Blockchains: Regulating the Unknown

*By Michèle Finck**

Abstract

This Article, which takes into account developments up until summer 2017, evaluates the early days of regulatory engagement with blockchain technology. My analysis unfolds in three parts. First, I provide a cursory overview of the technology itself to highlight considerable uncertainties concerning its future. Regulators asked to engage with distributed ledgers are thus compelled to regulate the unknown. Second, I will introduce a typology of regulatory strategies adopted to date and highlight their respective advantages and shortcomings. Third, I will outline a number of guiding principles regulators should follow in respect of blockchain technology. I will make the argument that despite the technology's uncertain future, early regulatory engagement is warranted as a young technology is a malleable technology. As technology develops, law has to adapt. As a consequence, I put forward a number of regulatory techniques, including a process of polycentric co-regulation that relies on the regulatory potential of (blockchain) software and the adoption of a so-called "28th regime" at the EU level which may help navigate the uncertainties of blockchain development and regulation.

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A. Introduction

"Blockchain" is the word on the street in the technology and business worlds right now.[1] It first emerged as the technology enabling the emergence of the Bitcoin cryptocurrency but has since acquired independent significance as developers around the globe rely on the tool to create a wide range of applications. Termed the "new Internet" or "the Internet of value," blockchain promises to anchor innovative solutions in multiple domains of business and life.[2] The technology remains in its very early stages of development and there can be no doubt that many of the current blockchain projects and start-ups are eventually doomed to fail.[3] There is moreover no way of knowing whether the technology itself, which suffers from considerable limitations, will be able to mature to a degree enabling these applications. Many are however certain that blockchain technology and its transformative influences are here to stay. With that development, many questions—which are to be approached from an interdisciplinary perspective—emerge. For lawyers, the challenge consists of identifying the legal, policy, and strategic implications of blockchain technology. Many of these aspects will crystallize as the technology and its use cases continue to unfold. Its precise future cannot be predicted so that policy-makers are essentially asked to regulate uncertainty. It is nonetheless not premature to map the regulatory and governance challenges that have already emerged and ponder possible solutions. This is particularly so as this an in and of itself neutral technology that will not however be used in a neutral manner. Rather, distributed ledgers can be used for good and malicious ends.

This is the task which this Article addresses. This Article will briefly introduce the technology and current projects before presenting a typology of regulatory approaches that have been adopted to date.[4] Drawing on early experience and past instances of technological innovation, the Article suggests that regulatory debates ought to accompany the technology from its early stages. While regulators must be careful not to stifle innovation nor repeat some of the mistakes of Internet governance, regulation amounts to a tool providing certainty for those involved in blockchain development. This can ultimately benefit, rather than restrict, innovation.

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[1] Blockchain technology is sometimes also referred to as Distributed Ledger Technology or Shared Ledger Technology. While these notions remain in flux and some consider them to designate different forms of technology, I will refer to them interchangeably for the sake of simplicity.

[2] Amy Cortese, *Blockchain Technology Ushers in "The Internet of Value"*, Cisco (Feb. 10, 2016), https://newsroom.cisco.com/feature-content?articleId=1741667.

[3] More generally, this is true of a large majority of start-ups, which does not, however, have to be seen as a negative score given that even unsuccessful start-ups give rise to a healthy ecosystem and train talent that can ultimately join or launch successful projects.

[4] Where not otherwise specified, the term regulators is used generically to refer to any law-makers and regulators across jurisdictions, whether they operate a transnational, supranational, national, or subnational level.

Blockchain, while itself presenting the capacity to regulate self and others, also hinges on a stable regulatory framework. The development of blockchain technology will in no small part depend on the regulatory framework within which it occurs. This is not to say, however, that a heavy regulatory hand ought to regulate the technology in every detail. Rather, flexible and open approaches are needed. Indeed, as technology develops, so must law.[5] With this in mind, I suggest that a co-regulatory approach accounting for the specificities of the technology should be deployed to create the certainty and stability needed to sophisticate and mature blockchains while respecting the public interest objectives regulators are designed to safeguard. This will hopefully provide guidance to those concerned with blockchain regulation, but also more broadly stimulate debate on the relationship between law and technological innovation. As we live in an age where new applications emerge with increased frequency and pace, this question is indeed one of general application.

The arguments outlined above will unfold in several parts. First, I introduce blockchain technology, including key concepts and terminology. Second, I shall explore the implications of this wave of technological development in introducing possible use cases. Third, I note that regulators ought to be involved from the early stages of blockchain development. Finally, these observations will lead me to conclude that early-stage regulatory discussions are necessary to accompany blockchains' development as they provide legal certainty for innovators and early adopters and allow for public interest objectives to be protected. In light of the fast pace of development in these areas it should be noted that this article takes into account developments up until summer 2017. Its aim is to provide a starting point for further analysis and discussion rather than comprehensive analysis.[6]

B. Blockchain Technology—A Primer

This Section provides a very cursory overview of blockchain technology in order to ground further analysis. In this context, we should bear in mind that the technology itself, as well as the terminology relied on to describe it, remain in flux.[7] In essence, a blockchain is a distributed digital ledger that uses cryptographic algorithms to verify the creation or transfer of digital records in a distributed network. It has also been defined as a "distributed, shared, encrypted-database that serves as an irreversible and incorruptible public repository of

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[5] For a more detailed account, see MICHÈLE FINCK, BLOCKCHAIN REGULATION AND GOVERNANCE IN EUROPE (forthcoming, Cambridge University Press 2018).

[6] A much more detailed engagement with these themes is provided in MICHÈLE FINCK, BLOCKCHAIN REGULATION AND GOVERNANCE IN EUROPE (forthcoming, Cambridge University Press 2018).

[7] For instance, it remains unsettled whether a blockchain is the same as a distributed ledger. On this, see further Angela Walch, *The Path of the Blockchain Lexicon (and the Law)*, 36 REV. OF BANKING AND FIN. L. (forthcoming), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2940335 [hereafter "Walch, *The Path of the Blockchain Lexicon*"] (noting that a lack of settled terminology burdens discussions between regulators and industry as well as between jurisdictions).

information."[8] Although a blockchain is frequently described as immutable, it is important to bear in mind that this is merely the case to the extent that its human creators decide not to intervene.[9] Blockchain gets its name from the fact that it constitutes a record of all transactions grouped into blocks that form a chain. The creation of this chain of blocks occurs through consensus algorithms that diverge depending on the blockchain at issue. The ledger's integrity is maintained through "consensus" reached by the participants.[10] Blockchains are complex systems, enabled by the combination of distributed computer networks, cryptography, and game theory, or "cryptoeconomics."

It is important to distinguish between blockchains and cryptocurrency. Blockchain first emerged as the technology enabling the peer-to-peer digital cash Bitcoin, which explains why blockchain and cryptocurrency are often taken as synonymous although they are not.[11] While blockchain has rendered Bitcoin possible, it has since been relied on by innovators to enable manifold other applications.[12] These applications rely on the central feature of blockchain technology, which is the capacity to provide "a distributed yet provably accurate record."[13] Blockchains thus decentralize data storing and information-management. While this at first sounds somewhat dry and unspectacular, blockchains could be a far-reaching innovation. Previously it was not possible to coordinate Internet activity without an intermediary. It is for this reason that much of our online—and offline—activity passes through intermediaries rather than being realized in a peer-to-peer fashion. Blockchain allows for value—including cryptocurrencies—to be traded between two parties without the involvement or approval of any other party.

Information and assets stored on a blockchain can be securely maintained cryptographically through keys and signatures that determine who can do what with the shared ledger. Termed the "Internet of value," some predict that soon "we will perform the equivalent of "googling" to verify records, identities, authenticity, rights, work done, titles, contracts, and other valuable asset-related processes."[14] Blockchains' tamper-proof nature births a new

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[8] Aaron Wright & Primavera De Filippi, *Decentralized Blockchain Technology and the Rise of Lex Cryptographia*, 1, 2 (2015) [hereafter "De Filippi & Wright, *Lex Cryptographia*"].

[9] *See* Walch, *The Path of the Blockchain Lexicon*, *supra* note 7, at 16.

[10] Consensus remains an unstable and evolving characteristic of blockchains with various blockchains relying on divergent mechanisms that each have advantages and disadvantages.

[11] *See generally* Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System,* https://bitcoin.org/bitcoin.pdf.

[12] For an overview of early applications of the technology, see *infra* Section *I.* below.

[13] Kevin Werbach, *Trust but Verify: Why the Blockchain Needs the Law*, Berkeley Tech. L.J. 1, 4 (forthcoming 2018).

[14] William Mougayar, The Business Blockchain xxiv (Wiley ed., 2016).

form of trust.[15] Functionally, the mechanism has the capacity to embed trust into cryptographic systems as it generates a singular trusted state without the need for trusted actors. "Trustless trust" makes it possible to "trust the outputs of a system without trusting any actor within it."[16] The set-up of blockchain allows actors to trust the technology, which dispenses from the need to trust human counterparties or institutions.[17] This novel variant of trust allows individuals, companies, and machines to interact directly without the need for third parties. While these entities may not trust another, trust in the blockchain is sufficient to allow them to interact. This is important as it underlines that trust doesn't disappear – it is placed in code and those that develop it instead of counterparties and institutions. The value of trustless trust can be observed in the context of the Internet of Things. Here, blockchains could maintain a growing set of records without the need for a vulnerable master record and can be considered as the missing link between reliability, efficiency, security, and privacy in respect of the network of billions of smart devices that will emerge in the coming years.[18]

Blockchains also support cryptoassets. While this is not the focus of the present analysis, they cannot be ignored when studying this technological phenomenon. Bitcoin emerged as the first digital currency, but we have since witnessed the emergence of additional digital currencies and the splitting of Bitcoin into distinct currencies.[19] Stanford economist Susan Athey has noted that digital currencies can "potentially expand international commerce, support financial inclusion, and transform how we shop, save, and do business in ways we probably cannot yet fully understand."[20] The Ethereum blockchain has enabled the emergence of cryptographic tokens, which can represent anything including property.[21] Their legal status remains undefined in many jurisdictions although the U.S. Securities and

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[15] *See The Trust Machine: The Promise of the Blockchain*, The Economist (Oct. 31, 2015) https://www.economist.com/news/leaders/21677198-technology-behind-bitcoin-could-transform-how-economy-works-trust-machine.

[16] Kevin D. Werbach, *Trustless Trust* 5 (2016).

[17] For the origins of the expression, see Reid Hoffman, *The Future of the Bitcoin Ecosystem and "Trustless Trust"—Why I Invested in Blockstream,* LinkedIn (Nov. 17, 2014), https://www.linkedin.com/pulse/20141117154558-1213-the-future-of-the-bitcoin-ecosystem-and-trustless-trust-why-i-invested-in-blockstream. *See also* Werbach, *Trust but Verify*, *supra* note 13.

[18] For example, see *Implement Your First IoT and Blockchain Project*, IBM, https://www.ibm.com/internet-of-things/platform/private-blockchain/ (last visited May 14, 2018).

[19] *See* Jimmy Song, *Bitcoin Cash: What You Need to Know*, Medium (July 24, 2017), https://medium.com/@jimmysong/bitcoin-cash-what-you-need-to-know-c25df28995cf.

[20] Susan Athey, *5 Ways Digital Currency Will Change the World*, World Econ. Forum Agenda (Jan. 22, 2015).

[21] *See* James Ray, *A Next-Generation Smart Contract and Decentralized Application Platform*, Github (May 8, 2018), https://github.com/ethereum/wiki/wiki/White-Paper.

Exchange Commission has recently clarified that they may in at least some circumstances qualify as securities.[22] Many other financial regulators have echoed this view.[23]

Blockchains can assume different configurations from public and permissionless to private and permissioned. A permissionless, or unpermissioned, ledger, such as the Bitcoin blockchain, has no single owner and allows anyone to contribute data. Everyone in possession of the ledger moreover holds identical copies thereof.[24] These features make a permissionless blockchain censorship-resistant and hard to hack—yet also complex to govern.[25] For a cyber-attack to be successful, all existing copies of the ledger need to be simultaneously attacked, which has never happened to date. Similarly, unauthorized modifications and malicious tampering cannot be undertaken, as network participants would quickly spot such attempts. Permissionless blockchains on the one hand are considered more secure as any attacks are out in the open and can minimize the power of small groups. Permissioned ledgers on the other hand have one or multiple owners, such as a group of financial institutions. When new records are added, the ledger's integrity is checked through a limited consensus process carried out by trusted actors. The distinction between public and private blockchains underlines that while these tools are frequently presented as a distributed ledger with no central controlling authority, they can in fact be designed as closed systems.[26]

Blockchains also serve as a support on which new applications are constructed. For example, the Ethereum blockchain offers a Turing-complete programming language to enable smart contracts and decentralized applications.[27] A smart contract is code that automatically executes (unless built-in mechanisms prevent this). They are automatically executed by a computer system and can be a tool to eliminate counterparty risk. Smart contracts, however, are neither smart in the AI sense (they need outside output to determine real-world events)[28] nor legal contracts.[29] They are nonetheless able to replicate elements of legal

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[22] *See* Nathaniel Popper, *S.E.C. Issues Warning on Initial Coin Offerings*, NY Times (July 25, 2017), https://www.nytimes.com/2017/07/25/business/sec-issues-warning-on-initial-coin-offerings.html.

[23] *See* Stan Higgins, *Singapore Central Bank: Token Sales May Be Subject to Securities Laws*, CoinDesk (Aug. 1, 2017) https://www.coindesk.com/singapore-central-bank-token-sales-may-be-subject-to-securities-laws/.

[24] Note, however, this distinction between full and lightweight nodes.

[25] No blockchain has been hacked to date.

[26] *See* Richard G. Brown, *Introducing R3 Corda: A Distributed Ledger Designed for Financial Services*, R3 (Apr. 5, 2016), http://www.r3cev.com/blog/2016/4/4/introducing-r3-corda-a-distributed-ledger-designed-for-financial-services.

[27] For an overview of this blockchain, see https://www.ethereum.org/.

[28] This function is fulfilled by online oracles.

[29] *See* Kevin Werbach & Nicolas Cornell, *Contracts Ex Machina*, Duke L.J. (forthcoming).

contracts by expressing the underlying agreement in computer code instead of legal language and have the advantage of low contracting, enforcement, and compliance costs. As such, they enable individuals, corporations, and machines to create digital agreements with the certainty that the agreement is honored in all databases or accounts of the parties involved. Smart contracts are written relying on source code and can be standardized and executed at little cost. Yet, as law and code merge, "the only way for people to infringe the law is to effectively break the code."[30] New applications are already being developed to bridge the gap between law and technology by auditing the compliance of software code and providing built-in arbitration mechanisms. Despite their challenges, smart contracts could thus emerge as a useful tool for transactional lawyers.

These developments enable decentralized applications (DApps), which are interactive services running on a blockchain.[31] The most ambitious category of a DApp is a Distributed Autonomous Organization (DAO), which is a nexus of smart contracts. Through decentralized organizations (DOs) and DAOs, software can replicate aspects of corporate governance and allow parties to enjoy the benefits of corporate structures while maintaining the flexibility of loosely organized groups. A DAO operates autonomously with no need for continuous human involvement, for example in facilitating real-time digital voting. The prospect of a possible future spread of such mechanisms has led some to see a new era of the Leviathan where in a techno-democratic system "governments themselves may be replaced by decentralized (autonomous) organizations."[32] With Bitnation, the "world's first virtual nation—a block chain jurisdiction" has emerged.[33] For the time being, blockchain applications are much more modest, yet no less innovative and paradigm-shifting. It is the aim of the subsequent Section to provide an overview of use cases that are currently being explored.

I. Blockchain Use Cases

This Section provides an overview of possible future blockchain use cases with the aim of elucidating some practical applications of distributed ledgers. It should be borne in mind that these are selective examples of an evolving field. While concrete applications remain rare, the technology's future cannot be said to be undervalued. Blockchains have been described as an innovation with the potential to "transform the delivery of public and private

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[30] De Filippi &Wright, *Lex Cryptographia*, *supra* note 8, at 27.

[31] Current examples include Storj, La'Zooz, and OpenBazaar.

[32] De Filippi &Wright, *Lex Cryptographia*, *supra* note 8, at 39.

[33] Bɪᴛɴᴀᴛɪᴏɴ, https://bitnation.co/main/ (last visited May 14, 2018).

services and enhance productivity through a wide range of applications."[34] As such, distributed ledgers are said to "have the potential to be radically disruptive."[35] The European Parliament has underlined that blockchains can "contribute positively to citizens' welfare and economic development."[36] I now turn to suggested use cases of the technology to illustrate why such sweeping statements concerning the potential of blockchain technology are being made. Blockchain is indeed considered a general purpose technology that could be relied upon in a wide variety of circumstances.

Blockchains are well-suited mechanisms to track the movement of goods and payments.[37] In Africa, blockchain has brought banking services to the unbanked, most famously through BitPesa, which provides blockchain-based mobile banking.[38] Companies such as BitPesa and BitSpark moreover allow for the fast and cheap transfer of remittances.[39] Blockchain moreover allows tracking the movement of goods in international commerce. Everledger offers diamond certification to stamp out blood diamonds[40] while Provenance.org provides information about the provenance and sustainability of a range of products, including garments, coffee, and fish.[41] Anything can be represented in tokens and traded on a distributed ledger. To illustrate, blockchain facilitates the operation of urban smart energy grids—where neighbors buy and sell energy to another—and has been piloted in a collaborative project between a local start-up and Siemens in New York City.[42]

Blockchain is moreover said to become a critical component of the Internet of Things as it facilitates machine-to-machine communication and micro-payments.[43] As the Internet of Things develops at rapid pace, this will enable new innovations and eventually machine-to-machine payments. Blockchain enables the transformation of property into

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[34] Matt Hancock & Ed Vaizey, *Distributed Ledger Technology: Beyond Block Chain*, Gov't Off. for Sci. 5 (Jan. 19, 2016), https://www.gov.uk/government/news/distributed-ledger-technology-beyond-block-chain.

[35] *Id.* at 14.

[36] Eur. Parl. Res. (2016/2007(INI)) art. 1 (2016).

[37] IBS Testing of BC for Mahindra Group.

[38] *See* BitPesa, https://www.bitpesa.co/ (last visited May 14, 2018).

[39] *See id.*; Bitspark, https://bitspark.io/ (last visited May 14, 2018).

[40] *See* Everledger, https://www.everledger.io/ (last visited May 14, 2018).

[41] *See* Provenance, https://www.provenance.org/ (last visited May 14, 2018).

[42] *See* Hobertus Breuer, *A Microgrid Grows in Brooklyn*, Siemens (Feb. 16, 2018), https://www.siemens.com/innovation/en/home/pictures-of-the-future/energy-and-efficiency/smart-grids-and-energy-storage-microgrid-in-brooklyn.html.

[43] *See Implement Your First IoT and Blockchain Project*, IBM, https://www.ibm.com/internet-of-things/platform/private-blockchain/ (last visited May 9, 2018).

smart property, that is to say the registration of devices and tangible property onto a blockchain, governed by smart contracts. Blockchains' enabling of micropayments is giving rise to a "metered internet" as Internet search engines are experimenting with micropayments for a new revenue-sharing solution between users and contributors.[44] Micropayments could come to play a crucial role in an ecosystem of peer-to-peer transactions. Given its capacity to create tamper-proof registries, blockchain technology is being experimented with as a new form of administering official records such as birth and marriage as well as land registries. Georgia is currently running a pilot project in respect of the latter.[45] Estonia has experimented with distributed ledgers in government, and is using Keyless Signature Infrastructure (KSI) to enable citizens to verify their records on government databases.[46]

Blockchains also promise to facilitate peer-to-peer transactions in commerce, particularly internationally, in a more transparent and inclusive manner, potentially challenging powerful intermediaries such as Google, Amazon, Facebook, and Apple (GAFA) and Baidu, Alibaba, Weibo, and Tencent (BAWT). The disruption blockchains can bring to digital platforms may moreover inaugurate a sharing economy on steroids where intermediary platforms such as Airbnb or Uber can be replaced, or adapt for fear of disruption, by a blockchain that charges a fraction of the intermediary fee currently charged by these platforms, or none at all.[47] Distributed ledgers can moreover enable the collaborative governance of these platforms. OpenBazaar, for example, enables online commerce with no middlemen or fees.[48] La`Zooz and ArcadeCity are designing a ride-sharing platform similar to Uber with no centralized operator.[49]

Some consider that in the long term, blockchains may bring disruption to democratic processes. Catherine Mullligan has argued that the eventual influence of blockchains "on British society may be as significant as foundational events such as the creation of the Magna Carta."[50] Voting is forecast to occur on blockchain. While it is unlikely that this will be

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[44] BRAVE, https://brave.com/about.html (last visited May 14, 2018).

[45] *See* Laura Shin, *Republic of Georgia To Pilot Land Titling on Blockchain With Economist Hernando De Soto, BitFury*, FORBES (Apr. 21, 2016), www.forbes.com/sites/laurashin/2016/04/21/republic-of-georgia-to-pilot-land-titling-on-blockchain-with-economist-hernando-de-soto-bitfury/#2421bdfe6550.

[46] *See also Security and Safety*, E-ESTONIA, *https*://e-estonia.com/solutions/security-and-safety/ksi-blockchain/ (last visited May 14, 2018).

[47] On the sharing economy, see further Handbook.

[48] *See* OPENBAZAAR, https://www.openbazaar.org/ (last visited May 14, 2018).

[49] *See* ARCADE CITY, https://arcade.city/ (last visited May 14, 2018); LA'ZOOZ, http://lazooz.org/ (last visited May 14, 2018).

[50] Hancock & Vaizey, *supra* note 34, at 65.

adopted at large scale for political elections in the short or medium-term, one could imagine voting in smaller settings, such as TV shows, but also companies and trade unions.[51]

Others consider that intellectual property rights are likely to be reshaped by blockchain technology, which can be used to track the rights and transactions of digital creative works such as music or artwork. Ascribe allows artists to create an "unbreakable link" between themselves and their art and frees them from the need to rely on intermediaries.[52] Grammy Award winner Imogen Heap has created her own blockchain-based company, Mycelia, which permits artists to distribute their music without the traditional intermediaries.[53] This allows for the instantaneous administration of music royalties and automatic distribution to composers and performers in real time.[54]

The above overview has provided very cursory insights into the practical applications of blockchains. They should be understood organically as indicating possible future evolutions in this area. At this moment in time, the technology remains immature as business models remain under-developed and under-established. The variety and speed of blockchain innovation is however understood to indicate that significant disruption, similar to that caused by the Internet and the World Wide Web a few decades ago, may be just around the corner.[55] Such disruption will challenge business models, industries, and society more broadly. As Carlotta Perez has shown, any disruption of such scale is always accompanied by a changing legal and regulatory landscape. Bearing this in mind, it is not too early to reflect on the first guiding principles of blockchain regulation.

II. Regulating Blockchains

The remainder of this Article reflects on the implications of blockchain technology from a regulatory perspective. While distributed ledgers are still in their early stages, regulators around the globe have started thinking about the legal, policy, and strategic implications of this new technology. We shall first establish a typology of approaches that regulators have already been adopted and subsequently devise a number of guiding principles regulators

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[51]*See* Iyke Aru, *Blockchain Voting May Lead to Liquid Democracy Globally in 20 Years*, Cᴏɪɴᴛᴇʟᴇɢʀᴀᴘʜ (Apr. 6, 2017), https://cointelegraph.com/news/blockchain-voting-may-lead-to-liquid-democracy-globally-in-20-years.

[52] Aꜱᴄʀɪʙᴇ, https://www.ascribe.io/ (last visited May 14, 2018).

[53] *See* Mʏᴄᴇʟɪᴀ, http://myceliaformusic.org/ (last visited May 14, 2018).

[54] *See* D.A. Wallach, *Bitcoin for Rockstars: How Cryptocurrency Can Revolutionize the Music Industry*, Wɪʀᴇᴅ (Dec. 10, 2014), https://www.wired.com/2014/12/bitcoin-for-rockstars/.

[55] Another indication of the speed with which this domain evolves is the increasing number of patents filed in relation to blockchain technology, including by established institutional actors. *See* Wolfie Zhao, *Bank of America Files for 3 New Blockchain* Patents, Cᴏɪɴᴅᴇꜱᴋ (Aug. 1, 2017), https://www.coindesk.com/bank-america-files-3-new-blockchain-patents/.

should adhere to when engaging with the technology in these early and uncertain stages of its development.

C. A Typology of Regulatory Strategies

This Section summarizes the regulatory strategies that regulators across the globe have adopted up until mid-2017. They are grouped into distinct typologies in order to underline the divergences in current approaches as well as their distinguishing features.

I. Wait-and-See

One possible approach for regulators is to wait and see how the technology unfolds while continuing to apply existing legal frameworks. The motto of this approach is "educate, do not regulate." Under the wait-and-see option, a novel phenomenon is allowed to unfold before concrete guidelines and rules are devised. This appears to be the mainstream regulatory approach at this moment in time, as it allows regulators to observe how blockchains develop without the need to make explicit pronouncements on the matter.

This approach has been widely adopted in the context of technological change. Wait-and-see is also the stance followed by the European Commission in other domains of digital innovation, notably the platform economy.[56] In respect of blockchain technology, the Commission has already announced that it is "actively monitoring" related developments.[57] This includes, for example, the organization of workshops on the matter as well as the financing of pilot projects.[58] It is indeed important to stress that the wait-and-see approach does not equal passivity. While no new regulation is issued and old legal principles continue to apply, a regulator in parallel actively assembles information and acquires knowledge through the consultation of stakeholders and experts, while often also assessing developments in other jurisdictions. This information-gathering process can subsequently give way to different approaches as, in light of the evidence collected, a regulator may conclude that existing rules should continue to apply or, to the contrary, that new guiding principles are needed. It may also reach the conclusion that further experimentation is required and adopt a sandboxing solution, or other experimentation regulatory strategies.[59] The popularity of the wait-and-see approach mirrors that blockchain remains an immature technology subject to evolution and that its practical affects remain largely speculative at

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[56] *See A European Agenda for the Collaborative Economy*, COM (2016) 356 final (June 2, 2016).

[57] Luke Parker, *European Commission "Actively Monitoring" Blockchain Developments*, Brave New Coin (Feb. 17, 2017), https://bravenewcoin.com/news/european-commission-actively-monitoring-blockchain-developments/.

[58] *See* Chuan Tian, *European Commission Hosts Blockchain Summit with Industry Focus*, CoinDesk (July 18, 2017) http://www.coindesk.com/european-commission-hosts-blockchain-workshop-industry-focus/.

[59] These strategies are introduced below.

this stage. It further echoes its fast pace of development. Indeed, if regulators were to adopt hard-binding rules now, they run the risk of quickly facing a need for amendment.

It is important to stress that as regulators observe the unfolding of the technology, existing legal principles continue to apply to blockchain-based activity. This can be unequivocally observed in the case of Silk Road, a now inactive online black market for illegal items and services that relied on Bitcoin as payment. The site was shut down in 2013 and the founder was subsequently sentenced to life in prison without parole.[60] This example illustrates that criminal activity occurring on a blockchain is not any less criminal than its analogue counterpart.

To determine whether existing legal frameworks apply while a regulator observes its wait-and-see approach, an exercise in legal classification is necessary. Legal classification has allowed the U.S. Internal Revenue Service to conclude that Bitcoin amounts to property rather than a currency and is, as a consequence, subject to the existing property law regime.[61] Legal classification is, however, often far from an easy undertaking. Regulators around the globe are currently struggling to qualify Initial Coin Offerings (ICOs) and determine whether the tokens that are issued in this context are securities.[62] This indicates the disadvantages of the wait-and-see approach. Until classification has occurred, innovators are faced with a lack of legal certainty, which can result in negative implications for the industry as building a business amid regulatory uncertainty can be like building on quicksand. To limit such negative implications, regulators may choose to issue guidance to these actors.

II. Issue Narrowing or Broadening Guidance

Where regulators have gathered initial insights from their observation of distributed ledgers they may decide to issue informal guidance as to how existing legal frameworks apply. This may in turn result in a narrow or broad application of these principles. This is not to be confused with the adoption of new legal norms but rather amounts to the application of existing legal frameworks while providing guidance to stakeholders as to how it is to be interpreted, and, importantly from the perspective of the regulated, an estimation whether their activity is caught by the laws at issue. The U.S. Securities and Exchange Commission has recently clarified that coins or tokens can be considered as securities if the existing legal test

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[60] *See* Andy Greenberg, *Silk Road Creator Ross Ulbricht Loses Life Sentence Appeal*, Wɪʀᴇᴅ (May 31, 2017), https://www.wired.com/2017/05/silk-road-creator-ross-ulbricht-loses-life-sentence-appeal/.

[61] *See 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), https://www.irs.gov/uac/newsroom/irs-virtual-currency-guidance.

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

is applied to ICOs.[63] Industry can in this context sometimes force regulators' hands in putting pressure on them to act. This can include lobbying efforts, media attention, or even strategic litigation techniques. Whereas such guidance will remove some of the lack of certainty innovators often face, guidelines present the disadvantage that they are simple guidelines rather than hard binding rules, and can, for example, be disregarded by courts that may adopt a contrary approach. This happened in the context of the platform economy where the ECJ's Advocate General Szpunar was unimpressed by the European Commission's guidelines on whether a platform should be considered as a mere intermediary or as also providing the underlying service.[64] Regulatory sandboxing is a newer approach that still allows regulators to observe and learn before crafting binding rules yet also provides enhanced legal certainty to innovators.

III. Sandboxing

After coming to terms with initial observations of blockchain technology and its applications, a regulator may feel that it is premature to change the law. I have already observed that the resulting lack of legal certainty risks negatively affecting the blockchain industry, which may be deterred from engaging in a given venture or leave the jurisdiction to find friendlier grounds. Jurisdictions that wish to retain or attract blockchain operators, yet do not wish to create binding legislation with general application, are increasingly adopting a so-called "sandboxing" approach to prevent these outcomes.

A regulatory sandbox can be defined as a set of rules that allows innovators to test their product or business model in an environment that temporarily exempts them from following some or all legal requirements in place.[65] In exchange, these actors are often obliged to operate their business model in a restricted manner, for instance through a controlled number of clients or risk exposure, and under close regulatory supervision. The technique is designed to be mutually beneficial for regulators and the regulated in reducing legal uncertainty for the latter. The former in turn hope to stimulate innovation and experiment with legal frameworks. The approach mainly finds application in the FinTech sector and constitutes an intriguing example of how, when technology changes, regulation does as well. Sandboxing is designed to be a tool to bring innovations to market more quickly while safeguarding public interest considerations.

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[63] *See Investor Bulletin: Initial Coin Offerings,* SEChttps://www.sec.gov/oiea/investor-alerts-and-bulletins/ib_coinofferings (last visited May 14, 2018).

[64] *See* C-434/15 Asociación Profesional Elite Taxi v. Uber Systems Spain (Dec. 20, 2017), http://curia.europa.eu/.

[65] The terminology is a play on the term development sandbox that denotes a safe environment for developers to work on software.

The approach was debuted by the United Kingdom in 2015, which approved the first sandboxed FinTech services in 2016. [66] The British framework allows innovators to test new technologies in a lightly but clearly regulated environment under close supervision and for a defined period of time.[67] The technique has since rapidly spread to other jurisdictions. The Swiss Financial Markets Supervisory Authority has created a new licensing category for innovative companies, which includes a license-exempt sandbox.[68] Singapore also has a regulatory sandbox.[69] The Canadian Securities Administration has equally launched a regulatory sandbox initiative,[70] and Australia has recently opened a research center on blockchain technology and plans to open a regulatory sandbox to allow firms to test products.[71] As of August 2017 numerous other jurisdictions were considering the adoption of sandboxing schemes.

Regulatory sandboxing comes with its own set of advantages and disadvantages. Sandboxes can be black boxes that lack transparency. Equality is another concern as in a sandbox setting some economic operators benefit from advantages not available to others. This risks being seen as incompatible with the rule of law so that it would not be surprising if judicial review actions would be initiated against some of these schemes. The selectivity of admission to a sandbox also highlights the challenges for these schemes to be technology and business model neutral.

The fact that actors transition from a general legal regime applicable to all to selective and privileged regime available only to the few also raises challenges in relation to on-boarding and off-boarding. For example, what about consumers that used a certain service before the firm entered into the sandbox thinking their relations would be covered by the generally applicable regime but then no longer are. Similarly, there is as of yet not sufficient data available to determine the intricacies of transitioning back from the privileged to the general regime. In the EU, Member States are moreover limited in what they can do in a sandbox

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[66] *See generally Regulatory Sandbox*, FINANCIAL CONDUCT AUTHORITY, (Feb. 14, 2018), https://www.fca.org.uk/firms/regulatory-sandbox (last visited May 14, 2018).

[67] *Id.*

[68] *See FINMA Reduces Obstacles to FinTech*, FINMA (Mar. 17, 2016), https://www.finma.ch/en/news/2016/03/20160317-mm-fintech/.

[69] *FinTech Regulatory Sandbox,* MONETARY AUTHORITY OF SINGAPORE, http://www.mas.gov.sg/Singapore-Financial-Centre/Smart-Financial-Centre/FinTech-Regulatory-Sandbox.aspx (last visited May 11, 2018).

[70] *See The Canadian Securities Administrators Launches a Regulatory Sandbox Initiative*, CANADIAN SECURITIES ADMINISTRATORS (Feb. 23, 2017), https://nssc.novascotia.ca/sites/default/files/docs/Feb.%2023,%202017%20CSA%20RegSandbox-press%20release-Final.pdf.

[71] *See* Stan Higgins, *Australian Finance Regulator Unveils Blockchain Research Effort*, COINDESK (Mar. 17, 2017), https://www.coindesk.com/australian-finance-regulator-launches-blockchain-research-effort/.

context, as the supremacy of EU law stands in the way of sandboxes that disregard EU law. Regulatory sandboxes, at least in their current form, are moreover limited to a single jurisdiction, which can create considerable difficulty for those offering services transnationally.

The clear advantage of sandboxing is that it allows regulators to buy time to continue observing and learning from the technology and related early ventures while at the same time encouraging innovation by providing legal certainty and formal avenues for dialogue between the regulated and the regulating. Some regulators are adopting a different approach in already issuing blockchain legislation at this stage.

IV. Issue New Legislation

Despite the still early stages of the technology's development, a number of jurisdictions have already taken the step of enacting new legislation. While this presents the advantages of portraying the jurisdiction as a progressive, blockchain-friendly venue to attract blockchain innovation, it also bears the risk of being premature. Such legislative enthusiasm may indeed prove to have negative consequences in the long-term as the technology continues to evolve, which may result in a need for legislative amendment sooner rather than later. As Walch has moreover noted, the terminology surrounding blockchains remains unsettled, which may also lead to complications in relation to the application of such legislative frameworks.[72]

A number of examples of said approach can be pinpointed. In March 2017, Arizona issued state legislation that qualifies signatures secured through blockchains and smart contracts as electronic signatures.[73] Russia has created a legal framework to legalize ICOs.[74] Vermont has considered legislation to make blockchain records admissible evidence in courts.[75] Alternatively, France has authorized debt-based crowdfunding recorded on blockchain.[76]

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[72] *See also Walch, The Path of the Blockchain Lexicon*, *supra* note 7.

[73] *See* Stan Higgins, *Arizona Governor Signs Blockchain Bill into Law*, COINDESK (Mar. 31, 2017), https://www.coindesk.com/arizona-governor-signs-blockchain-bill-law/.

[74] *See Russia is Creating a Regulatory Framework to Legalize ICOs*, ALTCOIN TODAY (July 20, 2017), http://www.altcointoday.com/russia-legalize-icos/.

[75] *See* Stan Higgins, *Vermont is Close to Passing a Law That Would Make Blockchain Records Admissible in Court*, COINDESK (May 17, 2016), http://www.coindesk.com/vermont-blockchain-timestamps-approval/.

[76] *See* Diana Ngo, *France Issues New Ruling for Mini-Bonds Trading on Blockchain Platforms*, BTCMANAGER (May 12, 2016), https://btcmanager.com/france-issues-new-ruling-for-mini-bonds-trading-on-blockchain-platforms/.

Delaware is also considering legally recognizing blockchain stocks, as well as the "creation and maintenance of corporate records using blockchain."[77]

The aim of such initiatives consists in providing legal certainty. Such moves may, however, backfire if they are adopted preterm. This tale emerges from New York State's experience with regulating Bitcoin through its BitLicense scheme. The 2015 scheme requires entities that engage in virtual currency operations that are not covered by an exemption from New York's virtual currency rules to obtain a BitLicense from the state's Department of Financial Services.[78] In two years, only three such licenses were granted—to Circle, Ripple, and Coinbase.[79] It has been argued that costs of applying for a BitLicense are prohibitive for smaller players and start-ups, which instead of applying for the license have other jurisdictions to establish their business.[80] California had planned a similar scheme, California bill AB 1326, that was however dropped after successful lobbying efforts by the Electronic Frontier Foundation which highlighted that it would discourage innovation as the absence of a "start-up exemption," and would leave no space for "thinkers and new entrants to experiment with new types of digital currencies that may transform the industry, and it will therefore kill digital currency innovation in California."[81]

While legislation can create legal certainty and provide evidence of how a given legislative strategy unfolds, rules that are too detailed risk becoming burdensome for operators in the area, potentially stifling innovation and causing headaches for law enforcement agencies compelled to enforce principles they know do not work. Of course, as time unfolds, legislation will become an increasingly accepted and necessary strategy. Determining when that is the case is far from straightforward as, when faced with the emergence of new technologies, timing is always difficult for regulators. Legislation should indeed not come too early to unnecessarily stifle innovation but also not too late to leave people and principles unprotected.[82] Legislating will also become easier as time passes and standards as well as terminology settle. It is worth noting that the International Standards Organization

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[77] Stan Higgins, *Delaware Introduces Bill to Legally Recognize Blockchain Stocks*, COINDESK (May 9, 2017), http://www.coindesk.com/delaware-introduces-bill-legally-recognize-blockchain-stocks/.

[78] *See* N.Y. Comp. Codes R. & Regs. tit. 23 § 200.1 et seq., http://www.dfs.ny.gov/legal/regulations/adoptions/dfsp200t.pdf.

[79] *See* Michael del Castillo, *Bitcoin Exchange Coinbase Receives New York BitLicense*, COINDESK (Jan. 17, 2017), http://www.coindesk.com/bitcoin-exchange-coinbase-receives-bitlicense/.

[80] *See* Yessi Bello Perez, *The Real Cost of Applying for a New York BitLicense*, COINDESK (Aug. 13, 2015), http://www.coindesk.com/real-cost-applying-new-york-bitlicense.

[81] Elec. Frontier Foundation, Opinion Letter (Aug. 11, 2016), https://www.eff.org/files/2016/08/18/eff_letter_-_oppose_ab_1326_aug._2016_-_final_.pdf.

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

is already working on technical and interoperability standards for distributed ledger technologies that might remedy some of these technological and terminological difficulties.[83] Beyond various regulatory strategies there has been an additional involvement of regulators with blockchains, namely their reliance on the technology to optimize their own processes.

V. Use Blockchain Technology for Their Own Purposes

Regulators have started relying on distributed ledgers to optimize their own processes. While this is not per se a regulatory strategy it does constitute an important facet of the "educate do not regulate" approach as it enables regulators to learn more about the technology by testing it themselves, and may, in the medium term, also come to affect some of the functions carried out by these agents.

A number of instances of government experimentalism with distributed ledgers can be identified. Ukraine has partnered with Bitfury to put government data on a blockchain with the hope of addressing concerns for transparency and accountability.[84] Sweden is experimenting with distributed ledger in the land registry context after Georgia became the first country to register land titles on the technology.[85] Estonia has been experimenting with blockchains in the context of health care data security to allow such data to be reliably stored and selectively shared.[86] The Singapore Smart Nation project has deployed a distributed ledger to handle domestic inter-bank payments.[87] Through the Dubai 2020 Initiative, the government of Dubai plans to move all government documents and systems onto blockchain by 2020.[88] Most of these projects are more adequately seen as attempts to better understand the technology and experience its opportunities and limitations first hand rather than attempts to replace existing processes.

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[83] *See Environmental* Management, ISO, ISO/TC 207 (last visited May 15, 2018).

[84] *See* Gertrude Chavez-Dreyfuss, *Ukraine Launches Big Blockchain Deal with Tech Firm Bitfury*, Reuters (Apr. 13, 2017), https://www.reuters.com/article/us-ukraine-bitfury-blockchain-idUSKBN17F0N2.

[85] *See* 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/.

[86] *See* Jonathon Marshall, *Estonia Prescribes Blockchain for Healthcare Data Security*, PWC Blogs (Mar. 16, 2017), http://pwc.blogs.com/health_matters/2017/03/estonia-prescribes-blockchain-for-healthcare-data-security.html.

[87] For further information on "project Ubin," see http://www.mas.gov.sg/Singapore-Financial-Centre/Smart-Financial-Centre/Project-Ubin.aspx.

[88] *See* Nikhil Lohade, *Dubai Aims to be a City Built on Blockchain*, Wall St. J. (Apr. 24, 2017), 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/ (last visited May 11, 2018).

These pilot projects present three benefits. First, they allow regulators to experiment with new approaches to existing government processes, with the hope of rendering them more straightforward, efficient, and transparent. Second, these pilot projects also enable regulators to observe the operation of a blockchain-based use-case first hand, which may in turn inform its regulatory approach to the technology. Third, such projects give rise to dialogue between governments and the distributed ledger industry. As underlined further below, this is an activity that should be encouraged to make sure that regulation is reflexive.

The above overview has grouped the regulatory strategies that have been adopted to date into distinct categories to illustrate that regulators' early engagement with the technology has taken a number of forms. We have also seen that each approach has its distinct advantages and disadvantages. Reflecting on this further, the subsequent Section formulates a range of principles regulators should adhere to when devising their approach to the phenomenon.

D. First Principles of Blockchain Regulation

We have already observed that while blockchains remain an evolving technology with evolving use cases, regulators have started pondering regulatory implications. This should not be considered a premature move, as many arguments in favor of early regulatory conversation can be identified. An immature technology is a malleable technology and as blockchains inevitably have to develop, there is an opportunity to engrain compliance and respect for public policy objectives since the beginning. Regulators will, however, need to realize that as technology changes, so does the law, and that old regulatory paradigms do not necessarily suit new technologies. Just as the platform economy, the Internet of Things, and Big Data, distributed ledgers pull systems and business processes previously conducted offline online.[89] The related challenge consists in identifying where private regulation through code stops and public regulatory intervention starts. Some will inevitably argue that virtual space should be left alone by real world regulators. Yet, just as declaring the independence of cyberspace did not prevent Internet regulation, the blockchain will become subject to regulatory imperatives.[90]

The key question, for regulators and stakeholders alike, is how to tailor such regulation in a manner accounting for the interests and objectives of both sides. Regulation should indeed allow for the protection of public interest objectives and stimulate innovation at the same time. For this to happen, they need to be mindful of not repeating past mistakes, which include a delayed interest in the new technology and the premature creation of new

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[89] *See Kevin Werbach, The Song Remains the Same: What Cyberlaw Might Teach the Next Internet Economy*, FLA. L. REV. 1 (forthcoming, 2018) [hereinafter "Werbach, The Song Remains the Same"].

[90] *See John Perry Barlow, A Declaration of the Independence of Cyberspace,* ELEC. FRONTIER FOUND. (Feb. 8, 1996), https://www.eff.org/cyberspace-independence.

institutions. Regulators should similarly learn from the advantages and disadvantages of early blockchain regulation outlined above. The burden of successful regulation does not solely rest on regulators themselves. Rather, industry and other stakeholders should actively seek dialogue with regulators in order to better explain their technology, but also their regulatory fears and needs. It is indeed only through a polycentric collaborative effort that the complex regulatory challenges posed by blockchain technology can be addressed satisfactorily. Bearing this in mind, we now turn to a number of guiding principles that can facilitate the achievement of that objective.

I. Regulatory Stability Is a Means of Innovation and Growth

First, we must reiterate that regulation is useful not only from the perspective of the regulator, but also of the regulated. Regulation creates legal certainty, which in turn frees entrepreneurs and innovators from the concern that their activity may be suddenly be qualified as illegal. Such concerns generate hesitant innovators, shy of eventually realizing their vision, or driven to flee the jurisdiction to establish themselves in more friendly territory. Looking back at an earlier wave of digital innovation, the emergence of the Internet, while initially skeptical, tech companies eventually welcomed regulatory intervention.[91] This can be explained by the certainty provided through such intervention in the form of clear rules applicable to all players. Similar tales emerge from the more recent phenomenon of the platform economy. Airbnb has long sought dialogue with regulators and accepted regulation to operate in various locations.[92] Its notoriously reluctant counterpart from the transportation industry, Uber, has now pushed for insurance legalization that applies unanimously across the United States.[93] As Werbach highlighted, "if anything, the innovators stand to lose the most by delaying the involvement of government in adopting reasonable solutions."[94]

Regulatory uncertainty creates additional negative externalities. In addition to negatively affecting entrepreneurial courage, it increases the costs of legal compliance as entrepreneurs must go to great lengths to clarify their legal situation, if possible. This is particularly problematic for small players and the many not-for-profit distributed ledger initiatives. Such a state of affairs further increases the risk of litigation, which in turn swells legal costs for companies. It will also give rise to a determination of applicable rules on a case-by-case basis, which would be ill-advised for all parties involved. An absence of

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[91] *See* Werbach, The Song Remains the Same, *supra* note 89, at 63.

[92] *See* Michèle Finck & Sofia Ranchordas, *Sharing and the City*, 49 Vand. J. of Transnat'l L. 1299 (2016).

[93] *See* Uber Team, *Insurance Aligned*, Uber (Mar. 24, 2015), https://newsroom.uber.com/introducing-the-tnc-insurance-compromise-model-bill/ (describing the TNC Insurance Compromise Model Bill).

[94] Werbach, The Song Remains the Same, *supra* note 89, at 1.

regulatory guiding principles moreover risks leaving public policy considerations unprotected.

II. Public Policy Considerations Must Be Considered from the Outset

Regulation is a classic tool with which to enforce public policy objectives, and this is no different in relation to blockchain technology. In this context, public policy considerations include—but are not limited to—the prevention of money laundering, safeguarding consumer protection, such as in the context of ICOs, and the protection of privacy and copyright.[95] The list of public policy concerns will expand as the technology develops. When it comes to the regulation of distributed ledgers, the challenge thus consists in striking a balance between the interests of the broader interests of society and system participants. Regulatory strategies must at all times ponder and account for the public policy implications of distributed ledger technology. Blockchains still are a malleable technology that can be used both for good and for malicious ends.

Regulators should also remain aware of the risk of regulatory capture and blind enthusiasm. It has been argued that in a climate of "pressures for deregulation, the regulatory authorities must ensure that the pendulum does not swing too far in favour of innovation, at the expense of compliance."[96] This should not lead regulators to be hostile towards the industry or claims that innovation is a public value in itself—and can thus also be considered to occur in the public interest—that regulators should actively encourage. Rather, while conversing with these actors, they should keep a critical and independent perspective and remember that their role is also one of protecting the public interest and that long-held values do not disappear as technology develops. It is in this context also paramount for regulators to be mindful that fact selection in regulatory debates can be tricky and embed agency capture and minoritarian bias—although new data solutions can help remedy some of these problems.[97] While remembering that their role is one of the protection of the public interest, regulators should not, however, shy away from discussions with industry representatives.

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[95] *See also* Garry A. Gabinson, *Policy Considerations for the Blockchain Public and Private Applications*, 19 SMU Sci. & Tech. L. Rev. 327 (2016).

[96] Holly Powley & Keith Stanton, *The Future of Banking Regulation*, Univ. of Bristol L. Sch. Blog (Apr. 24, 2017), https://legalresearch.blogs.bris.ac.uk/2017/04/the-future-of-banking-regulation/.

[97] *See also* 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).

III. The Importance of Regulatory Conversations

At present, regulators are starting to try to learn about blockchains and understand their uses and implications while innovators are struggling to find out what regulatory principles apply to their activity. Through dialogue and cooperation both sets of actors could remedy their respective struggles. We have already seen that sandboxes and government-backed initiatives are mechanisms to create such dialogue and allow both sets of actors to learn from the pragmatic application of the technology. Beyond, the creation of bodies discussing the technology and related questions of regulation are a good option. Through such dialogue between public authorities and industry representatives, public officials can learn and better understand the technology while industry leaders have a chance to explain it to the regulators. The distributed ledger industry is wise in its approach to contact regulators early on. Uber's fate in Europe has indeed illustrated that refusal to cooperate with public authorities and respect of public policy objectives ultimately harms the innovator itself.[98]

Ideally, such conversations would have a cross-jurisdictional component to account for the fact that, just like the Internet, distributed ledgers do not account for territorial borders.[99] While these jurisdictional questions are challenging and generate no easy answers, they echo existing issues of a global economy without a global government. There is however a potential for such conversations to emerge, underlined by the fact that Singapore and Switzerland have cooperated on FinTech rules.[100] There is moreover an obvious potential for the European Union to coordinate the action of its Member States in this respect. The subsequent Section illustrates that these more informal processes of dialogue can lead to a co-regulatory approach.

IV. Technological Innovation Triggers Legal Innovation

We have observed that the premature adoption of strict legislative frameworks presents a number of pitfalls, including the need for early amendment as the technology and business aspects of blockchains evolve. Regulators will need to think outside the conventional legislative toolbox when crafting frameworks with which to govern the early blockchain industry.

Technological innovation necessitates legal innovation. We have learned from the emergence of digital platforms that bridging fast technological change and the protection of

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[98] *See* Jon Henley, *Uber to Shut Down Denmark Operation Over New Taxi Laws*, Guardian (Mar. 28, 2017), https://www.theguardian.com/technology/2017/mar/28/uber-to-shut-down-denmark-operation-over-new-taxi-laws.

[99] *See* David Johnson & David Post, *Law and Borders: The Rise of Law in Cyberspace*, 48 Stanford L. Rev. 1367 (1996).

[100] *See* Jonathan Keane, *The State of ICO Regulation? New Report Outlines Legal Status in 6 Nations*, CoinDesk (July 13, 2017), http://www.coindesk.com/state-ico-regulation-new-report-outlines-legal-status-6-nations/.

public interest requirements is not always an easy task. [101] This experience has shown us that while code is a powerful self-regulatory mechanism it should not operate in isolation from regulatory framing.[102] Rather, a process of polycentric co-regulation should be adopted as it acknowledges the limits of traditional methods of top-down legislation in the context of technological innovation yet also ensures that public policy objectives are respected while ensuring a continuing dialogue between multiple stakeholders.[103]

Co-regulation, also referred to as "regulated self-regulation," encompasses various approaches that have in common that "the regulatory regime is made up of a complex interaction of general legislation and a self-regulatory body."[104] This regulatory solution creates collaboration between public authorities and private bodies to regulate private activity while accounting for its particularities and safeguarding public policy objectives. I advocate a polycentric form of co-regulation as it aptly 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.[105] 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 would bring all of these various actors to the table when regulation is 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.[106] Through such collaboration, it is hoped, there is less risk of regulatory capture or a lack of information leading to inadequate principles. Whereas there are stark contrasts between the 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. It is worthy of special note that polycentric co-regulation is not a one-point intervention but rather a continuous effort between many stakeholders, who operate under the guidance of

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[101] *See also* MICHÈLE FINCK, BLOCKCHAIN REGULATION AND GOVERNANCE IN EUROPE (forthcoming, Cambridge University Press 2018).

[102]*See Id.*

[103] *See Id.*

[104] CHRISTOPHER MARSDEN, INTERNET CO-REGULATION 46 (Cambridge University Press 2011).

[105] For a more critical take on the decentralized nature of these entities, see Angela Walch, *The Fiduciaries of Public Blockchains* (working paper on file with author).

[106] It is worth noting that this is also the rationale behind blockchain-based prediction markets such as Augur. *See* AUGUR, https://augur.net/.

the regulator.[107] A flexible and open principles-based approach allows for evaluation and adaptation rather than an obsession on certainty and finality. While polycentric co-regulation diverges considerably from existing regulatory approaches, it could easily be applied in the present context. Indeed, many of the technology's early applications operate in the financial services sector, which is already subject to alternative regulatory approaches.

In adopting such approaches, the benefits of (blockchain) software should be leveraged at the law making, implementation and enforcement stages. Software can be used to encourage the online consultation of a broader range of stakeholders at the law-making stage, to encourage polycentrism. While such approaches do have their own shortcomings, such as those related to selection bias, they provide the overall benefit of gathering a plurality of opinions of diverse stakeholders. Furthermore, blockchains have an inherently regulatory potential. In such technical artefacts, code acts as law as it defines the options of possible behavior. Using software to implement the agreed normative principles can thus ensure that they're complied with efficiently. Finally, software can also facilitate enforcement and regulators should consider using code to determine compliance with the defined regulations.

V. Regulators Should Encourage Experimentation

Information about blockchain and its development remains sparse. There are two reasons for this state of affairs. First, the technology simply is not sufficiently developed for there to be reliable, tested 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.

Blockchains remain an experiment, albeit one with staggering prospects. Regulators should embrace this spirit of experimentation in making this a key feature of their own approach. We have already observed that sandboxing has become a popular technique with which to allow innovators to experiment with technology in a controlled setting while providing legal certainty to participants. Make no mistake: Sandbox initiatives are primarily motivated by the desire to attract innovation to the jurisdiction. Yet, it would be erroneous to presume that the technique solely benefits innovators as it also provides an opportunity for regulators to closely watch the technology and its implications.

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[107] *See* MICHEL CALLON, PIERRE LASCOUMES &YANNICK BARTHE, ACTING IN AN UNCERTAIN WORLD (MIT Press 2009). It is also important to stress that where such cooperation does not go as planned the regulator is always free to withdraw from such efforts and regulate in a traditional top-down manner.

Given that we are faced with a promising yet immature technology the encouragement of experimentation and innovation is probably the most important step regulators can take. Beyond sandboxing, a number of additional experimental techniques are available. They can, for example, rely on small-scale experimentation, and sunset clauses—temporary regulation—or sunrise clauses—regulatory requirements that kick in only after certain events materialize.[108] Indeed, regulating distributed ledgers will also be an exercise in risk regulation and only time will clarify where risks lie in this context. While we often think of the national level as an experimental regulator, subnational authorities can be well placed to adopt an experimental approach in controlled settings. While—especially small—states have taken the lead in this domain, we can easily see similar initiatives develop at a regional scale, or, for instance with a specific focus on smart cities, in the context of local governments. The UK Chief Scientist has encouraged the establishment of blockchain demonstrators at city level.[109] In pursuing such an approach regulators should focus on blockchain use cases rather than the technology itself.

To date, regulatory sandboxes are the experimental regime that has attracted most interest from regulators in relation to blockchains. However, the technique suffers from a number of shortcomings as observed above. 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. A 28th regime is an optional legal regime, applicable throughout the EU, which does not however replace national frameworks. Should the supranational co-legislators thus come to the conclusion that a common supranational legal framework is desirable, they could choose this option.[110] 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 that such principles can presumably be adopted more quickly at EU level, adding harmonization where needed to facilitate cross-border transactions without replacing national law. 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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[108] For a discussion of these techniques, see Sofia Ranchordás, *Innovation Experimentalism in the Age of the Sharing Economy*, 19 LEWIS & CLARK L. REV. 871 (2015).

[109] *See* Hancock & Vaizey, *supra* note 34, at 11.

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

VI. Focus on Use Cases Rather than the Technology

Regulators should focus on specific use cases of blockchains rather than the technology itself.[111] This position finds support in experience with other disruptive technologies, such as the Internet and digital platforms. Blockchains are a neutral technology, neither good nor bad. As anything, it can, however, be relied on to pursue all kinds of objectives by the humans that operate it. We know that blockchains as well as 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 that can be applied to the blockchain—even though it is true that blockchain's cross-jurisdictional nature adds an additional challenge of detection and enforcement.[112] Yet, the technology also 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. Oftentimes, 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 realistic 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 protocol level. Regulators should moreover resist the temptation of prematurely creating new institutions.

VII. Regulators Should Resist the Temptation of Prematurely Creating New Institutions

We have already noted the pitfalls associated with premature legislation. The same warning should be issued regarding agency-creation. The Internet Corporation for Assigned Names and Numbers (ICANN) illustrates the hazards of too swiftly creating new institutions.[113] 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."[114] 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

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[111] *See* Julie Maupin, *Mapping the Global Legal Landscape of Blockchain and other Distributed Ledger Technologies*, (SSRN Working Paper, 2017), https://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=1101957 [hereinafter "Maupin, Mapping the Global Legal Landscape of Blockchain"].

[112] 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.

[113] *See* ICANN, https://www.icann.org/ (last visited May 13, 2018).

[114] Werbach, The Song Remains the Same, *supra* note 89.

through the creation of a distributed domain name registry system to store lists of domain names on a distributed blockchain database without having to go through governments and large corporations.[115] It is moreover worth noting that 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.[116]

VIII. Regulators Should Engage in a 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. Yet, no one will be fooled to believe in 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.[117] In the EU, there is clear potential 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 policy priorities.

E. Conclusion

Despite the buzz surrounding blockchain, it is important 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. It needs time and experience to develop and this is a key realization that should guide any regulatory action. Yet, looking at the speed of innovation and more recently also adoption of blockchain technology, this technology is not to be written off as emerging only in the long-term. Rather, given the rate of accelerated innovation that can be observed. Regulators should not wait to converse with the industry until blockchain is fully mature. Rather, innovators and regulators should collaborate already at this stage to facilitate

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[115] *See* NAMECOIN, http://bit.namecoin.info/ (last visited May 14, 2018).

[116] *See* Mike Ward, *Change is Coming: How the Blockchain Will Transform the Domain Name Business*, COINTELEGRAPH (Apr. 23, 2015), https://cointelegraph.com/news/change-is-coming-how-the-blockchain-will-transform-the-domain-name-business.

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

innovation beneficial to all. Blockchain is a malleable tool and how we frame it, including from a regulatory perspective, will be key. There also needs to be awareness on behalf of all actors involved in the system that setbacks will naturally occur.[118] 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.

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[118] *See* Perez C., *Technological Revolutions and Techno-Economic Paradigms* (Tallinn Univ. of Tech., Tech. Gov't and Econ. Dynamics, Working Papers, 2009).