-timestamps-approval/.

[249] Diana Ngo, *France Issues New Ruling for Mini-Bonds Trading on Blockchain Platforms*, BTCMANAGER, (May 15, 2020, 10:50 AM) https://btcmanager.com/france-issues-new-ruling-for-mini-bonds-trading-on-blockchain-platforms/.

acknowledging blockchain stocks and "creating and preserving corporate documents utilizing blockchain.[250]"

The purpose of these measures is to have legal certainty. However, if they are done early, these steps may backfire. In 2015, the New York State introduced the BitLicense scheme for the regulation of Bitcoin, and that required the entities involved in virtual monetary operations that are not exempt from the rules of New York's virtual currency to get a BitLicense from the state's Financial Services department.[251] Only three such licenses were issued to – Ripple, Circle, and Coinbase in the next two years.[252] It was claimed that the charges for applying for a BitLicense were prohibitive for start-ups, and smaller players and they had other jurisdictions to institute their business other than applying for the license.[253] California through the California Bill AB 1326, planned a similar system but was later scrapped following strong intervention by the Electronic Frontier Foundation, which stressed that it would deject innovation as the lack of "start-up exception," leaving no place for "thinkers and entrepreneurs to play with novel digital currencies that can change the market, and therefore, restrict California's digital currency innovation.[254]"

Although regulations may provide procedural clarity to explain how a particular policy plan is created, guidelines that are too complex can place operators in the area at risk, theoretically stifling innovation to generating problems for law enforcement departments who would be compelled to follow standards that they know are unsuccessful. Naturally, the legislation would become more frequent and an essential method as time progresses. It is not easy to determine when this would happen since it is always difficult for regulators to determine when such new technologies emerge.

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[250] Stan Higgins, *Delaware Introduces Bill to Legally Recognize Blockchain Stocks*, COINDESK, (May 15, 2020, 10:20 AM), http://www.coindesk.com/delaware-introduces-bill-legally-recognize-blockchain-stocks/.
[251] N.Y. Comp. Codes R. & Regs. tit. 23 § 200.1 et seq., http://www.dfs.ny.gov/legal/regulations/adoptions/dfsp200t.pdf.
[252] Michael del Castillo, *Bitcoin Exchange Coinbase Receives New York BitLicense*, COINDESK, (May 15, 2020, 10:20 AM) http://www.coindesk.com/bitcoin-exchange-coinbase-receives-bitlicense/.
[253] Yessi Bello Perez, *The Real Cost of Applying for a New York BitLicense*, COINDESK, (May 15, 2020, 10:30 AM), http://www.coindesk.com/real-cost-applying-new-york-bitlicense.
[254] Electronic Frontier Foundation, Opinion Letter (Aug. 11, 2016), (May 15, 2020, 10:40 AM), https://www.eff.org/files/2016/08/18/eff_letter_-_oppose_ab_1326_aug._2016_-_final_.pdf.

Law should not come too early to hinder innovation unnecessary, but also not too late to leave the people and principles sans protection.[255] As time passes, legislating would become more comfortable, with the establishment of standards and terminology. The International Standards Organisation has been working on technical and interoperability standards for DLTs as that could address some of those technological and like issues.[256] Regulators with blockchain have also additionally involved beyond several regulatory strategies, for optimizing their own processes with reliance on the technology.

5. USING BLOCKCHAIN TECHNOLOGY FOR OWN PURPOSES

In order to optimize their own procedures, regulators have begun relying on distributed ledgers. Although this is not in and of itself a regulatory tactic, it constitutes a significant facet of the 'educate do not govern' policy approach, which allows regulators to know more about the technology by testing it itself, which may change some of the roles undertaken by such agents in the long term.

Ukraine collaborated with Bitfury to place government data on a blockchain, hoping to address the issues about transparency and accountability.[257] Georgia was the first nation to register land titles on Blockchain technology, and Sweden followed suit by experimenting this technology in land registry context.[258] Estonia has been working for blockchains in relation to store and selectively share data from health care reliably.[259] The Singapore Smart Nation project deployed DLT to domestic inter-bank payments. The Dubai Government, through the Dubai 2020 Initiative, eyes to transfer all governmental documents and systems onto a blockchain.[260] Majority of these

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[255] Lyria Bennett Moses, *Agents of Change: How the Law "Copes" with Technological Change*, 20 GRIFFITH L. REV. 763 (2011).

[256] *Environmental* Management, ISO, ISO/TC 207.

[257] Gertrude Chavez-Dreyfuss, *Ukraine Launches Big Blockchain Deal with Tech Firm Bitfury*, REUTERS, Apr. 13, 2017, (May 15, 2020, 10:50 AM) https://www.reuters.com/article/us-ukraine-bitfury-blockchain-idUSKBN17F0N2.

[258] Jonathan Keane, *Sweden Moves to Next Stage with Blockchain Land Registry*, COINDESK (Mar. 30, 2017), https://www.coindesk.com/sweden-moves-next-stage-blockchain-land-registry/.

[259] Jonathon Marshall, *Estonia Prescribes Blockchain for Healthcare Data Security*, PWC BLOGS, Mar. 16, 2017, (May 15, 2020, 11:00 AM), http://pwc.blogs.com/health_matters/2017/03/estonia-prescribes-blockchain-for-healthcare-data-security.html.

[260] Nikhil Lohade, *Dubai Aims to be a City Built on Blockchain*, WALL ST. J., Apr. 24, 2017, (May 15, 2020, 11:20 AM), https://www.wsj.com/articles/dubai-aims-to-be-a-city-built-on-blockchain-1493086080. *See also Global Blockchain Council*, DUBAI FUTURE FOUNDATION, http://www.dubaifuture.gov.ae/our-initiatives/global-blockchain-council/.

initiatives are observed as attempts to know the technology better and explore its applications and limitations, rather than an attempt to revamp the standard processes.

These trial projects have three benefits. First, it allows regulators to experiment with new approaches to current governmental processes, with the hope of making them more relaxed, more efficient and more transparent. Second, these trial projects will allow regulators to track firsthand the activity of a blockchain-based use case that in effect, informs their technology regulatory approach. Third, such projects create a dialogue with the distributed ledger industry between governments.[261]

PRINCIPLES OF BLOCKCHAIN REGULATION

Any technology which is not mature enough is a malleable technology, and since blockchain would nevertheless develop, there is an opportunity to root compliance and abide by the public policy objectives right from the beginning. Regulators need to note further that as technology changes so does the law, and at that instance, the age-old regulatory paradigms will not sync with the new technologies. Like the platform economy, IoT, and Big Data, Distributed Ledger pull systems and business processes conducted prior from offline to online.[262] The challenge involves finding where exactly the private regulation through code stops and public regulatory intervention starts. There are some who advocates that the virtual arena should be left alone by the real-world regulators. However, declaration of the independence of cyberspace will not hinder Internet regulation, and Blockchain would inevitably become subject to regulatory constraints.[263]

Finding the balance of such regulations in a way that it accounts for the interests and objectives of both the regulators and stakeholders alike is a crucial factor, and these regulations should permit the protection of public interest goals, and enhance innovation simultaneously. They should also be careful to avoid past mistakes of showing delayed interest in the new technology and premature creation of new institutions and also learn from the advantages and disadvantages of previous

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[261] Nikhil Lohade, *supra* 260.
[262] Kevin Werbach*, The Song Remains the Same: What Cyberlaw Might Teach the Next Internet Economy*, FLA. L. REV. 1 (2018).
[263] John Perry Barlow, *A Declaration of the Independence of Cyberspace,* ELEC. FRONTIER FOUND., Feb. 8, 1996, (May 15, 2020, 10:50 AM) https://www.eff.org/cyberspace-independence.

Blockchain regulations. The regulators do not solely carry the risk of making legislation successful, rather the industry and other stakeholders should also actively engage in fruitful dialogues with the regulators to better explain their technology, also addressing their regulatory fears and needs.[264] The regulatory challenges posted by blockchain can only be addressed efficiently through polycentric collaborative efforts.

1. REGULATORY STABILITY IS A MEANS OF INNOVATION AND GROWTH

Legal certainty is brought forth by regulation, which takes away the concern of entrepreneurs and innovators from thinking that their activity may suddenly be categorized as illegal. These concerns also make some innovators hesitant, shy of subsequently fulfilling their vision, or drive to leave their jurisdiction to establish their innovation in more friendly territory. During the early wave of innovation, when the Internet slowly emerged, though initially skeptical, the tech companies gradually welcomed the regulatory intervention.[265] Certainty can be provided through such intervention by the usage of clear rules applicable to all players. Similarly, in the platform economy, Airbnb, with the help of long-sought dialogues with the regulators, accepted regulation to operate in various locations,[266] and the transportation industry counterpart, Uber then pushed for insurance legalization which unanimously applies across the whole of US.[267]

Regulatory uncertainty generates additional negative externalities, which beyond negatively affecting entrepreneurial courage, also increases the costs of legal compliance as entrepreneurs should go a great extent to clarify their legal situation, if possible. Small players and many not-for-profit distributed ledger initiatives would particularly face problems for this. Such state of affairs further increases the risk of litigation, which in turn hikes the legal costs for companies, and would also give rise to a determination of applicable rules on a case-by-case basis, which would be ill-

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[264] Michèle Finck, *supra* 215 at 677.

[265] Kevin Werbach*, supra* 262.

[266] Michèle Finck & Sofia Ranchordas, *Sharing and the City*, 49 VAND. J. OF TRANSNAT'L L. 1299 (2016).

[267] UBER TEAM, *Insurance Aligned*, UBER, Mar. 24, 2015, (May 15, 2020, 11:30 AM) https://newsroom.uber.com/introducing-the-tnc-insurance-compromise-model-bill/ (describing the TNC Insurance Compromise Model Bill).

advised for all parties involved.[268] Moreover, an absence of regulatory guiding principles risks leaving public policy considerations unprotected.

2. BALANCE OF PUBLIC INTEREST WITH TECHNOLOGY

Public policy considerations include, but are not limited to – the prevention of money laundering, safeguarding consumer protection (as in the context of ICOs), and the protection of privacy and copyright.[269] Public policy apprehensions would expand with technology, and in the case of distributed ledgers, the challenge involves achieving a balance between the interests of the broader interests of society and system participants. Regulatory strategies must, at all times, consider and account for the public policy implications of distributed ledger technology.[270]

Regulators should also vary in the risk of regulatory capture and blind enthusiasm. It has been opined that in a climate of "pressures for deregulation, the regulatory authorities must make sure that the pendulum does not swing too far in favour of innovation, at the expense of compliance.[271]" This should not point towards regulators turning hostile towards the industry or claim that innovation is a public value in itself, and can thus also be considered to occur in the public interest. Instead, while communicating with these actors, they should keep a critical and independent perspective and remember that their role to protect the public interest and that customary values do not fade away as technology develops. It is paramount for regulators to be mindful in this context about fact selection in regulatory debates which can be tricky and embed agency capture and minoritarian bias; however, new data solutions can help solve some of these problems.[272]

3. REGULATORY DIALOGUES AND STRATEGIC USE OF TECHNOLOGY

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[268] Michèle & Sofia, *supra* 266.

[269] Garry A. Gabinson, *Policy Considerations for the Blockchain Public and Private Applications*, 19 SMU SCI. & TECH. L. REV. 327 (2016).

[270] Garry A. Gabinson, *supra* 269.

[271] Holly Powley & Keith Stanton, *The Future of Banking Regulation*, UNIV. OF BRISTOL L. SCH. BLOG, Apr. 24, 2017, (May 15, 2020, 01:00 PM), https://legalresearch.blogs.bris.ac.uk/2017/04/the-future-of-banking-regulation/.

[272] Mark Fenwick, Wulf Kaal & Erik Vermeulen, *Regulation Tomorrow: What Happens When Technology is Faster than the Law ?,* UNIV. OF ST. THOMAS (MINNESOTA) LEGAL STUDIES LEX RESEARCH TOPICS IN CORP. L. & ECON., Working Paper No. 2016-8, 2016).

Today, regulators are beginning to seek and understand and use blockchains, although innovators are struggling to understand what regulatory standards apply to their operation. All actors could resolve their respective problems by means of dialogue and cooperation, and sandboxes and government-backed initiatives are tools for conducting such dialogues, which helps all parties to benefit from the strategic use of this technology. Hence, it is a good idea to set up bodies that address technology and related regulatory issues, wherein public officials can learn and better understand technology through communication between public authorities and industry representatives while industry leaders have the ability to demonstrate it to regulators.

The distributed ledger industry is wise in its approach to contact regulators early on. The fate of Uber in Europe shows that the innovator of the application itself gets ultimately affected due to his inability to comply with public authorities and to respect public policy objectives.[273] The developers of Arcade city have already made a prototype of an application similar to Uber on the Ethereum platform. If this gets into a fully functional application, then blockchain would possibly become a nightmare for centralized applications like Uber.

Ideally, these debates should have a cross-jurisprudential dimension to account for the fact that the distributed ledgers do not represent territorial borders, just as the Internet does.[274] These jurisdictional problems are challenging and do not provide a simple solution; instead, they resonate existing issues of a global economy without a global government. Nonetheless, there is the possibility of talks like this, which are highlighted by Singapore and Switzerland agreeing on FinTech rules.[275]

4. TECHNOLOGICAL INNOVATION TRIGGERS LEGAL INNOVATION

Regulators needed to think outside the conventional legislative toolbox while crafting frameworks to govern the early blockchain industry. Technological innovation necessitates legal innovation, and the emergence of digital platforms that bridge fast

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[273] Jon Henley, *Uber to Shut Down Denmark Operation Over New Taxi Laws*, GUARDIAN, Mar. 28, 2017, (May 15, 2020, 01:00 PM) https://www.theguardian.com/technology/2017/mar/28/uber-to-shut-down-denmark-operation-over-new-taxi-laws.

[274] David Johnson & David Post, *Law and Borders: The Rise of Law in Cyberspace*, 48 STANFORD L. REV. 1367 (1996).

[275] Jonathan Keane, *The State of ICO Regulation? New Report Outlines Legal Status in 6 Nations*, COINDESK, Jul. 13, 2017, (May 15, 2020, 02:10 PM) http://www.coindesk.com/state-ico-regulation-new-report-outlines-legal-status-6-nations/.

technological change and the protection of public interest requirements is not an easy task to achieve.[276] Though the code is a powerful self-regulatory mechanism, it should not operate in isolation from regulatory framing.[277] Besides, a process of polycentric co-regulation should be adopted as it acknowledges the limitations of traditional methods of top-down legislation in the context of technological innovation, and yet also ensures that public policy objectives are observed while ensuring a continuing dialogue between multiple stakeholders.[278]

Co-regulation, or "regulated self-regulation," creates collaboration between public authorities and private bodies to regulate private activity while accounting for its particularities and safeguarding public policy objectives.[279] The polycentric form of co-regulation is the aptest form as it reflects the characteristics of blockchains, as well as of the blockchain ecosystem. The decentralized scheme of blockchain technology is expected to bring decentralization into many spheres of life and commerce, leading, inter alia, to decentralized market structures and an intermediary-free economy.[280] Blockchain's ecosystem is moreover made up of a large range of diverse actors, and blockchains will concern an ever-larger number of stakeholders. Polycentric co-regulation brings all these aspects to the forefront when these regulations are discussed, framed, and implemented.

This technique taps into collective wisdom, helpful as the wisdom of the group will always outweigh that of its individual members. Through such collaboration, it is hoped that there is less risk of regulatory capture or a lack of information leading to inadequate principles. However, there are stark contrasts between various blockchain stakeholders, common engagement in a regulatory effort will allow them to cooperate and appreciate their respective thinking and language, which may enrich the technology's development. The polycentric co-regulation is not a one-point intervention but rather a continuous effort between many stakeholders, who operate under the guidance of the regulator,[281] and a flexible and open principles-based

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[276] Michèle Finck, *Blockchain Regulation And Governance In Europe*, CAMBRIDGE UNIVERSITY PRESS, 2018.
[277] *Id.*
[278] *Id.*
[279] Christopher Marsden, *Internet Co-Regulation* 46, CAMBRIDGE UNIVERSITY PRESS 2011.
[280] Angela Walch, *The Fiduciaries of Public Blockchains*, Presented at 2nd International Workshop P2P FINANCIAL SYSTEMS 2016, UNIVERSITY COLLEGE LONDON, Sept. 8, 2016.
[281] Michel Callon, Pierre Lascoumes &Yannick Barthe, *Acting in an Uncertain World* (MIT Press 2009).

approach allows for verification and adaptation rather than an obsession on certainty and finality. While polycentric co-regulation deviates substantially from the existing regulatory approaches, it could easily be applied in the present context.

In adopting such approaches, the benefits of Blockchain software should be leveraged at the law-making, implementation and enforcement stages. This software could be used to encourage the online consultation of a broader range of stakeholders at the law-making stage, to encourage polycentrism.[282] These approaches do have their own limitations, like those related to selection bias, but they provide the overall benefit of gathering a plurality of opinions of diverse stakeholders. Furthermore, blockchains have inherently regulatory potential. In such technical artefacts, code acts as law as it defines the options of possible behaviour.[283] Using software to implement the agreed normative principles can thus ensure that they are complied with efficiently. Finally, the software can also facilitate enforcement and regulators should consider using code to determine compliance with the defined regulations.

5. REGULATORS SHOULD ENCOURAGE EXPERIMENTATION

The data regarding developments taking place with blockchain technology remains sparse. There are primarily two reasons for this. First, the technology is not adequately developed for there to be dependable, verified knowledge regarding its functioning. Second, there are very few blockchain experts, and most regulators have not yet familiarized themselves with the available knowledge on the matter. In this context, it is paramount to realize that the only way for distributed ledgers and knowledge about them to improve is for them to be used in practice. However, many nations have now invested a lot into developing this technology seeing the prospects, but, India is still trying to understand the real possibilities of this technology.[284]

Blockchains still remain an experiment, albeit its staggering prospects. Regulators should embrace this spirit of experimentation in making this a key feature of their own approach, and the sandboxing technique which was already observed above has become a popular technique which allows innovators to experiment with technology in a controlled setting while providing legal certainty to participants.[285] Moreover,

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[282] *Id.*
[283] *Id.*
[284] SRINIVAS MAHANKALI, BLOCKCHAIN THE UNTOLD STORY 61, (2d Ed. 2019).
[285] Michèle Finck, *supra* 215 at 675.

Sandbox initiatives are primarily motivated by the desire to attract innovation to the jurisdiction, and it helps not only the innovators but also provides an opportunity for regulators to watch the technology and its implications closely.[286]

A number of additional experimental techniques are also available other than Sandboxing technique. They can, for instance, rely on small-scale experimentation, and sunset clauses—temporary regulation—or sunrise clauses—regulatory requirements that kick in only after certain events materialize.[287] Indeed, regulating distributed ledgers will also be an exercise in risk regulation, and only time will clarify where risks lie in this context. The UK Chief Scientist has encouraged the establishment of blockchain demonstrators at the city level.[288] In pursuing such an approach, regulators should focus on blockchain use cases rather than the technology itself.

Regulatory sandboxes are the experimental regime that has attracted the most interest from regulators in relation to blockchains to date. However, this technique suffers from several shortcomings. A possible further option that has thus far not been considered by law-makers is the reliance on a so-called "28th regime" in the context of the European Union, which is an optional legal regime, applicable throughout the EU, which does not replace the national frameworks in place. Should the supranational co-legislators come to the conclusion that a common supranational legal framework is desirable, they could choose this option.[289] The private sector would then have the option of relying on applicable national rules or, alternatively, the optional EU legal framework, in the context of their transactions. The benefits of this approach are such that principles can presumably be adopted more quickly at the EU level, adding harmonization where it is needed to facilitate cross-border transactions without replacing national law.[290] An added benefit is that the concrete implications of such a legal framework can more easily be tested as it can be compared to the national legal regimes that remain applicable.

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[286] *Id.*

[287] Sofia Ranchordás, *Innovation Experimentalism in the Age of the Sharing Economy*, 19 LEWIS & CLARK L. REV. 871 (2015).

[288] Matt Hancock & Ed Vaizey, *Distributed Ledger Technology: Beyond Block Chain*, GOV'T OFF. FOR SCI. 5, Jan. 19, 2016, (May 15, 2020, 5:00 PM) https://www.gov.uk/government/news/distributed-ledger-technology-beyond-block-chain.

[289] Opinion of the European Economic and Social Committee, *The 28th Regime – an Alternative Allowing Less Lawmaking at Community Level*, INT /499 (2010).

[290] Id.

6. FOCUS ON USE CASES RATHER THAN THE TECHNOLOGY

Regulators should focus on specific use cases of blockchains rather than the technology itself[291] , and this position finds support in its experience with other disruptive technologies, such as the Internet and digital platforms. Blockchains are a neutral technology, and it can be relied on to pursue all kinds of objectives by the humans that operate it. Nevertheless, blockchains, as well as for cryptocurrencies, can be manipulated for illicit ends, including tax evasion using cryptocurrencies that guarantee strong privacy protections and can serve as online bazaars of prohibited items and activities. These activities are already illegal under existing regulatory schemes, and this understanding of illegal acts can be applied to the blockchain. However, blockchain's cross-jurisdictional nature adds an additional challenge of detection and enforcement[292], and yet, the technology presents undoubtedly positive evolutions such as its efficiency-enhancing features, already displayed in the FinTech context. Inventions such as BitPesa have moreover been able to change the lives of many people for the better.

Mostly, the classification will not be as clear-cut as qualifying Silk Road as "bad" and BitPesa as "good." Regulators thus need to think carefully about each case, especially those operating in the grey area between these two poles. From a technical perspective, this is the only real choice they have given that there is no realistic option of preventing the spread of blockchains except for disconnecting citizens from the Internet or intervening at the protocol level.[293]

7. REGULATORS SHOULD RESIST THE URGE TO CREATE NEW INSTITUTIONS PREMATURELY

The problems associated with creating premature legislations have already been discussed. Similar caution should also be taken for agency-creation, and the Internet Corporation for Assigned Names and Numbers (ICANN) illustrates the hazards of too

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[291]Julie Maupin, *Mapping the Global Legal Landscape of Blockchain and other Distributed Ledger Technologies*, SSRN Working Paper, 2017, (May 15, 2020, 05:00 PM) https://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=1101957.

[292] Blockchain's permanence of records can however also be considered to add a significant advantage to regulators from a detection perspective as unlike paper and online records, those on Blockchain cannot be erased.

[293] Julie Maupin, *supra* 291.

swiftly creating new institutions.[294] The criticisms directed towards it are many and include claims that while it was designed as an "independent collective voice of the people of cyberspace" it represents a "naked exercise of power politics by the United States, which in turn sought to head off intervention of power politics from other governments.[295]" Before new institutions are created, we need to think carefully about the role of old ones and expectations for new ones. The Blockchain community itself has already rejected an ICANN analogy for blockchain-based applications through the creation of a distributed domain name registry system to store the list of domain names on a distributed blockchain database without having to go through governments and large corporations.[296] Moreover, the ICANN system is currently facing the risk of being disrupted by the emergence of blockchain technology, which enables the creation of blockchain-based domain names.[297]

8. REGULATORS SHOULD ENGAGE IN TRANSNATIONAL CONVERSATION

In an ideal world, world commerce and a global blockchain would be regulated by a global regulator. Short of such cooperation, rules will be fragmented, cooperation between various authorities on illicit blockchain-based activity such as tax evasion will be complicated, and innovators face additional hurdles by having to come to terms with manifold regulatory frameworks.[298] However, no one will be fooled to believe that a global legal framework is a realistic option. Short of such a radical option, more realistic avenues capable of pursuing the same objectives should be envisaged. This includes transnational cooperation and dialogue, including on questions of experience sharing as well as technological and data interoperability. In the United States, the various states are realizing the benefits of cross-jurisdictional cooperation on this matter. The American Uniform Law Commission has indeed recently passed a model act for digital currencies.[299] In the EU, there is clear potential

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[294] ICANN, https://www.icann.org/ (May 16, 2020, 08:30 AM).

[295] Kevin Werbach, *supra* 262.

[296] NAMECOIN, http://bit.namecoin.info/ (May 16, 2020, 08:30 AM).

[297] Mike Ward, *Change is Coming: How the Blockchain Will Transform the Domain Name Business*, COINTELEGRAPH (May 16, 2020, 08:30 AM), https://cointelegraph.com/news/change-is-coming-how-the-blockchain-will-transform-the-domain-name-business.

[298] Peter van Valkenburg, *The ULC's Model Act for Digital Currency Businesses Has Passed*, COIN CENTER, July 19, 2017, (May 16, 2020, 09:00 AM). https://coincenter.org/entry/the-ulc-s-model-act-for-digital-currency-businesses-has-passed-here-s-why-it-s-good-for-bitcoin.

[299] *Id.*

for the European Commission to shepherd such efforts as part of its internal market competence and the fact that the Digital Single Market is one of the Juncker Commission's policies priority.

DIRECT AND INDIRECT REGULATIONS

Many countries around the world, including the US, Malta, and Belarus, have admitted that there is a requirement for proper blockchain regulations. Most of the countries that allow the use of blockchain and cryptocurrency trading is currently using either Indirect or Direct methods or both to regulate this sector.

Direct regulations: These are regulations governing blockchain-related technology that is officially introduced by the government.

Indirect regulations: Here, the blockchain companies have to obey the standard regulations enforced on tech companies as well as those explicit towards blockchain compliance.

Following the Indirect regulations are not always feasible. The GDPR, brought in by the EU, for instance, bestows every citizen the "right to be forgotten", i.e., the right to be entirely forgotten online, if/when they wish to do so, and delete their profile or account. Such an approach cannot be easily incorporated with blockchain, because of its immutable character, and the burden to comply with that law fell on blockchain companies in this aspect[300].

THE UNITED STATES

The US has many businesses accepting cryptocurrency for their daily operations, and they are considered as one of the most advanced countries in the world in terms of blockchain and cryptocurrency[301]. The intricacy of US legislation lies in various governmental levels – local (state) and federal ones. Though the digital currency is legalized and recognized on a federal level, the laws might differ from each state.

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[300] Darya Yafimava, *Blockchain and the law: Regulations around the World*, Jan 17, 2019, BLOCKCHAIN INSIGHTS, (Jun. 10, 2020, 05:00 PM) https://openledger.info/insights/blockchain-law-regulations/.
[301] *Id.*

Several federal agencies regulate the blockchain-related businesses in the United States, and they are classified as three agencies, which are very similar to each other, and hence, allow various agencies to collaborate on enforcement and regulatory matters:

- The US Revenue Service describes cryptocurrency as assets for taxation roles.
- The Commodities Futures Trading Commission, also known as CFTC, describes cryptocurrency as a commodity[302].
- The Securities and Exchange Commission (SEC) classifies digital currency as a security.

While the US government emphasized the extensive regulations of the cryptocurrency industry, it has been quiet on the other blockchain-related business models, and there are no specific regulations that are present in the department[303]. Nevertheless, SEC released various statements regarding the activities of fundraising through an Initial Coin Offering (ICO) or token sale, considering them as securities. The Federal Trade Commission (FTC) went further and made a Blockchain Working Group, and their main objective is to arrest the illegal and fake schemes arising in the marketplace from time to time[304]. Besides, this group also focuses on other objectives:

- For increasing the expertise of FTC staff in Blockchain technology and cryptocurrency.
- For assisting internal and external communication on enforcement actions.
- For providing a platform for discussing possible influences on FTC's aims and finding ways to respond to them.

This group has brought various significant lawsuits over the years. In 2018, the Federal Trade Commission made the US Federal Court crackdown a bunch of individuals who were involved in misleading practices. In 2016, the FTC brought up a case against Butterfly Labs, for misleading customers about the profitability and age of mining machines. Besides enforcing things, FTC also educates as well, as they are the ones hosting public forums on the blockchain[305]. Overall, the US government takes the same stance with the blockchain industry, as it does with anything else –

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[302] *Id.*
[303] *Id.*
[304] *Id.*
[305] *Id.*

regulations primarily, business secondary. Various governments and regulatory agencies in the world have taken the cue and have begun to narrow down on high-profile offenders and design regulations to restrain companies from taking undue advantage of investors.

BELARUS

Belarus was one among the first nations in the world to make a formal regulatory framework for the blockchain industry. The president of Belarus signed a decree in 2017, which focused on blockchain and cryptocurrency-related innovations positioned within the Hi-Tech Park (HTP), known as Belarusian 'Silicon Valley'[306]. The bill was called the "Digital Economy Development Ordinance", and it came into effect on March 2018. As per this bill, the Hi-Tech Park was designated as a unique sector in the country, with exclusive legal and the tax regime for blockchain and crypto businesses. The Company-residents of the HTP was not restricted to issue, store or trade digital tokens. Moreover, the blockchain-centred companies that were members of HTP were also entitled a tax-break for the next five years, until 2023.

The subsequent law on Blockchain enforced in 2018 by the Belarus government was targetted on the prevention of money laundering, terrorism financing, and propagation of weapons of mass destruction using blockchain-related activities[307].

MALTA

The Blockchain Island, as Malta is commonly addressed as, believes that the capability of blockchain is endless. The country has of lately introduced two blockchain-related acts, as part of their initiative to embrace this technology known as Malta Digital Innovation Authority Act[308] (MDIA Act) and Innovative Technology Arrangement and Services Act (ITAS Act). MDIA Act is based on setting up of digital ledgers and regulation of new blockchain entry.

GIBRALTAR

Gibraltar started with its initiative to regulate the digital ledgers back in 2014 and was also the first countries to adopt blockchain regulation. Its regulations are applied to wallet provides, exchanges, all other business models working on a Distributed

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[306] *Id.*
[307] *Id.*
[308] *Id.*

Ledger Technology[309]. The DLT firms of the country are regulated by the Gibraltar Financial Services Commission (GFSC), and on January 1, 2018, these regulations came into force. It provides nine essential principles, which has to be followed by every company working in the blockchain industry.

CONCLUSION

Despite the buzz surrounding blockchain, it is essential to not lose out of sight that blockchain remains at the very early stages of its development, faced with challenges of scalability, maturity, performance, privacy, security, and, as of now, also wide-spread adoption.[310] It needs time and experience to develop, and this is a crucial realization that should guide any regulatory action. However, looking at the speed of innovation and the more recent adoption of blockchain technology across various State and private organisations, this technology is not to be written off as emerging only in the long-term. Rather, it can be observed with the given rate of accelerated innovation. Regulators should not wait to converse with the industry until blockchain is fully mature.[311] Instead, innovators and regulators should collaborate already at this stage to facilitate innovation beneficial to all. A Blockchain is a flexible tool and how we frame it, including from a regulatory perspective, will be critical. There also needs to be awareness on behalf of all actors involved in the system that setbacks will naturally occur.[312] Early applications of blockchain are at least in part overhyped, but that does not mean that the technology is in itself. As with every technology, the turning point of adoption comes when opportunities are considered to outweigh risks. When that happens, technology and industry are ready to go, and the regulatory framework should be too.

The regulation and control of these decentralized applications and Blockchain-based organisations are complicated and pose a problem for the regulators. If Digital currencies garner widespread adoption, it might become nearly impossible to shut it down, mainly because they lack a centralized authority and are not controlled by any

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[309] *Id.*

[310] MICHÈLE FINCK, *supra* 276.

[311] *Id.*

[312] Perez C., *Technological Revolutions and Techno-Economic Paradigms,* TALLINN UNIV. OF TECH., TECH. GOV'T AND ECON. DYNAMICS, Working Papers, 2009.

governmental organisations or subject to the authority and regulation of any regulators. Blockchain technology has a pseudo-anonymous nature, which combined with encryption, could potentially restrict the legal organisation's ability to unearth and put a lock on illegal activities, including tax avoidance or communications between terrorist cells.

CHAPTER V

BLOCKCHAIN MODELS AROUND THE WORLD – FRAMEWORKS AND COMPARATIVE STUDY

INTRODUCTION

Value and money are different from traditional information. Some crucial shifts are revealing the limits of government in an age of accelerating innovation. For instance, the 2008 financial crisis revealed to the world, how the speed and complexity of the global economic system render traditional centralized rulemaking and enforcement increasingly ineffective. However, stronger regulation is not the antidote, as governments cannot hope to oversee and regulate every corner of the financial market, technology, or the economy, because there are too many players, innovations, and products[313]. This experience illustrates that governments can at least force transparency to shed light on the behaviour and create change. Governments can demand that the actions of banks, for example, be transparent on the Web and let citizens and other parties contribute their data and observations. Citizens can even help enforce regulations, too, perhaps by changing their buying behaviour or, armed with information, by organizing public campaigns that name and shame offenders[314].

Governments must indeed be the key stakeholder and leader in governance. They must also acknowledge that their role in governing the blockchain will be fundamentally different from their historical role in monetary policy and financial regulation. While generally positive, the US response has sometimes seemed contradictory. "In the US there is a realization from the Congress to the executive branch to different agencies including law enforcement that this technology has serious, legitimate uses," said Jerry Brito[315]. Indeed, the internet has shown the world that, by temperament and institutional design, the US not only tolerates but welcomes innovations that push the boundaries. It also fences off innovation through regulations – some of which may be misguided and are almost certainly premature.

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[313] DON TAPSCOTT AND ALLEN TAPSCOTT, BLOCKCHAIN REVOLUTION – HOW THE TECHNOLOGY BEHIND BITCOIN AND CRYPTOCURRENCY IS CHANGING THE WORLD 296, (2d Ed. 2018).
[314] *Id.*
[315] Jerry Brito's Interview, June 29, 2015, by Don Tapscott & Alex Tapscott.

The risks of regulating prematurely before firmly grasping the implications can have profound consequences. Steve Beauregard[316], described the pitfalls of regulating too soon: "When Web pages were first going up, regulators were trying to determine what regulatory regime under which they should belong."[317] Regulation is different from governance, and it is about laws designed to control behaviour.[318] Governance is about stewardship, collaboration, and incentives to act on shared interests. However, experience suggests that governments should approach regulating technologies cautiously, acting as a collaborative peer to other sectors of society, rather than as the heavy hand of the law.[319] They must participate as players in a bottom-up governance ecosystem rather than as enforcers of a top-down regime of control.

Brito of Coin Center argued that there is a role for governments, but they should exercise caution. He advocates for a multistakeholder solution, which starts with education: "briefing folds in Congress, at the agencies, in the media, and answering any of their questions or putting them in touch with the people who can intelligently answer the questions."[320]

THE DIMINISHING ROLE OF GOVERNMENT

Instead of merely regulating, governments can improve the behaviour of industries by making them more transparent and boosting civic engagement, and that is not a substitute for better regulation but as a complement to the existing systems. Effective regulation, by extension of effective governance, is derived from a multistakeholder approach where openness and public involvement are treasured more highly and weigh more heavily in making decisions.[321] It is for the first time in history that nonstate, multistakeholder networks are forming to solve global problems.

In recent decades, two significant developments have provided the basis for a new model. First, the advent of the Internet, created the means for stakeholders of all forms, down to the individuals, to communicate, contribute resources, and coordinate action, and for many things, we no longer required the government officials to

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[316] Steve Beauregard, CEO of GoCoin, a leading company in the Blockchain industry.
[317] Steve Beauregard's Interview, April 30, 2015, by Don Tapscott & Alex Tapscott.
[318] DON & ALLEN, *supra* 313 at 297.
[319] *Id.*
[320] Jerry Brito's Interview, *supra* 315.
[321] DON & ALLEN, *supra* 313 at 298.

convene for the rest of us to align our goals and efforts.[322] Secondly, businesses, academia, NGOs, and other non-state stakeholders have gained the ability to play an essential role in global cooperative efforts, and there were no businesses, NGOs, or nonstate stakeholders at the table at Bretton Woods.[323] Today, these stakeholders routinely engage with governments to address issues in all facets of society, right from the governance of a global resource like the Internet to addressing global problems like climate change and human trafficking.

The combination of these developments enables the new model. For a growing list of global challenges, self-organizing collaborations can now achieve global cooperation, governance, and problem-solving – and make faster, more robust progress than traditional state-based institutions.[324] Broadly, the ecosystem that governs the Internet is vibrant with lessons, and that it has become a global resource in such a short period is astounding, in no small part, courtesy of the strong leadership and governance and despite the powerful forces against it.

A NEW FRAMEWORK FOR BLOCKCHAIN GOVERNANCE

Instead of having State-based institutions, we need collaborations of civil society, private sector, government, and individual stakeholders in nonstate networks. This collaboration is called *Global Solution Networks* (GSNs).[325] These Web-based networks are now proliferating, achieving new forms of cooperation, social change, and even the production of global public value. One of the most important is the Internet itself, which is curated, orchestrated, and otherwise governed by a once-unthinkable collection of individuals, civil society organizations, and corporations, with the tacit and sometimes active support of nation-states. Nevertheless, no government, country, corporation, or state-based institution controls the Internet, and yet it works. In doing so, it has proven that diverse stakeholders can effectively steward a global resource by inclusiveness, consensus, and transparency.[326]

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[322] *Id.*

[323] The Bretton Woods Conference, formally known as the United Nations Monetary and Financial Conference.

[324] DON & ALLEN, *supra* 313 at 299.

[325] *Id.*

[326] Brian Forde's Interview, June 26, 2015, by Don Tapscott & Alex Tapscott.

There are ten types of GSNs, and each involves some combination of companies, governments, NGOs, academics, developers, and individuals. None of them is controlled by states or state-based institutions like the UN, the International Monetary Fund (IMF), World Bank, or the G8. All will play an essential role in the leadership and governance of Blockchain technology.

1. KNOWLEDGE NETWORKS

The primary function of knowledge networks is to develop new thinking, research, ideas, and policies that can help solve global problems. More informed and savvy users can better protect themselves from fraud and theft and protect their privacy. They can also realize the full value of this disruptive technology, creating opportunities for a more significant share in global prosperity and more excellent financial connectivity.[327]

BLOCKCHAIN IMPLICATIONS: Knowledge networks are the origination points for disseminating new ideas to other GSNs and the broader world. They are the key to avoiding pitfalls and showstoppers. Knowledge will prepare stakeholders to advocate more effectively, create or co-create policy, and spread critical information to users. According to Jerry Brito of Coin Center, whatever the particular policy issue is, if governments "do not understand the technology and do not understand the implications, they are setting themselves up for failure."[328] Many raise the need to create spaces for ideas and information to be shared and debated. Tyler Winklevoss said, "there should be a forum to present proposals or ideas."[329] MIT's Digital Currency Initiative is a leading knowledge network, trying to unite and excite academics and universities globally. Blockchainworkships.org is another group that has convened stakeholders to spread knowledge and critical lessons. Reddit, the online forum and community, is also a breeding ground for new knowledge in the space.

2. DELIVERY NETWORKS

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[327] Adam Killick, *Knowledge Networks, Global Solution Networks Program*, MARTIN PROSPERITY INSTITUTE, UNIVERSITY OF TORONTO, 2014.
[328] Jerry Brito's Interview, *supra* 315.
[329] Tyler Winklevoss's Interview, June 9, 2015, by Don Tapscott & Alex Tapscott.

This class of networks delivers the change it seeks, supplementing or even bypassing the efforts of traditional institutions. For example, ICANN performs an essential role in Internet governance network, delivering solutions in the form of domain names.

BLOCKCHAIN IMPLICATIONS: We would likely be having an "ICANN moment" for blockchain, where organizations will form to deliver essential functions. However, whereas ICANN and many other GSN types in the Internet governance network are distinctly American, blockchain leaders should push to make these organizations international. Joichi Ito said, "I do think there is already a big push to make governance non-American and international from the beginning because that is one thing we learned from ICANN, that it is hard to get out from under America once you get started as part of America."[330] The Coalition for Automated Legal Applications (COALA) is a global organization that performs a few crucial roles: It disseminates knowledge, influences policy, and advocates for blockchain technology, and supports the development and deployment of blockchain-based applications, all critical to overcoming major potential showstoppers.[331]

3. POLICY NETWORKS

Sometimes networks create government policy, even though they may consist of non-governmental players. Policy networks support policy development or create an alternative for policy, whether governments support them or not. The goal of policy networks is not to wrest control of the policy-making process from governments. Instead, their goal is to turn decision making from the traditional hierarchical broadcast model to one of consultation and collaboration.[332]

BLOCKCHAIN IMPLICATIONS: Today, a nascent policy network is emerging. The Chamber of Digital Commerce, a trade organization, focuses on promoting the acceptance and use of digital currencies.[333] The United Kingdom has its own Digital Currency Association, as do Australia and Canada, that speaks for industry. Coinbase became the first company to install a permanent policy advocate.[334] Promoting and uniting many influential voices in the policy arena will ensure that blockchain has a

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[330] Joichi Ito's Interview, August 24, 2015, by Don Tapscott & Alex Tapscott.
[331] COALA IP, (May 16, 2020, 08:30 AM), http://coala.global/?page_id=13396.
[332] DON & ALLEN, *supra* 313 at 302.
[333] CHAMBER OF DIGITAL COMMERCE, (May 16, 2020, 09:30 AM). www.digitalchamber.org/.
[334] *Id.*

better chance of fulfilling its potential. For instance, mining consumes much energy, and that climate change is a big problem. The responsible policy will go a long way toward building a sustainable future, and the government cannot do it alone.

4. ADVOCACY NETWORKS

Advocacy networks seek to change the agenda or policies of governments, corporations, and other institutions. The Internet has lowered the cost of collaboration, and today the world is witnessing the dramatic rise of increasingly powerful advocacy networks that are more global, widely distributed, and technologically sophisticated than anything seen before.

BLOCKCHAIN IMPLICATIONS: Advocacy networks arise with the disillusionment with traditional political and civic institutions, making them a logical fit for the blockchain community, which is trying to upend how those traditional institutions solve problems. However, in these early days, advocacy networks must work with the government as a partner. Advocacy networks are closely tied to policy networks,[335] and COALA, MIT's Digital Currency Initiative, and others are trying to create an imprint in this area. Advocacy is critical to scaling blockchain technology. In the absence of influential advocates who stand up for stakeholders and stakeholder rights, governments and other powerful institutions could try to stifle, twist, or usurp this robust open network to their exclusive advantage, another potential severe showstopper.

5. WATCHDOG NETWORKS

These networks scrutinize institutions to ensure that they behave appropriately, and these topics range from human rights, corruption, and the environment to financial services. In the process, they drive public debate, boost transparency, and ignite movements for change. The role of watchdogs is inherently intertwined with that of advocacy networks and policy networks. Policy networks collaborate with the government to shape policy that works. Watchdogs ensure that industry complies with policies and effectively monitors and enforce compliance. Governments that abuse the public trust can also be scrutinized and held accountable.[336]

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[335] DON & ALLEN, *supra* 313 at 303.
[336] *Id.*

BLOCKCHAIN IMPLICATIONS: The Blockchain Alliance is a partnership between law enforcement, NGOs, trade organizations, and the private sector and is the first dependable advocacy network to form in the space.[337] Coin Center and the Chamber of Digital Commerce, with the support from Bit-Fury, Bitfinex, BitGo, Blockchain, Circle, Coinbase, and others have partnered with law enforcement agencies such as the US Justice Department, the FBI and the like. As it was explained in the previous chapter, despite the good deeds of using blockchain, it is also being co-opted by criminals on a widespread scale is a showstopper. These watchdogs have a vital advocacy role as well. In the aftermath of the Paris terrorist attacks, some European lawmakers, regulators, and law enforcement blamed bitcoin as the source of terrorism financing. The Blockchain Alliance called for patience: 'Let us not regulate out of fear',[338] they said.

Other than the self-policing role of community members who convene, collaborate, and debate on forums and Reddit, few other watchdog networks have stepped up.[339] Partnerships with law enforcement are a helpful start, but the blockchain ecosystem needs fully independent organizations, perhaps like traditional watchdogs such as Amnesty International and Human Rights Watch, to monitor governments, corporations, and other large institutions. Otherwise, there will be an imminent showstopper: that blockchain becomes a new and powerful surveillance tool used by corrupt and unscrupulous governments.[340]

6. PLATFORMS

The digital age allowed organizations to be much more than closed, siloed institutions; they can also be platforms for value creation, innovation, and global problem-solving. Organizations like Change.org empower individuals to initiate campaigns in support of social causes from human rights to climate change. A "petition platform" harnesses the collective force of millions of people and catalyzes

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[337] *Id.*
[338] Chamber of Digital Commerce, *Dear G7, Bitcoin is already highly regulated*, (May 16, 2020, 10:00 AM). *http*://www.digitalchamber.org/assets/press-release---g7---for-website.pdf.
[339] *Id.*
[340] DON & ALLEN, *supra* 313 at 304.

their passion into lasting impact. Open data platforms can apply to many issues – from climate change to the blockchain.[341]

BLOCKCHAIN IMPLICATIONS: As blockchain technology gains in systemic importance, stakeholders must aggregate and scrutinize data.[342] The bitcoin blockchain may be radically open, transparent, and reconcilable, but closed blockchains used in everything from financial services to the Internet of Things (IoT) might not be. A platform that allowed regular citizens to aggregate and scrutinize data, proving a strong bulwark against creeping showstoppers of scalability, government encroachment, or unsustainable energy use, would enable watchdogs and advocates among us to hold institutions and corporations more accountable and drive constructive discussions.[343]

7. STANDARDS NETWORKS

Standards networks are non-state-based organizations that develop technical specifications and standards for virtually anything, including standards for the Internet itself. They determine the standards that form the fundamental building blocks for product development and allow a promising innovation to leap to mass adoption. For global standards networks to work, they must engage the expertise of individuals, institutions, civil society organizations, and most of all, private-sector enterprise. The Internet Engineering Task Force (IETF), one of the primary standards bodies for the Internet governance network, excels at incorporating the many views of diverse stakeholders.[344]

BLOCKCHAIN IMPLICATIONS: Originally, The Bitcoin Foundation funded the development of the bitcoin core protocol, the common standards used by the community. However, the near-collapse of the foundation (precipitated by mismanagement and waste) proved the need for networked governance solutions. Recognizing the profound importance of this technology and the need for careful stewardship and nurturing, MIT created the Digital Currency Initiative, which has

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[341] Anthony Williams, *Platforms for Global Problem Solving, Global Solution Networks Program*, MARTIN PRESPERITY INSTITUTE, UNIVERSITY OF TORONTO, 2013.
[342] *Id.*
[343] DON & ALLEN, *supra* 313 at 304.
[344] *Id.*

since bankrolled the bitcoin core developers so they can continue their work.[345] For the core developers, their ability to work autonomously was central to the design.

Gavin Andresen[346] believes that leadership is required to move the agenda forward on common standards, such as the much-debated block-size question. Pointing to the early days of the Web, Andresen said, "The Internet model shows that you can have technologies where consensus does arise, even though there is no one clear leader," but that "you can either have a person or a process that ends in a person, but you definitely need one or the other."[347] Consensus mechanisms alone cannot support standards developments.

Scalingbitcoin.org is an organization that convenes engineers and academics to address major technical issues, including standards questions. In financial services, both R3 and the Hyperledger Project are tackling critical standards issues. Invariably, there will have to be standards networks on a variety of things, from the blockchain protocol that forms the basis of the financial services industry of the future to the common standards for privacy and payments in the IoT.[348]

While each of these groups attacks the problem from different angles and with different agendas, each shares a common goal to make his technology ready for prime time – by building infrastructure, developing standards, and making it scalable.

8. NETWORKED INSTITUTIONS

Some networks provide such a wide range of capabilities that we describe them as "networked institutions." They are not state-based but sincere multi-stakeholder networks. The value they generate can range from knowledge, advocacy, and policy to actual delivery of solutions.[349]

BLOCKCHAIN IMPLICATIONS: The World Economic Forum (WEF), a leading networked institution, has been a vocal proponent of blockchain technology. Jesse McWaters[350] believes that blockchain technology is a general-purpose technology, like the Internet, which we can use to make markets radically more efficient and

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[345] Brian Forde's Interview, *supra* 326.
[346] Gavin Andresen - one of the core developers working at MIT.
[347] Gavin Andresen's Interview, June 8, 2015, by Don Tapscott & Alex Tapscott.
[348] *Id.*
[349] DON & ALLEN, *supra* 313 at 306.
[350] Financial innovation lead at the WEF.

improve access to financial services. The WEF predicted that within a decade, we could store 10 per cent of global GDP on blockchains.[351] As an organization, the WEF has championed and advanced significant issues, such as income inequality, climate change, and even remittances. Networked institutions often have a role to play in influencing government policymaking, making them a critical link and strategic partner in overcoming several significant showstoppers.

9. DIASPORAS

Diasporas are global communities formed by people dispersed from their ancestral lands and united by culture and identity with their homeland. Courtesy to the Internet, these people and affiliated organizations can collaborate in multistakeholder networks. One of the functions of many of today's diasporas is to address and help solve common global problems.[352]

BLOCKCHAIN IMPLICATIONS: Blockchain makes the process of process of sending remittances affordable and straightforward. Far from being a job killer, blockchain creates time and resources for these people to pursue other wage-earning opportunities or entrepreneurial endeavours.[353] While a few companies have originated in places such as the Philippines and Kenya, diasporas must do more to accelerate knowledge, adoption, and acceptance of blockchain payment methods.

10. GOVERNANCE NETWORKS

The blockchain governance network will combine all the features and attributes of the nine other GSN types. Ultimately, a blockchain governance network should strive to be inclusive and welcome participation from all relevant stakeholder groups. The network should be a meritocracy, meaning that the community would champion viable proposals regardless of the rank and status of the proposer. The network should be transparent, releasing all of its data, documentation, and meeting minutes for public scrutiny. Finally, decisions should be reached, as much as possible, by consensus in order to gain legitimacy for the outcomes.[354]

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[351] World Economic Forum, (May 16, 2020, 11:00 AM).www3.weforum.org/docs/WEF_GAC15_ Technological_Tipping_Points_report_2015.pdf,7.
[352] *Id.*
[353] DON & ALLEN, *supra* 308 at 307.
[354] DON & ALLEN, *supra* 308 at 307.

THE CHINESE BLOCKCHAIN MODEL

Deloitte[355] in 2019, published a report focusing on the global attitude towards Blockchain after performing some surveys. According to that report, blockchain broke into the modern world dramatically, and it was derived that the businesses' perspective of this innovative technology changes with time. Deloitte surveyed various enterprises from different countries, and among them, 200 were from China. Incidentally, 73% of the Chinese companies saw blockchain as a top-five strategically important technology in the future, and Chinese respondents also demonstrated the highest confidence in tomorrow's blockchain applications.[356]

BLOCKCHAIN IN CHINA: WELCOME STRANGER

Government Stance: The sudden evolution of digital assets, consequently paved the way for regulatory movements in China. During the past several years, China has been designing various strategies to restrict innovation in fintech. On June 2018, the China Banking and Insurance Regulatory Commission (the "CBIRC") designed a working plan to give blockchain-enabled digital assets independently as a legitimate monetary asset issued by the People's Bank of China (the "PBOC"), which is the primary financial regulatory body in China.[357]

It was proposed by the CBIRC to equate those assets to fiat currencies in value and utilize them as a medium of exchange and transfer.[358] This plan rules out all the other digital assets like the Bitcoin, and others, tagging them as "non-sovereign" and thus, not legalized and authorized as fiat[359]. Through this way, China planned to establish its "national" blockchain assets, though the government has officially recognized and accepted the proposed classification by far. They only made the exception to recognize Bitcoin as a tradable asset, but the position of the other cryptocurrencies is still unclear.

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[355] One of the "Big Four" accounting organizations and the largest professional services network in the world by revenue and number of professionals.
[356] Anton Lashuk, *Blockchain in China: Status Quo in the Land of the Rising Sun*, Nov 14, 2019, BLOCKCHAIN INSIGHTS, OPEN LEDGER, (May 16, 2020, 02:10 PM), https://openledger.info/insights/blockchain-in-china/.
[357] *Id.*
[358] *Id.*
[359] Anton Lashuk, *supra* 356.

Presently, China's official cryptocurrency is still in the development phase. The governmentally appointed task force has been exploring the depths of blockchain technology, but the release date of the asset is yet to be disclosed[360].

<u>Anti-Money Laundering and Know Your Customer:</u>   The existing Anti-Money Laundering (AML) practices in China are mainly based on the Know Your Customer (KYC) system with regards to clients' sensitive data and transaction reports. Consequently, the authorities could quickly determine any sorts of fraud in financial procedures by assigning actions to corresponding players and taking the needful legal measures promptly[361]. Nevertheless, in the case of cryptocurrency, AML has shown its deficit. The origins of these blockchain-powered investments are anonymous and are thus hardly traceable and detectable. It is for the same reason that digital currencies are an attracting medium for swindlers who does money-laundering. Moreover, the cross-border crypto-based remittances can be transferred without having the notice of the State Administration of Foreign Exchange.

In 2013, the People's Bank of China needed financial institutions to impose some AML policies; they also independently started assessing the money laundering risks of digital assets and promptly drawing measures in response[362]. Cryptocurrencies, without a doubt, require a more intelligent approach in terms of regulatory oversight, as those assets are untraceable and anonymous, and the most crucial aspect is that they are irreversible and encrypted.

BLOCKCHAIN INITIATIVES IN CHINA

When the CAC imposed new regulations on February 15, the providers were given 20 days to register both the names as well as server addresses with the CAC. The regulations also required the providers to make improvements in KYC practices by demanding both new and present users to give valid identification or a mobile number. Providers had to also maintain records of the user's service history for not less than six months, and voluntarily provide such information to the CAC or law officers when requested. Those providers who refused to follow regulations were charged with a penalty ranging from 5,000 ($740) to 30,000 ($4,445) yuan, and

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[360] *Id.*
[361] *Id.*
[362] *Id.*

suspended from operating till that issue was addressed correctly. If the offence committed was significant enough, the providers might also have to face criminal investigation[363].

These new regulations imposed by China, though pointed towards providing more transparency in the blockchain sector, were introduced in an overbearing and authoritative tone. The regulations lacked a depiction of the meaningful or productive relationship between the provider and government[364]. In Cryptocurrency and Blockchain technology, regulation is a necessity, and China has been taking significant measures to strengthen the progress of blockchain, and it resulted in the steady increase of blockchain businesses in their region[365]. However, these regulations pulled China a step backwards from leading the sector despite an increase in blockchain businesses in China between 2017 and 2020.

The People's Bank of China purportedly started testing some blockchain-based finance platforms and technological hubs, including Shenzhen, one of the rapidly growing cities in China. The Cyberspace Administration of China published the list of registered blockchain firms early in 2019, which included Chinese retail giants like Tencent, Baidu, and Alibaba. China's regulatory sandboxes are worth noting as they are the special economic zones which assist companies that develop technologies[366]. For example, the Hainan sandbox offers government-sponsored incubators for startups, access to investment for innovators, straight communication with fintech businesses and developers, along with testing in a managed surrounding, along with other benefits.

Currently, China has a vibrant ecosystem of blockchain projects broken down into layers. The initial, underpinning layer incorporating blockchain projects supported by CEOs and venture capital enterprises. There, the importance is given on tech aspects and product design rather than marketing problems[367]. Overall, the project developers seek financial assistance first and then develop use cases and prototypes, and finally

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[363] Darya Yafimava, *China's new Blockchain Regulations*, Feb 11, 2019, BLOCKCHAIN INSIGHTS, OPENLEDGER, (May 16, 2020, 03:00 PM). https://openledger.info/insights/china-blockchain-regulations/.
[364] *Id.*
[365] *Id.*
[366] *Id.*
[367] *Id.*

move towards promotion. The second layer includes a network of incubators and educational institutions, which contributes to technology awareness through hackathons and blockchain laboratories. This helps to find new talents and build and an active tech community, with young people adapting to innovations quickly. The final layer is a lively fintech landscape and dynamically changing regulatory environment. Although the gap between the regulated banking industry and Distributed Ledger projects is still substantial, the most prominent financial institutions, like the PBOC, is already considering the ways of blockchain implementation in their operations[368]. Regardless of the general positive movement, China is experiencing adoption challenges complicating blockchain evolution in that region.

CHALLENGES TO MASS ADOPTION

Trust comes in as the primary problem. The big players in China are still hesitant about Blockchain's security, and they need to figure out the risks that they might encounter while dealing with such digital assets[369]. For instance, if they lose access to their digital funds, are there any ways in which they could recover those? They used to have funds in private bank accounts, and blockchain proposes opting out of banks and other third parties.

Security and Stability come in at second. As conventional asset trading platforms, the blockchain-enabled ones are hugely volatile. One cannot be sure about tomorrow, if the platform used for trading, uses $200m of its value. Hence, businesses and individual entrepreneurs require a guarantee that those platforms operate with stable mechanisms which save them from abrupt profit losses[370]. Thirdly, regulations mainly reflecting the banks' attitude towards the blockchain. Generally, Chinese banks can be classified into two groups – the ones who are confident about blockchain and supporters of innovations, and the ones that are suspicious and resistant. The proper blockchain education might be the solution to this issue of the latter[371].

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[368] Anton Lashuk, *supra* 356.
[369] Id.
[370] Id.
[371] Darya Yafimava, China's new Blockchain Regulations, Feb 11, 2019, Blockchain Insights, Openledger, https://openledger.info/insights/china-blockchain-regulations/, last accessed on June 12, 2020.

Since, blockchain is still an emerging technology with a short history, scientists are brainstorming about how to categorize its concepts, like data assets, smart contracts, and others. From the above, it is clear that these Chinese companies are not in a dire need to move to the blockchain, but the Deloitte reports confirm the growing change and interest in this technology.

THE CANADIAN BLOCKCHAIN MODEL

The technology sector in Canada is rapidly expanding in the Blockchain genre. Deloitte in 2018 conducted a survey[372] targeting companies around the world with attention towards blockchain technology, and according to the results, 51% of those companies in Canada were currently investing in Blockchain. In comparison, the US joined the feat towards Blockchain adoption late, and hence only 24% of respondents in the US were investing in Blockchain technology.[373]

Canada is famed for its availability of high internet speeds, low energy costs, and favourable regulations, due to which many blockchain and cryptocurrency industries are attracted towards this country[374]. The mining process consumes a tremendous amount of energy, making it an appropriate and costly procedure, and the low energy rates in Canada makes it a favourable environment for blockchain. Moreover, mining rigs usually need a significant amount of energy for its functioning and are susceptible to overheating, and in terms of its cold climate in Canada, it is a bonus for mining as there is a static cold temperature there[375].

In the actual case scenario, Quebec, which is recognized as the Canadian mining centre holds a lot of indigenous features which are not seen anywhere in the world,

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[372] Ksenia Dobreva, *How soon will Blockchain be widely adopted?*, May 16, 2019, BLOCKCHAIN INSIGHTS, OPEN LEDGER, (May 16, 2020, 03:00 PM), https://openledger.info/insights/deloitte-blockchain-survey-2018.
[373] *Id.*
[374] Don Tapscott, *2018 Blockchain Regulation Roundtable – Addressing the regulatory challenges of Disruptive Innovation*, August 2018, BLOCKCHAIN RESEARCH INSTITUTE. (hereinafter referred as '*Blockchain Regulation Roundtable*)
[375] *Id.*

which includes the availability of surplus local energy (comparable to 100 Terawatt hours for ten years), in addition to low-cost electricity and high-speed internet.[376]

One of the essential members of Toronto-based Blockchain Research Institute (BRI), is the Enterprise Ethereum Alliance (EEA) which has been at the forefront of the blockchain's mass adoption worldwide. The BRI was created by Don and Alex Tapscott in Toronto in 2017 to address the present problems faced by blockchain. Since the introduction of BRI, it has come a long way to be a global think tank promoting several blockchain-based projects around the world[377]. The institute maintains its focus on the industries like telecom, technology, energy and power, resources and mining, financial services, government, manufacturing, media, healthcare and retail.

The BRI is hailed as the pioneers in the blockchain arena. Their proposal for reduced rates for blockchain startups to access the research has, in turn, led to substantial changes being made in the blockchain industry[378]. Canada is significantly focused on innovation over anything else, which is why blockchain is prospering in the country.

BLOCKCHAIN PROJECT OF BANK OF CANADA

The Bank of Canada, which is the central bank of the country, in 2017 joined hands with Payments Canada, the central payments processor, and R3, a distributed database technology company, to research on Project Jasper. This research targeted on blockchain solutions, which could improve the clearance and settlement of high-value inter-bank transactions[379]. The Bank of Canada published an extensive white paper, and among its key findings, the Canadian Central Bank took note of the potential cost savings which can be done through cutting down costs of reconciliation since, "Distributed Ledger-based system allows banks to evaluate their transactions at the initial stages. It could lessen back-office reconciliation work and potentially accomplish major cost savings for the commercial segment."

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[376] Ksenia Dobreva, *supra* 372.
[377] Blockchain Regulation Roundtable, *supra* 374.
[378] *Id.*
[379] Bryan Weinberg, *Why is Canada at the Forefront of the Blockchain Sector?*, Apr. 25, 2019, BLOCKCHAIN INSIGHTS, OPENLEDGER, (May 16, 2020, 03:30 PM) https://openledger.info/insights/blockchain-in-canada.

The Bank of Canada also highlighted in its report, the great advantage of using DLT technology on a broader scale which includes cross-border payments, and also emphasised on operational and technical efficiencies, in addition to cash and collaterals. The report also highlighted that using blockchain on a broader scale in banking would result in "improved and more efficient securities and monetary interactions between participants[380]," apart from reducing participant costs to evaluate and reconcile delivery in addition to consolidating and optimizing collateral requirements among interbank large-value payments.

REGULATIONS DEVELOPED WITH INNOVATION IN MIND

Canada understood the requirement for a regulation that suits the innovators rather than work against them. Lax regulations were introduced by the British Columbia Securities Commission (BCSC) for the blockchain and crypto industry to promote the mass adoption of blockchain technology[381]. The BCBS in 2017 incorporated blockchain-centred businesses in its regulatory sandbox to enhance the ability of businesses to use innovative products and services, and applications across Canada.

Presently, several tax incentives are offered to the startups in the blockchain segment of Canada, so that innovation could be further promoted in the region[382]. That also allows the developers in this sector to target significantly on innovation instead of regulation. Cryptocurrency and blockchain-centred businesses are entirely legalized in Canada, and there are also a variety of initiatives in Canada that back the blockchain research.

Aion's Development Platform: After the launch of Ethereum, there have been many blockchain products made from Canada, which are used worldwide. Aion, one among those products developed in 2015 by Matthew Spoke, a board member of Ethereum – the goal of Aion is to give an alternative to both Bitcoin and Ethereum

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[380] *Id.*

[381] *Id.*

[382] Bryan Weinberg, Why is Canada at the Forefront of the Blockchain Sector?, Apr. 25, 2019, BLOCKCHAIN INSIGHTS, OPENLEDGER, (May 16, 2020, 04:30 PM) https://openledger.info/insights/blockchain-in-canada/.

blockchains[383]. Though Aion is similar to Ethrerum, it dramatically differs from bitcoin as it in the form of a smart contract.

THE INNOVATIVE FUTURE IN CANADA

Because of the work put in by the Canadian government, Vitalik Buterin, Aion, and Ethereum, Canada is rapidly developing into a global hub for blockchain technology. The country boasts an ideal weather condition, electricity rates and regulations, all of which promote this innovative technology[384]. The BRI has also instigated innovation in Canada and is always working on 100+ projects simultaneously, where each of the projects has its roots to several industries, be it automotive, banking, or financial. The focus of Canda on innovation is what is making its rapid growth in the blockchain segment globally[385]. Canada is one of the favourite places for blockchain development, and it would surely enjoy the position in the coming future too.

BLOCKCHAIN FRAMEWORK IN THE EUROPEAN UNION

On May 25, 2018, the EU introduced the General Data Protection Regulation (GDPR) to regulate the citizens' rights for online privacy[386]. According to GDPR, persons and parties such as Facebook and Google are not permitted to gather users' data without their voluntary consent. Personal data, according to this legislation, includes anything that can recognize someone, for instance, name, location, ID, and the like. Also, if any person or entity decides to erase their profile or identity from a particular web platform, it has to be completely erased without any data of that person left behind.[387]

It has to be noted that parties and people should also follow the GDPR rules in countries outside the EU if they were to offer items for access (web platform/website) or purchase (online store and the like) to the citizens living in any of the EU geographical places. If any organization does not comply with the regulations

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[383] *Id.*
[384] Blockchain Regulation Roundtable, *supra* 374.
[385] *Id.*
[386] Ksenia Dobreva, *supra* 372.
[387] Ksenia Dobreva, *Blockchain and GDPR: Can they live under one Roof?*, May 23, 2019, BLOCKCHAIN INSIGHTS, OPEN LEDGER, (May 16, 2020, 04:30 PM), https://openledger.info/insights/blockchain-and-gdpr/.

established by GDPR, they can be awarded a penalty of 4% of its annual business or a flat fee of 20 million Euros.[388] These fines are in the form of a sliding scale and will depend on the extend of non-compliance.

THE GDPR AND BLOCKCHAIN CONUNDRUM

The Blockchain collects data in each transaction, and if that transaction has data that could be private, everyone who has permission to that blockchain could see that particular data, hence allowing those people to be identified either directly or indirectly[389]. The level of permission to the data depends on the type of blockchain network. Hence, in Permissionless (Public) Blockchains, the data can be accessed by everyone within the network; however, in Permissioned (Private) Blockchains, only a selected group of participants can access the data. In consortium blockchains, which are similar to the Permissioned/Private Blockchains, the participants could determine the extent of permission for each particular act in the network, (as it is done, for instance, in Hyperledger).[390]

EU citizens using blockchain soon realized that GDPR comes into the system and disturbs the technology. They understood that GDPR was not made to control the technology, but how the technology collects the data from its users, and those regulations are the reason why the blockchain users' life is complicated.[391] Besides, GDPR consent guidelines do not permit a 'Terms and conditions' agreement to be written and extended in a manner in which only lawyers could understand, instead of parties and people are entitled to get user consent in a readable form, clearly expressing their intentions. Consequently, the Commission Nationale de l'Informatique et des Libertés (CNIL) suggested the EU look into the GDPR through the perspective of its interaction with blockchain and examine what solutions could be potentially reached there.

For GDPR and Blockchain to coexist without conflicts, three things should happen:

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[388] Stefan Bayer, Janis Graubins, et al., *Blockchain and Cyber Security*, THE EUROPEAN UNION BLOCKCHAIN OBSERVATORY & FORUM, May 22, 2020.
[389] *Id.*
[390] *Id.*
[391] Ksenia Dobreva, *supra* 387.

- Firstly, the user should be able to swiftly examine through any type of data in the blockchain that could be utilized to identify the individual or a company on a blockchain solution[392].

- Secondly, after obtaining the user data, the Blockchain Company should be able to excerpt it and send it to that particular individual or company whose information is there on the blockchain ledger.

- Thirdly, if an individual wants the data in the blockchain to be eradicated, the company must erase all that data[393].

The points mentioned above make up to the pros of the likely compromise. However, there is a huge drawback, as it will be a requirement to redesign the blockchain technology finally. It hints towards giving the users a likelihood to erase their data, which is presently considered immutable in a blockchain, and that is in contradiction to the initial logic of blockchain being immutable[394].

Companies' compliance with GDPR: For a company to comply with the GDPR, primarily it requires the companies to review their online marketing and sales activity to confirm that they are not collecting any sort of personal data to remain compliant with GDPR norms. Secondly, the companies need to review the 'Terms and Conditions' to confirm that there are concise, and not too long or complicated or both. The companies need to simplify it and make it more user-friendly, which includes adopting user consent widgets and starting to offer an "opt-out" option for email marketing[395].

A solution to the Issues: The CNIL considers that a solution in collaboration with the European authorities is required for the blockchain challenge to comply with the "human rights and fundamental freedoms". Creation of a more streamlined GDPR application using blockchain technology is one of the solutions.[396] Recently, Slant proposed a solution to the GDPR, which has compliance with the data privacy regulations through their app 'the EOS Blockchain'. It permits both the company and

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[392] Ksenia Dobreva, *supra* 387.
[393] *Id.*
[394] Stefan, Janis et al., *supra* 388.
[395] *Id.*
[396] Ksenia Dobreva, *supra* 372.

the person to make the data that they store on their app private.[397] Presently, many organizations are working towards achieving a compromise between GDPR and Blockchain. For instance, LTO Network and POA Network decided to have a partnership with the motive to tackle the challenge by making a new public blockchain solution compliant with the GDPR.

If a company is located in the EU jurisdiction, it does not imply that blockchain technology cannot be used. For switching to the blockchain business model, one needs to determine whether a blockchain solution is required for the business, and if that person is convinced, then commence reviewing that business model to ensure that the GDPR guidelines are followed.[398] Finally, getting in touch with a company that specializes in blockchain solutions can help create a solution that is compliant with the GDPR.

INDIA'S BLOCKCHAIN FRAMEWORK

Blockchain comes with a variety of features which makes it favourable in the processes needing decentralized access, security, auditability, programmability and disintermediation. Some alternatives like the Distributed databases or Centralized databases which has distributed API grant could also solve some issues in processes at a decreased rate, but Blockchain is equipped with the potential to solve these issues simultaneously.[399]

Many frameworks were put forward in recent times to check the applicability of blockchain-based solution, and the framework suggested by the World Economic Forum (WEF) was found to be most natural. The potential business features of blockchain solutions are categorized into Improving profitability and quality, Increasing transparency, and Reinventing products and processes.

Table 1: Possible business features of blockchain solutions.

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[397] Id.
[398] Stefan, Janis et al., *supra* 388.
[399] *Blockchain: The India Strategy – Towards Enabling Ease of Business, Ease of Living, and Ease of Governance*, Part I, January 2020, NITI AAYOG. (May 18, 2020, 03:00 PM), https://niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_Strategy_Part_I.pdf.

Improving quality and profitability	• Automation using algorithms/smart contracts • All historical transactions can be traced • Increased efficiency and speed of transactions by cutting intermediaries • Enhanced protection by encryption of data at the stage of dissemination • Prevents tampering of data as any tampering acts may leave a trail behind
Increase in Transparency	• Distributed Ledger • Provides a complete picture: all stakeholders can see the same information to which they have permission • Availability of multiple copies of the shared data
Reinventing products and procedures	• Clear and predefined rules which facilitate the formation of new products/procedures through a decentralized model • Tokenization or Digital Assets which are physical objects with an exclusive digital representation that enables digital ownership, management and transfer.

Source: NITI Aayog

THE BLOCKCHAIN USE-CASE SELECTION FRAMEWORK

1. <u>Need to reduce intermediaries:</u> The primary requirement for a blockchain-based solution to be suitable is the need for decreasing the intermediaries (brokers/entities/processes) and the like.[400] However, if it is faster, cheaper, and more efficient to communicate directly with the counterparties, for instance, forward transactions among trusted parties in commercial markets, blockchain solutions are not suited. However, it will be useful in cases where there is a known rationale for decreasing intermediaries.

Blockchain solutions will not strictly lead to disintermediation[401], i.e., not the removal of intermediaries, but the reduction of intermediaries. Most of the possible use cases for blockchain would be permissioned blockchain, instead of public ones. Bitcoins, which are public blockchains do not have any centralised authority and are considered as enablers of 'Total disruptive

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[400] Blockchain: The India Strategy, *supra* 399.
[401] *Id.*

disintermediation'.[402] The Permissioned blockchains are put up on private computing networks, with restricted permission and editing rights, i.e., there are also central authorities with administrator rights[403]. However, the parties can initiate peer-to-peer transactions without the regulation of a centralized authority, once they are permitted into the permissioned network.

2. <u>Multi-stakeholder environment</u>: Blockchain-based solutions can perform the role of a source of trust, in addition to auditability and transparency, and are thus, apt for the procedure flows with multiple entities.[404]

3. <u>Digitally native assets</u>: In order to apply the blockchain solutions successfully, there is a requirement for assets which could be represented successfully in a digital format. If an asset were to have a physical representation that can shift its form, then it is challenging to track and effectively manage that asset on the blockchain.[405] For instance, the tracking and tracing of wheat across the complete supply chain as it changes from wheat to flour, to bread is challenging to be plotted and recorded in a blockchain. In other cases, like the fertilizers, which are also physical assets, the digital representation is accomplished through sales invoices and challans.

4. <u>Permanent and authoritative proof of record</u>: Immutability is one of the prime features of Blockchain and consensus cannot be achieved on the condition of the object or transaction through trusted sources[406], i.e., in the case of disputed land records, a proper block representation of that object/transaction is not feasible.

5. <u>Share write access</u>: If multiple entries from multiple parties are not needed to update the records, a centralized repository which has multiple real-time read-only instances is more practical than a blockchain-based solution.

6. <u>Low transaction value</u>: Despite the late technological advances, blockchain technology is still choked with limited processing power, which restricts itself from performing numerous transactions simultaneously.[407] For instance, the widely used blockchain platform, Ethereum is still struggling to touch the benchmark of 3000 transactions per second from the present stage of a couple of

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[402] *Id.*
[403] Asset Finance International
[404] Blockchain Regulation Roundtable, *supra* 374.
[405] Blockchain: The India Strategy, *supra* 399.
[406] *Id.*
[407] *Id.*

hundred transactions per second. In comparison, real-time payments like Visa is capable of processing more than 50,000 transactions per second. Even though permissioned blockchains are capable of handling larger volumes of transactions than public blockchains, the limitations of processing time persist.

7. <u>Non-transactional data</u>: Blockchain solutions should not be viewed as an alternative to databases and should not be utilized for storing proprietary or private information, as it is best suited for transaction records.

8. <u>Reliance on trusted third-parties</u>: If a particular process has specific requirements on the usage of trusted partners or intermediaries or regulators, blockchain deployment might become complicated.[408] It might become necessary in such cases to include regulators and the like in the projects and provide how the regulators can guarantee compliance with the laws.

9. <u>Controlling functionality</u>: If there is a desire to have the ability to alter the functionality on a blockchain (distribution, node, permissioning, engagement rules) without holding a detailed discussion across the full open-source forums for blockchain, then a permissioned blockchain is better for that purpose.

BLOCKCHAIN – THE INDIA IMPERATIVE

A peculiar strategy is employed by the Indian Government to become the front runner in developing public digital infrastructure and permitting private sector innovation to influence it for further development. During the past decade, India successfully made foundational digital infrastructure envisioned to allow private sector applications to run atop it, similar to the government building roads and sewage infrastructure in a place and the private companies construct buildings.[409] India has developed a unique model of foundational digital infrastructure which includes Aadhaar, Unified Payments Interface (UPI), e-Sign and Digilocker along with digitally empowered tax governance networks like GSTN or digitally authorized health coverage such as Pradhan Mantri Jan Arogya Yojana (PM-JAY).

Table 2: India's Digital Foundational Infrastructures

Aadhar	• World's largest identity database with more than 1.2bn biometric identities.

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[408] Blockchain: The India Strategy, *supra* 399.
[409] *Id.*

	• More than 25 million authentications per day
Unified Payments Interface (UPI)	• World's most sophisticated digital payments system • 1.3bn transactions processed in December 2019
Goods and Services Tax Network (GSTN)	• More than 400 million returns filed • More than 800 million invoices uploaded
PM-JAY	• World's largest healthcare initiative with ~500 million beneficiaries covered • ~119 million e-cards issued so far, ~8 million hospital admissions

Source: NITI Aayog

In an Indian use case scenario, blockchain solutions are both properly fitted for addressing various challenges and would also profit from the infrastructure already created.[410] The benefits for using Blockchain solutions in India would incorporate better contractual management and attainment, decentralization of authority in making decisions, and broader accountability and quality control across supply chains. For instance, blockchain applications can be used to verify certification of the origin of organic produce, thereby increasing their marketability in foreign markets.

From an execution perspective, a blockchain-based technology stack needs incorporation with an identity platform and an incentive platform or mechanism.[411] India has already proven its capability through Aadhaar and UPI. It, therefore, has an inherent benefit in going after blockchain solutions in the commercial scale, compared to other countries who struggle to find a good proxy for identity and need to make sure the sanctity of crypto assets.

BLOCKCHAIN INITIATIVE IN TAMIL NADU – NAMBIKKAL INAIYAM

Tamil Nadu is one of those states in India, who aims to create and sustain a state-wide infrastructure based on Blockchain which could be connected with all Government departments and agencies, public sector undertakings and others. Recently, Tamil Nadu has also rolled out the Tamil Nadu Blockchain Policy, 2020 among other policies in AI and Cyber Security.[412] They have also set up Centers of Excellence in various technologies including Blockchain to further develop technologies for better governance.

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[410] Blockchain: The India Strategy, *supra* 399.

[411] *Id.*

[412] Tamil Nadu e-Governance Agency, *Blockchain Backbone,* (June 6, 2020, 06:00 PM), https://tnega.tn.gov.in/page/36

The State of Tamil Nadu will select qualifying parties after strict scrutiny to build an efficient, transparent, and secure citizen-oriented and inter-organizational work environment. Both Government2Government and Government2Citizen, enterprise-grade products and services would be developed using the Blockchain infrastructure. In addition, it would also be used to enhance existing platform in legacy and IT by providing an immutable ledger with zero down-time and hash-encryption. In the subsequent stages, it is aimed to offer modules and processes to the government workflows to make them more efficient, secure and efficient. It would also empower the government services to be more reliable and significantly reduces the chances of tampering. The State plans to develop a single platform that can be used creating and distributing Blockchain applications among all the government departments in the State.[413]

The State has named the initiative as 'Nambikkai Inaiyam' (NI) which means 'Trust Link' in Tamil. The platform would boast of a hybrid infrastructure. The nodes in the network could either be on a private cloud or a State SCS or on-premise.[414] This infrastructure would also function as BAAS provider to the Public sector organizations and Government departments, companies and agencies. Moreover, the organization which do not wish to host a node could also access the Blockchain through an API Gateway. The NI would include an encrypted infrastructure consisting of various Blockchain cores, client API gateways, and a business logic layer.[415]

CONCLUSION

Blockchain technology has evolved to grow into a potentially transformative force in various aspects of the government, and private sector works. Its potential has been widely acclaimed across the globe, with international organizations and technology companies from different genres highlighting the benefits of its application in decreasing the operational costs and compliance, as well as in improving efficiencies. Although the technical foundations of the technology can be menacing to a significant section of policy and decision-makers – both functionally and simply, blockchain can

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[413] *Id.*
[414] *Id.*
[415] *Id.*

permit ease of collaboration for the enterprises, and ease of living for the country's citizens by upbringing transparency across the government and private sectors.

The real potential of the technology is still left unexplored, and it is still in a nascent stage of development, and broader applications of blockchain could be seen as it continues to evolve. It is equally crucial for the regulators, policymakers, industry and citizens to have a clear understanding of the functional definition and capabilities of the entire suite of blockchain or DLTs along with regulatory and legal issues and other implementation requirements.[416] It also has to be noted that the technology might not be universally efficient in all aspects and hence, particular use cases have to be identified to find where the technology adds value and where it does not.

Though India is far behind countries like Canada in coming up with a use-case using blockchain, one cannot disregard the fact that in the past two years Blockchain has been getting recognition in some of the states in India. Telangana and Andra Pradesh were the front runners in developing Blockchain-related applications, and the recent verdict from the Hon'ble Supreme Court branding the ban of cryptocurrency as unconstitutional and the RBI altering its previous stand to recognize Distributed Ledger Technology as a viable alternative comes certainly as a boost to the developers and regulators of blockchain. The critical aspect of working with Blockchain is to have a harmony with the existing regulations of the country and tune the applications accordingly emphasizing permissioned blockchains.

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[416] *Id.*

CHAPTER VI

CONCLUSION AND SUGGESTIONS – THE FUTURE OF BLOCKCHAIN REGULATION AND GOVERNANCE

INTRODUCTION

The game-changing technology of Blockchain is as disruptive a revolution to money as the Internet was to concepts, and the governments cared a lot about both the currencies. The authoritarian governments acted quickly to arrest the Internet with stringent norms and regulations, using the same technology to promote the party line, censor and curb free speech, and be watchful on the dissidents. However, the democratic governments moved in the opposite direction. They released the ownership laws for broadcasting, digital media, and the print press to the extent that the power over communications channels has concentrated under a bunch of oligarchs who now control the Western parts and also exert their growing influence over policymaking.

The continuous pressure of such extremes has had a disturbing effect on privacy and the truth. Its citizens no longer trusted governments, consumers did not trust their corporations, politicians raising doubts about scientific evidence, and their voters are ill-prepared or ill-equipped to distinguish between fact and fiction for themselves.[417] To this pile of communications protocols, blockchain adds a transaction layer of value, which is already disrupting capital markets and banking applications. The founding innovators of the Internet created it based on free and transparent nature, but in effect, it is the exact contradiction to their original views, and Blockchain cannot be left alone to suffer the same outcome as that of the Internet. It all depends on what the innovators do with Blockchain, i.e., what they do now with blockchain, in terms of writing regulations concerning human rights and other values make right the unintended wrong of Internet regulations.[418]

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[417] Blockchain Regulation Roundtable, *supra* 374.
[418] *Id.*

Blockchain knows no jurisdictional hindrances like the atmosphere.[419] After six years of technological gestation amid cryptographers; computer scientists, software, and blockchain developers gathered the attention of four groups:

- law enforcement that used it to track down crime on the Dark Web,

- venture capitalists who recognized its genius,

- regulators who aimed at preventing investment fraud (for instance, initial coin offerors who disappeared with the funds), and

- financial intermediaries who took its disruptiveness seriously.[420]

The regulatory response ranged from China's ban on ICOs to laissez-faire in South Korea.[421] The regulatory response ranged from China's ban on ICOs to laissez-faire in South Korea. Joel Telpner, a Blockchain Research Institute fellow, said that those people who believe that blockchain is beyond regulatory reach should rethink, as should those who think that self-regulation is the only way forward.[422] The key lies in understanding the middle ground. The reality is that there are aspects of blockchain and its applications which should be regulated, and some other aspects which should not be regulated. Regulations were always outpaced by innovation, and the development of blockchain is happening at a rate well over the ability of regulators to respond, in several ways mirroring the development of the Internet, but with two critical differences:

- The pace of Rollout: Internet advanced and developed at the speed of sound. However, blockchain technology is evolving at around the speed of light.[423]

- Potential impact: Internet changed how we manage information. Nevertheless, Blockchain alters how we make and manage the value, which includes the value of everything we value, from money, bonds, and stock, to

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[419] *Id.*

[420] Jason Weinstein, *How Can Law Enforcement Leverage the Blockchain in Investigations?*, COINCENTER.ORG, COIN CENTER, May 12 2015, (May 18, 2020, 04:00 PM) coincenter.org/entry/how-can-law-enforcement-leverage-the-blockchain-in-investigations; See also Gareth Jenkinson, *Unpacking the Five Biggest Cryptocurrency Scams," Cointelegraph, Cointelegraph*, Apr. 18 2018, (May 18, 2020, 04:00 PM) cointelegraph.com/news/unpacking-the-5-biggest-cryptocurrency-scams.

[421] Samuel Haig, *Regulatory Round-Up: South Korea Says Laissez Faire, Zimbabwe Dislikes and Singapore to Regulate*, BITCOIN NEWS, BITCOIN.COM, SAINT BITTS LLC, Nov. 24 2017, (May 18, 2020, 04:00 PM) news.bitcoin.com/regulatory-round-up-south-korea-says-laissez-faire-zimbabwe-dislikes-and-singapore-to-regulate.

[422] Joel Telpner, *The Lion, the Unicorn, and the Crown*, White Paper, foreword by Don Tapscott, BLOCKCHAIN RESEARCH INSTITUTE, THE TAPSCOTT GROUP, May 2018.

[423] *Id.*

music, art, votes, and even our identities. It might radically change our institutions and the economy.[424]

The principal element of blockchain is its unpredictability nature in both its developmental track and technological progeny. It is oblivious to jurisdictional boundaries, and it already spans every nook and corner of the world with the capability to pierce into every aspect of our life, both clearly and imperceptibly. It is a severe challenge to regulate under such uncertainty. There is no doubt that the Internet is entering into its second era based on this nascent technology, and there is no going back. The alluring force of blockchain in motivating entrepreneurship, stimulating an innovation economy, and producing prosperity for all is meeting the usually immovable object of the law and its agents in protecting investors, steadying capital markets, and conserving human rights. It is, by far, undoubtedly, the most challenging time to be a regulator.

In contrast to the Internet's first era – the Internet of information, today's Internet of Value deals with assets such as land, money and other financial instruments, intellectual property, the identities of people and things, cultural artefacts like music, art and literature and even scientific findings. The Internet of Value additionally allows various types of assets to be stored, managed and transacted securely. Consequently, society has a massive interest in checking that governments develop appropriate policies, legislation, and enforcement mechanisms. Blockchain empowers better ways of attaining financing and capital investment for people conventionally excluded from the process. Citizens of many countries will be able to establish digital identities, take part in wealth creation, and experience decreased social disillusionment. Blockchain and crypto-economics could make opportunities and encourage innovation.[425]

Many people during the Internet's early development, urged the governments to leave Blockchain technology and not to implement any regulations to mould or control it. However, government bodies in the democratic countries became interested in implementing these policies around intellectual property, privacy, and other social concerns. Governments in the totalitarian countries censored the Internet and utilized it to spy on its citizens or control society.

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[424] *Id.*
[425] Blockchain Regulation Roundtable, *supra* 374.

BLOCKCHAIN GOVERNANCE

The governments besides shouldering the entire regulatory burden also have a significant role in forming principles that drive the approach of all participants in the capital and other markets which are not implemented primarily by regulators but by a vast self-organizing ecosystem of stakeholders driven by collective interest and applying blockchain-based solutions. Stakeholders in the platform could codify their common ground employing standards networks, respect the members' interests and constraints through advocacy networks, help check that nobody does any harm through watchdog networks. Besides, they can invite stakeholders with radically different views of what needs to be done through networked institutions like the WEF, participate in policy debates and coordinate regulation through policy networks[426], get up to race through knowledge networks, and build necessary market infrastructures through operational networks.

A regulatory system such as above could respond swiftly respond to innovation with a lighter touch and deal with numerous complexities of the countless new participants in blockchain-enabled markets because a broader ecosystem could step up to safeguard market functioning and participant interaction. Transparency can act as a better disinfectant rather than as government enforcement. Moreover, this ecosystem could use blockchain itself to help oversee the process. Although it might seem a bit utopian, it is not so. We already utilize multi-stakeholder networks to regulate the Internet today. There will be people who try to flout the system, and in those cases, the governments should take action as a last resort. Those concerns are more likely 'implementation challenges' rather than 'reason why blockchain is a bad idea.'

Since the second era of the Internet is based on Blockchain, the innovators could develop and actively address a positive government intervention. This new Blockchain-infused platform enables management, storing, and transaction of assets (objects of value for which the society has a genuine interest). The disruptions would be more significant this time around as well, incorporating disruptions to the markets

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[426] Vivian Yang, *Blockchain: The Next Generation of the Internet*, Press Release, WORLD ECONOMIC FORUM, June 28 2017, (May 20, 2020, 04:00 PM), www.weforum.org/press/2017/06/blockchain-the-next-generation-of-the-internet.

and industries that manage many valuable assets – especially capital markets and financial markets and the need for a proper regulation is crucial.

However, as Blockchain revolution unfolds, the regulators would have the wisdom to avoid the chainsaw when microsurgery could perform much better. In the movement of excitement, lawlessness is challenging, and several investors and consumers might also get hurt as well. Nevertheless, the path forward should balance the priorities of regulators to uphold the law, maintain the integrity of capital markets, and allow innovation to flourish. In order for that to happen, the industry should alter its perspective from narrowly defined regulation to a broader concept of governance.

Many blockchain enthusiasts would recoil a the notion of governance over and above what they have written in code. Governance can be delivered by governments, in part. However, the stewardship of the Internet's second era and its impact on capital markets would only be effective when all stakeholders come together and evolve a genuine understanding of their common interests. It is not an impossible task. As Pindar Wong, one of the Blockchain Research Institute's collaborators, said, "Just because, you are decentralized does not mean you need to be disorganized."[427]

Blockchain technology holds the potential to revamp interaction between the governments, businesses and citizens in a manner that was incomprehensible a decade ago. Blockchain technology is often categorized with technologies such as Artificial Intelligence or the Internet of Things; however, the technology is peculiar in its foundational nature. Contrary to other technologies, which can deliver entirely new services to citizens and other stakeholders alike, blockchain can revolutionize the current processes to unlock new sources of efficiency and value.

India faces unique challenges in governance corresponding to the scale, complexity, and diversity of processes involved in the delivery of varied public services. Blockchain presents exclusive possibilities for addressing the concerns relating to improving governance. By permitting 'self-regulation' in business, India can extensively move towards improving the 'Ease of Doing Business' by allowing individuals and organizations to interact through a trusted medium with a decreased dependency on complicated regulatory oversight and compliance. Blockchain would

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[427] Pindar Wong, interviewed via telephone by Don Tapscott, 7 April 2017.

also help in improving the 'Ease of Living' by empowering citizens through the features of decentralization, transparency, and accountability.

When it comes to blockchain and its Wild West nature, we need to think hard about governance. We have many reasons to get the right regulation balance. For one, a clear, stable, and open regulatory environment will attract entrepreneurship and capital. In turn, it will enable economic growth, stimulate innovation, and create jobs throughout a national economy.

BUILDING AN ENTERPRISE-READY BLOCKCHAIN

Though many pilot studies are going on parallelly, several challenges have to be completed before DLT can be deemed to be an enterprise and production-ready. The top technical concerns amongst them include security, privacy and scalability, and these should be adequately addressed, however regulatory and legal feasibility are also significant hurdles to be surpassed before the adoption of this technology. Blockchain technology, in all its forms, is evolving at a rapid pace. Concerns that remained obstinate a while ago, like low transactions-per-second compared to other technologies that are being used are slowly starting to get resolved. The industry has come together on the desire to have permissioned, rather than public ledgers, has opened the door for new, improved, consensus algorithms, and the thoughts of reaching hundreds or thousands of transactions-per-second are on the horizon.

There are other challenges like harmonizing privacy, security and regulatory transparency that remains. Over the years, there have been several privacy solutions that were put forward, and until now, no solution has emerged as a clear winner. As the late exploitation of smart contract trials in the public sphere has demonstrated, there is a rising need to form robust security audit techniques and developer best practices for blockchain systems which have to be at par with the other enterprise systems in place before going into the market.

It is also promising to note that the legal experts and regulators are getting more involved in earnest, publishing papers and issuing calls for comment. Though a good majority of them are yet to formally comment on the topics like legal enforceability and digital property rights, industry consortia are providing a platform to discuss such topics collectively. There is much work still left to be done to bridge the gap between

PoC and real-world production systems, but we could hope that the combined efforts of technologists, business stakeholders and other governing bodies could drive the issues to resolution. The most difficult challenge of all would be maintaining motivation and the industry focusing on bringing workable solutions to market along with the evolution in technology.

SUGGESTIONS

1. Selecting the right Use cases for Blockchain implementation: In the initial stages of development, any transformative technology, as it gradually steps out of research or the development phase to the first few applications to large scale deployment are faced with several challenges. One of the main aspects of that problem is that such technologies are initially intended to solve a specific set of problems. Bitcoin, which introduced its underlying technology of Blockchain, was initially intended to develop a peer-to-peer electronic cash system which could solve the double-spending problem without being dependent on trusted intermediaries. However, some original design features of Bitcoin, like the limited supply and pseudonymity later become potential challenges in the full-scale implementation of Blockchain. The success rate of the initial use-cases of blockchain plays a hefty role in bringing the technology out of its research silo. Hence, it is crucial to find out the best viable use-cases for a State.

2. Ensuring that the data going in is 'Dispute-free': It is necessary to create a single source of truth to agree with its 'immutable' nature before a process is put on a blockchain. In order to keep the purity of the blockchain network, and curb retrospective changes to blocks, the business data at the time of blockchain implementation has to be the single source of truth. The unit governing the record-keeping of land records has to ensure that all instances of the records are dispute free. Proper land titling has been a common issue around the globe, especially in India, leading to a lack of large scale initiative globally, although this has been an intuitive use case of blockchain.

3. A shared view of success potential needs to be defined: Blockchain requires the asset being tracked to be represented digitally. For the

development of a viable blockchain use case, there is a requirement to change the traditional process of blockchain before being deployed, which might feel like the whole procedure is time-consuming and costlier than before thereby making the involved stakeholders reluctant to participate. For instance, in the blockchain application for 'track and trace' of pharmaceutical drugs, there is a need to introduce QR code or Bar code and the stakeholders were required to scan these codes at each stage of transfer so that a digital record is created. In order to obviate this challenge, it should be made clear to the stakeholders about potential cost savings due to the blockchain in the long run.

4. <u>Integration with legacy systems must be at the forefront of technical design choice</u>: The integration with existing and usually complex legacy systems would be pivotal for the large corporations, as the technology comes out of the research phase. Most use cases tend to be limited to a specific part of business, as corporations find it hard to figure out their blockchain strategy, and even public blockchain use cases found it troublesome to integrate information coming from external systems (called Oracles) in a trusted manner. However, given the predominance of such legacy systems like the national IDs, payment systems, weather, among others, in the current economy, it is crucial for blockchain systems to develop the capability to integrate with legacy systems.

5. <u>Legal and regulatory modifications are vital to enable deployment of blockchain at scale in the Public and Private sectors</u>:Traditionally, to fill the void of trusted digital means of executing transactions, checks and balances were deployed in the form of certifications or physical verification or presence attestation. For instance, during the procedure for transfer of land, the registration of sale deeds at the registrar requires the physical presence of witnesses to verify that the transactions are genuine. Blockchains, alternatively offer a means to carry out these processes in a manner that would exclude the need for such cumbersome processes allowing the witnesses to verify transactions, electronically on a blockchain. It would straightaway cut off the need for physical presence and ease the process while maintaining the means of establishing that transactions are genuine. Among others, modification or easing of existing regulations to examine the potential benefits of blockchain, either by way of 'sandboxes' or otherwise.

6. <u>Promoting this technology through channelled initiatives and International exchanges</u>: A country like India is one of the best places to initiate a pilot study, considering the complex problems it encounters and the intricacy of the regulations to be included in the code. Even so, numerous countries have successfully implemented blockchain applications and learning from them is the best way to improve our development in this arena. Estonia, one of the leaders in Blockchain governance have kept their doors open for anyone to come and learn about their achievements in Blockchain. There are also scattered initiatives from some Indian states to explore the viable applications of this technology widely, but in a vast country like India, one should hope for more pooling of resources and channel their works in a suitable direction to get the best possible outcome.

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APPENDIX

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Allen P Alex 12 Oct

by Athira P S

General metrics

66,315	9,767	527	39 min 4 sec	1 hr 15 min
characters	words	sentences	reading time	speaking time

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