Lex Cryptographia – The role of a principles-based approach in Blockchain/DLT Regulation

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1.1 Introduction:

With the release of the Bitcoin in 2009, a variety of associated new concepts and technologies such as Distributed Ledger Technology (DLT) and Blockchain have become popularized. Indeed, the terms DLT and Blockchain are often interchangeably used.[1] As the terminology surrounding these technologies is still evolving,[2] I have assumed the following distinction; Blockchain, is the underlying technology of several virtual currencies (including Bitcoin – which is how the technology was popularized). Blockchain, belongs to a subset of similar technologies, which are collectively defined as DLT (i.e. DLT includes Blockchain). A technical definition of these concepts is given below.

A blockchain is a type of database that takes a number of records and puts them in a block (rather like collating them on to a single sheet of paper). Each block is then 'chained' to the next block, using a cryptographic signature. This allows blockchains to be used like a ledger, which can be shared and corroborated by anyone with the appropriate permissions. There are many ways to corroborate the accuracy of a ledger, but they are broadly known as consensus(or 'the consensus protocol').[3]

Distributed ledger technology refers to the ability for users to store and access information or records related to assets and holdings in a shared database (*i.e.*, the ledger) capable of operating without a central validation system and based on its own standards and processes. DLTs differ from standard accounting ledgers in that they are maintained by a distributed network of participants (known as "nodes") rather than a centralized entity. Another common feature of DLTs is the use of cryptography as a means of storing assets and validating transactions.[4]

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[1] UK Government Chief Science Advisor, 'DLT: Beyond Blockchain', p.17, URL: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf

[2] *Supra* Note 1, p.17.

[3] *Supra* Note 1, p.17.

[4] Kakavand, De Sevres and Chilton, 'The Blockchain Revolution: an analysis of regulation and technology related to distributed ledger technologies', p.4-5, January 2017,URL: https://ssrn.com/abstract=2849251.

These technical features – such as the 'consensus protocol', the existence of nodes, the use of cryptography and oracles[5] (a unique centralised software component) which ensure the validity and integrity of information on the ledger and Smart Contracts (software which executes transactions on the platform upon the satisfaction of contractual terms) – are common to all DLT platforms, irrespective of their purpose.

The greatest impact of DLT may be felt in industries where having an audit trail/immutable log is crucial or where there are many layers or multiple players between buyers and sellers.[6] A key element of this technology is that a single ledger exists as a true record but is held in multiple synchronous copies by users.[7] It brings together database, network, access, workflow, and creates discrete silos of technology which can be addressed in an integrated way for the first time.[8] DLT do not depend on a central intermediary and instead rely on software protocols (also referred to as 'trust-less trust') to ensure the validity of the records stored within the platform. Many scholars believe that DLT could potentially lead to the deployment of a wide variety of products and services – collectively known as the 'DLT ecosystem'. Ideally, the entirety of this ecosystem will rely on the use of tokens or virtual currency to facilitate transactions for these products and services.[9]

The most prominent use-case of DLT is in the virtual currency market. Transactions (for example, in Bitcoins) are aggregated into "blocks" and appended to existing records in a decentralized network or "chain" (hence the name blockchain). An encrypted signature is used to validate any transaction. The underlying operating model is open by design and allows anonymous parties to interact without any access restrictions, also referred to as "permission-less".[10] Another associated concept is that of the Initial Coin Offering (ICO), which can be considered as the equivalent of an Initial Public Offer (IPO) in the cryptocurrency space. Interested investors can buy into the offering and receive a new cryptocurrency token issued by the company. This token may have some utility in using the product or service the company is offering, or it may just represent a stake in the company or project.[11]

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5   Alexander Tsankov, 'The "Oracle Problem" isn't a problem and why Smart Contracts makes Insurance better for everyone', (*Medium,* June 21, 2018), https://medium.com/@antsankov/the-oracle-problem-isnt-a-problem-and-why-smart-contracts-makes-insurance-better-for-everyone-8c979f09851c.

6   Maull, Godsiff, Mulligan, Brown, Kewell, 'Distributed Ledger Technology : Applications and Implications', (2017), 26 (5) Journal of Strategic Change, pp.481-489, <https://doi.org/10.1002/jsc.2148> or <https://onlinelibrary.wiley.com/doi/full/10.1002/jsc.2148>, accessed on 27/10/19.

7   See MAULL, *Supra* Note 6, p.485.

8   See MAULL, *Supra* Note 6, p.485.

9   See for example, KAKAVAND *Supra* Note 4.

10   Callsen, 'Fintech, DLT and Regulation', ICMA - International Regulatory Digest, Issue 45, Second Quarter 2017.

11   Cumming, Johan, Pant, 'Regulating the uncertainties of the crypto-economy: Managing Risks, Challenges and Regulatory Uncertainty', p.3, Journal of Risk and Financial Management, 24th July 2019.

Collectively, these new technologies and concepts have led to a series of regulatory concerns and developments, in the financial sector (due to the use of virtual currency) and beyond.

For example, the potential for unrestricted transactability between parties has led to a growth of DLT-based Fintech services. A major challenge for the financial industry with regards to ensuring the legitimacy of transactions resides in the lack of technical standards and harmonised rules. This is a critical aspect for the adoption of any emerging DLT solution in a "network industry" such as finance.[12] Before going further into the concerns faced in regulating DLT (and the questions this thesis seeks to address), I will discuss some examples of how regulators have approached this technology so far.

1.2 Existing Attempts to Regulate DLT – an introduction:

The numerous applications of Blockchain in the digital asset market have been recognised by the European Legislator. For example, in the 2018 FinTech Action plan, the European Commission requested the European Supervisory Authorities (ESAs) assess the suitability of the EU regulatory framework with regards to ICOs and crypto-assets more generally.[13] In its 'Advice to EU institutions', in 2019, the ESMA (European Securities and Markets Authority) called for the adoption of an 'EU-wide approach', considering the cross-border nature of crypto-assets and the need to establish a level playing field in the EU for all stakeholders involved.[14]

A similar approach to DLT regulation has been undertaken by American regulators at both Federal and State levels – for example, by focusing on the use of DLT platforms on the crypto-asset market with the intention of subjecting trade on these platforms through existing KYC (Know Your Customer) and AML (Anti Money Laundering) regulation backed by Federal Laws, which has resulted in numerous federal and state-level regulations. The disparate decision-making bodies have created a patchwork regulatory landscape for cryptocurrencies and blockchain technology which runs on antiquated money transmitter laws.[15]

12　See MAULL, *Supra* Note 6.

13　European Commission, 2018. 'FinTech Action plan: for a more competitive and innovative European financial sector', March 2018. Available at https://ec.europa.eu/info/publications/180308-action-plan-fintech_en

14　ESMA, 'Crypto-assets need common EU-wide approach to ensure investor protection', 9th January 2019, URL at: https://www.esma.europa.eu/press-news/esma-news/crypto-assets-need-common-eu-wide-approach-ensure-investor-protection.

15　Scott Hughes, 'Cryptocurrency Regulation and Enforcement in the U.S', 45 W. St. L. Rev. 1, 2017.

Recently, an attempt to harmonise the existing regulations in the USA was made in the form of the recent Uniform Regulation for Virtual Currency Business Act (URVCBA);[16] however, this has been met with considerable backlash for several reasons, such as the introduction of a money transmitter license on crypto and blockchain companies – with the state of Nevada (amongst others) rejecting the proposed regulation.[17]

There have been also regulatory developments with respect to use-cases of DLT outside of virtual currency as well. For example, the EU has taken purposeful strides towards the creation of a regulatory framework for DLT in general, with the launch of the EU Blockchain Observatory and Forum ("the Forum") on 1st February 2018 by the European Commission. This initiative was created for the purpose of "...mapping key initiatives, monitoring developments and inspiring common actions".[18] Created as an EU Pilot Project, the Forum is run under the EC's Directorate General for Communications Networks, Content and Technology (DG CONNECT) and has established partnerships with private contractors and academic institutes.[19]

The Forum has established several working groups (WG) to identify and research existing blockchain initiatives within the EU and other countries, monitor and discuss technical developments and challenges, look at the regulatory and legal conditions in order to offer more legal certainty, seeking to draw lessons and formulate potential ideas for action at European level and the members were chosen through an open call selection process conducted by the Forum.[20] Consider for example, the Blockchain Policy and Framework Conditions WG.

This Group aims to look at cross-technology and cross-industry issues to define the policy, legal and regulatory conditions needed to promote the regulatory and legal predictability necessary for larger-scale deployment of blockchain applications.[21] This WG explores regulation in the context of the DLT ecosystem (by considering cross-technology and cross-industry issues), as opposed to a narrower focus on a single-use case (usually cryptocurrency) of DLT. As we will see below in the problem

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16 Keith Bishop, ' Legislator Proposes Enactment of Uniform Regulation for Virtual Currency Business Act', <the National Law Review, March 1, 2019>, URL at: https://www.natlawreview.com/article/legislator-proposes-enactment-uniform-regulation-virtual-currency-businesses-act.
17 Osato Nomayo, 'Nevada Lawmakers scrap flawed cryptocurrency bill', <bitcoinist blog, 19th March 2019>, URL at: https://bitcoinist.com/nevada-scrap-cryptocurrency-bitcoin-regulations/. A letter in opposition to this bill from a local blockchain company can be found here : https://www.leg.state.nv.us/App/NELIS/REL/80th2019/ExhibitDocument/OpenExhibitDocument?exhibitId=37683&fileDownloadName=SB%20195_Letter%20of%20Opposition_Filament.pdf.
18 European Commission, 'European Blockchain Observatory and Forum', Last updated: 9 November 2019, URL: https://ec.europa.eu/digital-single-market/en/eu-blockchain-observatory-and-forum
19 EU Blockchain Observatory and Forum, 'FAQ', URL: https://www.eublockchainforum.eu/faq.
20 See the Forum FAQ, *Supra* Note 19.
21 See the Forum FAQ, *Supra* Note 19.

statement, this thesis also shares a similar focus, as the proposal made is targeted towards regulating the DLT ecosystem as a whole.

The reason this thesis chooses to focus on regulating the DLT ecosystem in general is due to the fact that a majority of the existing attempts to regulate DLT are from a financial perspective, viewing the technology as a means to exchange virtual currency and not accounting for the unique technical features of the platform. This has for example, enabled the DLT platform (through virtual currency service providers) to serve as a regulatory target for existing instruments of financial regulation such as various AML and KYC directives, despite the fact that the pseudonymous nature of cryptocurrency enables cross-border transactions to bypass such KYC and AML regulation.[22]

The lack of consideration for the architecture of the DLT platform can be evidenced from attempts to circumvent existing regulations in the form of either illegal payments through the use of the onion routing (which involves the use of a web browser known as Tor, which hides the IP address of the user)[23] to make virtual currency payments; or using exchanges such as BitMex which are based in jurisdictions outside the ambit of such regulations.[24] There are increasing uses of DLT platforms for criminal purposes with the amount of cryptocurrency spent on the dark web estimated at around $600 million in the last three months of 2019 alone,[25] with DLT also being used as platforms for the financing of terrorist groups[26] from the Middle East. Techniques of exploiting a DLT platform in general, such as a 51% attack - which is an attack by a group controlling 51% or more of the transacting power on a blockchain – have also not been considered by regulators. In the USA, some

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22 See HUGHES, *Supra* Note 15, p.7 and 8, for examples in the USA. Despite this feature of DLT platforms, the US Financial Crimes Enforcement Network mandates crypto-exchanges and administrators to register as Money Service Businesses which are expected to comply with AML and KYC regulations. More examples of similar regulation in other countries will be provided in Chapter 3.

23 See for example in the United states, Nathaniel Popper, 'Dark Web drug sellers dodge police crackdowns', <the New York Times, June 11, 2019>, URL: https://www.nytimes.com/2019/06/11/technology/online-dark-web-drug-markets.html?action=click&module=RelatedLinks&pgtype=Article.

24 BitMex has been publicly accused of financing terrorism and escaping regulations due to its location, see Bambrough, 'Bitcoin Bears poised after Dr Dooms dire crypto exchange warning', <Forbes, Jul 18, 2019>, URL: https://www.forbes.com/sites/billybambrough/2019/07/18/bitcoin-dr-doom-nouriel-roubini-made-a-massive-bitmex-warning/#61c0f6ee4862. Bitmex has also been subject to an investigation by the US CTFC to determine whether it has broken American law by allowing US users to trade on its platform – see https://www.ccn.com/crypto-exchange-bitmex-under-cftc-investigation-over-us-users-bloomberg/

25 Propper, 'Bitcoin has lost steam, but criminals are still loving it', <the New York Times, January 28, 2020>, URL : https://www.nytimes.com/2020/01/28/technology/bitcoin-black-market.html.

26 Propper, 'Terrorists turn to bitcoin for funding and they're learning fast', <the New York Times, August 18, 2019>, URL : https://www.nytimes.com/2019/08/18/technology/terrorists bitcoin.html?action=click&module=RelatedLinks&pgtype=Article

headway has been made in this regard, with scholars debating on the applicability of existing laws in such an incident.[27]

Important problems from a law enforcement perspective include a lack of information on transactions in the ledger and also the fact that transaction details are encrypted by the user. This makes it harder to link specific payments to specific individuals[28]. While issues such as trust and control over nodes in a DLT[29] are common issues discussed in the context of DLT regulation – adapting regulation to tackle DLT specific crime and misuse has not yet been done.

The integrity of the Distributed Ledger has also not been taken into account by regulators. For example, the closest example on validity of the blockchain comes from a brief mention in a statement on emerging audit technologies (including blockchain) by the American Institute of Certified Public Accountants in 2019[30] - this anecdotal note on the integrity of the DLT platform has only been mentioned by a professional organization and not a regulator. The need to ensure the integrity of the blockchain is mentioned, but there is surprisingly no mention of the terms 'Oracle' and 'forking' – which are associated with the integrity of the ledger.

While regulators are pressed to ensure a balance between the freedom to innovate and the protection of market participants, it must be noted that technological solutions to these problems are slowly being developed, which can be favourably relied upon by regulators. For example, researchers have discovered a means to deanonymize Tor users through Bitcoin transaction analysis.[31] Tools for analysing DLT records to find suspicious financial information are also being developed. This has also led to the growth of the field of Blockchain forensics.[32] Therefore, DLT have unique elements in their architecture including nodes, Oracles, forks in the chain – and such vulnerabilities on these networks can only be exploited by actors who have a significant degree of computing power and technical knowledge.

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27   Josh Lawler, 'Punishing the Byzantine Fault: Application of US Law to a 51% attack', <Medium.com, 8th Jan 2020>, URL at: https://medium.com/swlh/punishing-the-byzantine-fault-application-of-us-law-to-a-51-attack-or-threat-921bb0469247.

28   Ian Kearns, 'Is Blockchain good news or bad when it comes to policing and crime?'. <The Police Foundation UK, 21st September 2018>, URL at: http://www.police-foundation.org.uk/2018/09/is-blockchain-good-news-or-bad-when-it-comes-to-policing-and-crime/.

29   Walton, Dhillon, 'Understanding Digital Crime, Trust and Control in Blockchain Technologies', 23rd Americas Conference in Information Systems, 2017, URL at: https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1075&context=amcis2017

30   AICPA, 'Proposed Statement on Auditing Standards', 20th June 2019, URL at: https://www.aicpa.org/content/dam/aicpa/research/exposuredrafts/accountingandauditing/downloadabledocuments/20190620a/20190620a-ed-sas-audit-evidence.pdf.

31   Jawaheri, Sabah, Boshmaf, Erbad, 'Deanonymizing Tor hidden server users through Bitcoin Transaction Analysis', 10th July 2019, URL at: https://arxiv.org/pdf/1801.07501.pdf.

32   'Blockchain Ledgers are unlocking the new level of Forensics', <Crypto Briefing, 22nd July 2019>, URL at: https://cryptobriefing.com/blockchains-distributed-ledger-unlocking-forensics/.

The purpose of this section was to show that EU and American regulators have taken cognizance of the various use-cases of DLT, but have mostly focused on the cryptocurrency space due to its popularity. As the technology is still developing and the field of DLT regulation is still growing, regulators face significant challenges in effectively governing the technology as a whole – with questions arising as to whether the technology must be regulated as a whole in the first place, due to technical vulnerabilities such as the ones mentioned above.

The reason for pointing out the above technical vulnerabilities in cryptocurrency regulation is to show that they arise due to the actions of actors manipulating the technology (and are not irredeemable flaws). They also extend to the wider DLT ecosystem and involve the exploitation of certain elements of DLT architecture common to all platforms and their exploitation involves a great degree of technical knowledge and computational power. Furthermore, in response to this apparently unrestricted freedom, technological solutions have emerged, as mentioned earlier.

The role of law in resolving these technically grounded issues, together with other legal difficulties faced by regulators will be discussed in the next section.

1.3 Problem Statement - The role of a new body of DLT-specific law in addressing its regulation:

In order to answer the above problem statement, the first sub-question will involve a critical analysis of how state regulators have approached the regulation of DLT. As stated earlier, most of the regulatory activity to date has focused on the decentralized virtual currency applications of DLT. This focus is partially explained by the fact that decentralized virtual currencies are the first and most widely adopted use of the underlying technology, receiving extensive media coverage and venture-capital attention, especially with the introduction of Bitcoin and Blockchain in general in 2009.[33] An example of the wider DLT community being affected by virtual currency focused regulation was given earlier in the form of the American URVCBA – which shows that regulating DLT only in context of virtual currency can negatively impact the wider DLT community.

Virtual Currency applications have led to an increase in usage of DLT as they facilitate quick and anonymous transactions of currency across the globe. The increasing popularity of illegal activity in the virtual currency sector represents an imminent need to introduce new regulation that

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33   Reyes, 'Moving beyond bitcoin to an endogenous theory of decentralised technology regulation: An initial proposal', Villanova Law Review, 2016, vol.61, no.1, p.203.

accommodates this unique technical architecture (which is common to all platforms), as opposed to waiting for an ideal alternative regulatory proposal to gain public approval. Regulatory cognizance of these features would not only benefit financial regulators, but also the wider DLT ecosystem in general – as these technical features (and vulnerabilities) are shared across all platforms.

Therefore, the aim of answering the first sub-question is to show that state regulators will be in a better position to regulate the technology by taking cognizance of certain important technical elements of the platform and by being more inclusive towards the wider DLT community as well. This will be done in Chapter 3, as the insights derived from the second sub-question will be also relied on to justify these aims. In order to better understand the current trends in DLT regulation, the second sub-question aims to analyse how scholars have approached the topic of DLT regulation.

The task of regulating a DLT ecosystem across numerous undetermined sectors (as it slowly takes shape) will, in my opinion, require some degree of cross-sector collaboration between governments, businesses, non-profits, communities and the public as a whole.[34] This can be defined as the linking and sharing of activities, resources, capabilities and information by organizations in two or more sectors to achieve jointly an outcome that could not be achieved by organizations in one sector separately.[35]

Cross-sector collaboration will currently only occur in a limited sense and will be difficult to measure effectively, as the ecosystem is gradually developing across more sectors (outside of virtual currency) and these sectors further need to reach a point where they can better achieve their goals through such collaboration with governments and with operators from other sectors.[36]

Inspired by the concept of code-based or architecture-based regulation (i.e. regulating a technology through the manipulation of the underlying code upon which it operates) which was first proposed by Lessig (1998, in the form of 'code-as-law' or CAL) and with the intention of achieving the collaborative outcome given above, scholars have proposed several promising alternatives to conventional regulation which can be applied to the technology as a whole such as, the endogenous theory of DLT regulations (Reyes, 2016), Multistakeholder co-regulation (Herian, 2019) and Polycentric Co-regulation (Finck, 2018). However, as this thesis will aim to show through a literature review, these theories can only be applied once the ecosystem has developed to an appropriate extent.

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[34] Bryson, Crosby and Stone, 'The Design and Implementation of Cross-Sector Collaborations: Propositions from the Literature', p.1, University of Minnesota Public Administration Review, December 2006.
[35] See BRYSON, *Supra* Note 34, p.1
[36] See BRYSON, *Supra* Note 34, p.2.

This literature review will also aim to show what an idealised DLT ecosystem could look like, in order to justify the above points on cross-sector collaboration.

Regulators must ultimately focus on creating a balance between protecting lawful participants in the market and the need to ensure such regulation is not restrictive enough to create a "chilling effect" on the innovation of DLT in general. It is argued that this protection, given the current state of the DLT ecosystem, can only be guaranteed by law enforced through state-backed regulation. A short-term measure is useful because it addresses the gap in regulation while at the same time providing creators with the freedom to innovate the technology further. In the original debate on the law of cyberspace, between the Honourable Judge Easterbrook and Lawrence Lessig, I choose to follow the stance of Judge Easterbrook, who states:

> "Let us not struggle to match an imperfect legal system to an evolving world that we understand poorly. Let us instead do what is essential to permit the participants in this evolving world to make their own decisions".[37]

By answering the first two sub-questions, the aim is to highlight the current trends in DLT regulation and to show what needs to be achieved to allow regulators to effectively govern the use of this technology. The third sub-question concerns my proposal for putting regulators in a better position to regulate the technology as a whole. The role of law in addressing the technical vulnerabilities mentioned in the previous section, along with my proposal for regulating the ecosystem as a whole will be discussed.

The DLT ecosystem is characterised by a wide range of new business practices and novel technical features that do not have a precise equivalent in the off-chain world (e.g. the technical features mentioned in Section 1.1).[38] In order to aid regulators in the short-term as the ecosystem expands, I propose the use of four principles, which aim to serve as a set of guidelines which regulators can further modify, depending on how they wish to govern DLT as a whole. Due to the constant flux in the DLT ecosystem, this small set of principles (as opposed to a larger and more comprehensive framework) can be effectively incorporated into the regulation of any DLT platform and can serve as a foundation for other DLT-specific regulation.

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37   Frank H. Easterbrook, "Cyberspace and the Law of the Horse," 1996 University of Chicago Legal Forum 215 (1996).
38   Alexis Collomb, Primavera De Fillipi, Klara Sok, 'Blockchain Technology and Financial Regulation: A risk based approach to the regulation of ICO's', p.29, European Journal of Risk Regulation, Cambridge University Press, 2019.

A shift from rules to principles,[39] affords a greater degree of openness and flexibility to regulators while preventing new innovations from being bogged down in a regulatory thicket. Furthermore, by sticking to a few select principles, this proposal will allow future revisions in the regulatory regime, as both the technology and the ecosystem scale.[40] In answering this sub-question, the aim will also be to show that applying the novel regulatory theories discussed earlier to a principles-based regulatory framework would be a better choice than existing rule-based DLT regulation, due to the drawbacks highlighted in Chapter 3.

My proposal seeks to regulate the technical architecture of DLT through the rule of state-backed law, in the form of principles-based regulation. CAL is used to regulate the technology through its underlying architecture/code – effecting the rule of law through the modification of the technical architecture. The importance of regulating technical architecture, as opposed to giving effect to regulation through this architecture (which is what CAL is), in the context of DLT regulation – will be explained in Chapter 4. This argument also ties into the criticism mentioned in the previous section, regarding the lack of consideration of technical architecture by regulators.

Since the creation of an entirely novel body of law would be far beyond the scale of this thesis, I have chosen to classify these principles as a precursor which regulators can use in creating this novel body of law – which I choose to term as a *Lex Cryptographia*. It represents a series of novel legal principles that refer to a new body of law, which Wright and de Fillipi suggest regulators must take into consideration while regulating blockchain technology[41] or any other variant of DLT, which must in the short-term, be administered through state-backed regulation.

The above is my own interpretation of their concept which greatly differs from the original – which firstly considers such a body of law to represent a series of novel legal questions (as opposed to principles) and secondly advocates for the administration of such a law through self-executing smart contracts and decentralised (autonomous) organisations (as opposed to doing this through state-backed law).[42] Therefore, Chapter 4 will discuss my proposal in greater detail, further explaining the benefits of a principle-based approach in the context of DLT regulation.

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39 Fenwick, Mark D.; Kaal, Wulf A. Ph.D.; and Vermeulen, Erik P.M. "Regulation Tomorrow: What Happens When Technology Is Faster than the Law?," American University Business Law Review, Vol. 6, No. 3 ()., p.590

40 See FENWICK, *Supra* Note 39, p.590.

41 Wright, Aaron and De Filippi, Primavera, 'Decentralized Blockchain Technology and the Rise of Lex Cryptographia', (March 10, 2015). URL at: SSRN: https://ssrn.com/abstract=2580664.

42 See WRIGHT and DE FILIPPI, *Supra* Note 41.

1.4 Main Research Questions and Sub-questions:

The main research question is essentially whether conventional state-backed regulation would better enable public regulators to govern the use of DLT as a whole. In order to answer this question, three sub-questions emerge. The first sub-question aims to examine how various regulators across the EU and US (along with a few other countries) have approached the regulation of DLT. The second sub-question aims to examine how scholars have approached the topic of DLT regulation. In answering both these sub-questions, the aim is to establish the current trends of DLT regulation and also to point out several key areas which DLT-specific regulation must focus on, to better aid regulators in regulating a technology that is currently in a constant state of flux.

The third sub-question centres around my proposal of principles-based regulation, as a means of addressing the main research question given above.

Main Research Question:
Can DLT Regulation be better aided through the incorporation of a novel body of law (*Lex Cryptographia*) in the form of principles which can be tailored according to regulatory needs and demands?

Sub-questions:
(i) What is the current global landscape of DLT regulation?
(ii) In comparison with the existing body of literature on DLT regulation, how effective have current attempts to regulate DLT been, especially in consideration of its many use-cases?
(iii) Is the concept of a *Lex Cryptographia* achievable? In light of the existing attempts at DLT regulation, can some general principles be established for the purpose of creating a *Lex Cryptographia*?

1.5 Methodology:

This thesis will employ an evaluative approach with respect to describing the global landscape of DLT regulation and will analyse the drawbacks of these existing attempts at such regulation, which will be done in Chapter 3. A similar evaluative (and analytical) approach will be carried out in the second chapter as well, with the intention of reviewing selected literature on DLT regulation. The findings from both these chapters will be comparatively analysed for the purpose of identifying essential principles which can constitute a precursor to a *Lex Cryptographia* – and the effectiveness of these principles will be explored.

1.6 Overview of Chapters:

Chapter 2 will be a literature review of selected academic literature on the topic of DLT regulation. The aim of such a review will be to examine whether the theories put forth by scholars would be suitable to regulate the technology in its current state and to also examine what an idealized DLT ecosystem could look like.

In Chapter 3, the aim will be to examine in greater detail how state regulators in the USA and the EU (along with several other countries) have approached the concept of DLT regulation. Through this analysis, the aim will be to establish what regulators have done right so far in regulating the technology and also identify certain areas of under-regulation which can potentially undermine the entire exercise of regulating the technology.

In Chapter 4, we will examine my proposal for allowing state regulators to better govern the technology, in the short-term. By doing so, the aim will be to show the effectiveness of a principles-based approach and how such an approach would better serve regulators as opposed to the long-term solutions of CAL and the hybridized regulatory theories which have originated from it.

Chapter 5 will be the concluding chapter, with the aim of summarising the observations from the previous chapters and highlighting the fact that this thesis seeks to regulate DLT by conventional means, as opposed to the popular idea of using CAL to give effect to regulation – and how this benefits DLT regulation in the short term.

Chapter 2: DLT Regulation – A literature review:

2.1 Introduction:

This chapter aims to discuss how scholars have approached the topic of DLT regulation, in the form of a literature review. There are three reasons for doing so. First, to gauge the effectiveness of the use of several hybridized theories of regulation, with respect to the DLT ecosystem as a whole. Second, a vast majority of scholars have remained focused on virtual currency applications of the technology – and as mentioned in the introduction, the wider DLT community can benefit from some of the ideas put forth from this regard. Lastly, in providing this review, we will also justify why the ecosystem as a whole should be subject to the exercise of regulation.

In this review, I have selected 11 articles, published between the years 2012-2019. In a time-frame of 7 years, there is a clear shift in the way scholars are perceiving DLT. Initially only regarding its first use-case in virtual currency platforms as opposed to the technology itself, there is a shift towards advocating for the need to regulate DLT as a whole. The body of academic literature on DLT is extremely vast and a comprehensive review of its entirety would be not be manageable in the context of this thesis. I have limited my review to articles, which provide an overview of how scholars in general have approached the concept of DLT regulation.

2.2 Classification of existing attempts – a closer look:

Most of the literature selected either advocates for some form of a 'wait-and-watch' approach[43] or proposes its own unique regulatory approach as a suitable alternative to existing regulatory proposals.[44] Some proposals of the second type rely on Lessig's concept of 'code-as-law'. As mentioned in the introduction, 'code-as-law'(CAL) refers to the enforcement of law through technical architecture (i.e. through computer code).

Of this second type, three hybridized theories of regulation which heavily rely on the use of CAL and its application to DLT regulation in the immediate future will be examined. In order to judge their

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[43] Some examples (from the literature selected) include Collomb and Sok, 'Blockchain/DLT : What impact on the financial sector?', *Digiworld Economic Journal*, No. 103, 3rd Q, p. 93, 2016 and De Fillipi, 'Bitcoin: A regulatory nightmare to a libertarian dream', Internet Policy Review: Journal on Internet Regulation, Volume 3, Issue 2, 24th May 2014.

[44] A good example of this type of approach is Reyes, 'Moving beyond bitcoin to an endogenous theory of decentralised technology regulation: An initial proposal', Villanova Law Review, 2016, vol.61, no.1, p.203.

effectiveness, other literature selected will be utilised to describe an idealised version of the DLT ecosystem and its potential for scalability. These theories will be discussed in greater detail in the next section.

First is Reyes's article, which in my opinion, provides the most compelling argument in favour of adopting the 'code-as-law' approach and hence it was selected for this review. In synthesising an 'endogenous theory of DLT regulation', she has evaluated existing attempts of self-regulating through code-as-law and has ultimately designed a unique proposal involving the incorporation of compliance into the DLT code thereby eliminating the need for incentives.

Secondly, Polycentric co-regulation, proposed by Finck (2019), involves the application of co-regulation (delegation of legislative objectives to established parties in the field), adopted through polycentric decision-making, to make the process more inclusive, with the intention of using CAL to simulate polycentric participation in the law-making phase – focusing on the positive impact of digital tools on civic engagement.[45]

Thirdly, Multistakeholder co-regulation (MS), discussed by Herian (2019)[46], calls for consensus across jurisdictions in order to collectively define the form and nature of regulation in a range of circumstances. This also operates on a smaller scale across individual jurisdictions, regulatory groups and regimes.

Herian's work also identifies the current trends in DLT regulation as 'self-regulation' and 'rule by entrepreneur', which he considers as a form of 'bottom-up' regulation. In order to get past this trend, further understanding of what forms of regulation are possible in a blockchain context and in particular, where the potential choke points is what he feels regulators need to pay attention to.[47] This aspect of his work is relied on as it provides a useful base for supporting the aims of this chapter.

With respect to the 'wait-and-watch' type of proposals, the authors often go a step further than this,[48] in the sense that they try to predict possible scenarios and future challenges and how regulators may

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[45] Michele Finck, 'Blockchain Regulation and Governance in Europe', pp.172, 176, 178-9, Cambridge: Cambridge University Press, 2019.

[46] Robert Herian, 'Regulating Blockchain: Critical Perspectives in Law and Technology', p.63-65, Routledge, October 2018.

[47] See HERIAN, *Supra* Note 46, p.2

[48] An example from the literature selected - Reuben Grinberg, *Bitcoin: An Innovative Alternative Digital Currency*, 4 Hastings Sci. & Tech. L.J. 159 (2012), URL:
https://repository.uchastings.edu/hastings_science_technology_law_journal/vol4/iss1/3.

better anticipate them. These kinds of proposals often relate to the financial aspect of DLT, where they often predict that the state would eventually have to regulate either cryptocurrency or DLT from a financial perspective.[49] The predictive element of these approaches will be highlighted later on in this review, with the intention of determining which of these predictions are more likely to occur and tailoring the solution discussed in the fourth chapter to take these predictions into account. For the table below, I shall categorize these types of proposals as 'predictive' (in a general sense), as they attempt to predict future challenges and scenarios with respect to the DLT landscape and its regulation.

In this chapter, the aim will be to use these 'predictive' articles to not only show what the ecosystem looks like at the present, but also to provide an account of what an idealized DLT ecosystem might look like. Furthermore, the applicability of the hybridized regulatory theories mentioned above to the ecosystem at present will be examined. In determining this applicability, an important factor which must be taken into consideration is the ability to effect some form of cross-sector collaboration. As we will see in the next section, this collaboration is a desirable outcome for not only the abovementioned regulatory theories, but also with the 'wait-and-watch' and 'predictive' types of proposals.

Cross-sector collaboration (which was discussed in Chapter 1), implies the formation of links between different types of companies, industries and public institutions, aiming to address the challenges and opportunities that cannot be realised, or are difficult to realise within a single organisation.[50] The concept of a DLT ecosystem itself, in my opinion, will have to depend on such collaboration in order to be functional. As we will see in the Chapter 3, effective DLT regulation focuses on achieving some degree of cross-sector collaboration.

Effective collaboration is a difficult concept to measure in itself – due to the constant flux of the DLT ecosystem, as it develops across more sectors. For the purpose of my thesis, I will choose to assess such effectiveness based on the definition given above – i.e. whether the use of such regulatory theories would encourage different elements of the ecosystem to collaborate, as opposed to trying to achieve their goals without collaborating.

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[49] Collomb and Sok, 'Blockchain/DLT : What impact on the financial sector?', *Digiworld Economic Journal*, No. 103, 3rd Q, 2016.
[50] Cankar, Petlovsek, 'Private and Public Sector Innovation and the Importance of Cross-Sector Collaboration', The Journal of Applied Business Research, Volume 29, No.6, p.2, November/December 2013.

The following table summarizes the literature selected, the dates of publication and based on the classifications made above, categorizes the proposals used (as either 'wait-and-watch', a unique regulatory proposal or predictive):

No.	Name of Article and Author	Year Published	Nature of Proposal
1.	GRINBERG, 'Bitcoin: An innovative alternative digital currency'.	2012	Predictive
2.	De Fillipi, 'Bitcion: A regulatory nightmare to a libertarian dream',	2014	'Wait-and-watch'
3.	Wright, Aaron and De Filippi, Primavera, 'Decentralized Blockchain Technology and the Rise of Lex Cryptographia'.	2015	Predictive
4.	Tu and Meredith, 'Rethinking Virtual Currency Regulation in the Bitcoin Age'.	2015	Predictive
5.	Collomb, Sok, 'Blockchain/DLT : What impact on the financial sector?',	2015	Predictive
6.	Reyes, 'Moving beyond bitcoin to an endogenous theory of Decentralised technology regulation: An initial proposal'.	2016	Unique regulatory approach based on Lessig's concept of 'code-as-law'
7..	Kakavand, De Sevres and Chilton, 'The Blockchain Revolution: an analysis of regulation and technology related to distributed ledger technologies'.	2017	Predictive
8.	Phillip Paech, 'The Governance of Blockchain Financial Networks'.	2017	Predictive
9.	Michele Finck, 'Blockchain Regulation and Governance in Europe'.	2018	Unique regulatory approach based on 'code-as-law'
10.	Herian, 'Regulating Blockchain : Critical Perspectives in Law and Technology'.	2019	Unique regulatory approach & predictive
11.	Douglas Cumming, Sofia Johan, Anshum Pant, 'Regulation of the crypto-economy:	2019	Predictive

Managing Risks, Challenges and Regulatory Uncertainty'.		

2.3 Review and Critical Analysis of the Literature Selected:

The purpose of this section is to highlight the approaches scholars have taken towards the regulation of DLT, since the creation of the Bitcoin in 2009 under the pseudonym Satoshi Nakamoto[51] until 2019. Due to the popularity of cryptocurrencies, it is understandable that a majority of the earlier literature focusses on cryptocurrency regulation – with minimal focus on the underlying DLT technology. Initially, scholars were dismissive of regulatory concerns even with respect to virtual currency. Grinberg (2012) for example, "most consumers do not care about anonymity and centralization" and hence Bitcoin (and other virtual currencies) would not be competitive in the traditional e-commerce market.[52]

Fillipi (2014), believes that the Bitcoin ecosystem can operate in a regulated framework either through self-regulation or by means of state regulation. At this stage, it is clear that although largely confined to its initial use-case as a virtual currency trading platform, the technology behind the Bitcoin is largely responsible for its disruptive potential. However, he concludes by stating that given the current state of impact at that time, there is little need for government intervention and regulation of the protocol would arise 'organically'[53] – without the need for such governmental intervention, as bitcoin adoption increases.

However, he himself changes his stance (which is the foundation for the concept of *Lex Cryptographia*) in his article together with Wright (in 2015), – which introduces the concept of *Lex Cryptographia* in the context of blockchain technology. This is the first article from the literature selected (chronologically) which discusses a broader scenario of regulating DLT and discusses the need for doing so:

> "As blockchain technology becomes widely adopted, centralized authorities, such as governmental agencies and large multinational corporations, could lose the ability to control and shape the activities of disparate people through existing means."[54]

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[51] Satoshi Nakamoto, 'Bitcoin: A Peer-to-Peer Electronic Cash System, Bitcoin Project, 2008, URL: http://bitcoin.org/bitcoin.pdf.
[52] Grinberg, 'Bitcoin: An innovative alternative digital currency', 4 Hastings Sci. & Tech. L.J, p.169.
[53] De Fillipi, 'Bitcion: A regulatory nightmare to a libertarian dream', Internet Policy Review: Journal on Internet Regulation, Volume 3, Issue 2, p.9, 24th May 2014.
[54] Wright, Aaron and De Filippi, Primavera, 'Decentralized Blockchain Technology and the Rise of Lex Cryptographia', (March 10, 2015). URL at: SSRN: https://ssrn.com/abstract=2580664.

A similar broader approach is also adopted by Tu and Meredith (2015), who provide a convincing reason to reform virtual currency regulation, arguing that "a narrow focus on the technical applications and extension of existing law creates a deficient regulatory regime". In this regard, they propose the following suggestion for regulators, which echoes the cross-collaborative outlook described in the previous section:

> "(1) engage the various agency stakeholders to promote cross-communication; (2) think more globally about the wide spectrum of issues arising from virtual currency; and (3) embrace the unique and distinct characteristics of virtual currency."[55]

However, they do not argue in favour of a specific proposal and conclude by calling for a more workable, comprehensive and cohesive regulatory regime for virtual currencies.[56]"

The trend of looking beyond virtual currency and recognising the potential of the underlying technology (which, as stated earlier, is blockchain – a variant of DLT) picks up around 2016-2017. This also marks the start of scholars highlighting the need for cross-sector collaboration, which is why the concept was examined in this Chapter. The need for collaboration is primarily due to the diversity of actors in the DLT ecosystem, as a result of its numerous applications both inside and outside the financial sector, thereby justifying the fact that DLT is much bigger in scale than virtual currency markets.

Peach (2017) provides a comprehensive account of the impact of blockchain in financial markets and highlights features of this technology which can potentially be disruptive in the future. He advocates for the need to subject blockchain financial networks to a functionally equivalent regulatory and legal framework – i.e. one that takes these features into account, as he believes that the blockchain revolution will not result in some form of unified, fail-proof ecosystem; it will instead be a technological revolution with new ways of transaction processing, recording and reporting, creating a more efficient financial market. He also rightly opines that there will be some degree of intermediation in a blockchain-based economy,[57] and correctly shows that the idealized concept of a completely decentralised economy is not possible in the DLT ecosystem. This need for intermediation

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[55]   Tu and Meredith, 'Rethinking Virtual Currency Regulation in the Bitcoin Age', Washington Law Review, Vol. 90, p. 271, 2015.

[56]   *Supra* Note 55, p.347.

[57]   Phillip Paech, 'The Governance of Blockchain Financial Networks', 80(6), Modern Law Review, p.1108, 1109, 1110 2017.

will require cross-sectoral collaboration, due to the diverse nature of actors which function as intermediaries on these networks.

Collomb and Sok (2016), provide other examples of financial applications of DLT in addition to virtual currency platforms – such as corporate governance, financial accounting and reporting, supply chain management, compliance and crowdfunding.[58] Kakavand , De Sevres and Chilton (2017), in their article, provide a wealth of information on DLT (in its true sense) and its various applications – both financial (in financial markets and smart contracts) and otherwise (for example, in real estate, healthcare, smart governance and for artificial intelligence).[59] Cumming, Johan and Pant's (2019) article also contributes similarly, but is restricted mostly to the virtual currency space – by describing various means by which cryptocurrency fraud (which could theoretically be committed on any DLT platform that is tokenized) can occur.

Due to the numerous industries in which DLT platforms can be used, technical interoperability (or compatibility) between these platforms is essential for the DLT ecosystem to function effectively as a collective ecosystem. This brings about the need for cross-sector collaboration to ensure such interoperability, so as to ensure the functioning of the ecosystem as a whole, which can be seen from the warnings given by these authors.

For example, the challenges outlined by Collomb are similar to the gaps in existing DLT regulation today – governance, standards and interoperability.[60] Kakavand's warning of parallel and inconsistent regulatory development due to the fragmentation of this space could become a reality.[61] As he correctly states, DLT still has to go through numerous iterations, trials, evolutions and failures before it reaches a stage of widespread adoption.[62]

Furthermore, it is evident that it is still too early to determine how the landscape will develop and how interoperability between different systems will be achieved – and on what scale.[63] Especially in the case of financial markets – where a large majority of the attention is focused, technical aspects

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[58]   See COLLOMB and SOK, *Supra* Note 49, p.99.
[59]   Kakavand, De Sevres and Chilton, 'The Blockchain Revolution: an analysis of regulation and technology related to distributed ledger technologies', p.12, January 2017,URL: https://ssrn.com/abstract=2849251.
[60]   See COLLOMB and SOK *Supra* Note 49, p.110.
[61]   See KAKAVAND, *Supra* Note 59, p.26.
[62]   See KAKAVAND, *Supra* Note 59, p.26.
[63]   See COLLOMB and SOK, *Supra* Note 49.

such as standards and interoperability are key areas which have not been paid much attention to by regulators.[64]

Cumming's article calls for the need for internal collaboration between governmental agencies and DLT platform developers in the establishment of a regulatory framework, as more research needs to be done to understand the appropriate legal and surveillance/enforcement regimes that will minimize negative externalities from blockchain applications without stifling innovation – this offers a natural setting for the intersection of the fields of law and technology and law and economics.[65]

As we will see in Chapter 3, these warnings have not been completely heeded by regulators and do not consider the importance of the technical architecture of the platform. There is just one general standard on Smart Contracts and the standard on DLT platforms will only be released in 2021 (discussed below) and together with the technical features explained in Chapter 1, which form the basis for such standards, regulators have not taken the technical architecture into cognizance.

With only a single global ISO standard on smart contracts[66] and the first DLT-specific standards proposed for 2021,[67] the presence of numerous opinions and long-term directional views on DLT[68] has already led to a disharmonized body of DLT regulation. For example, the Smart Contract standard is primarily for the purpose of interoperability between different forms of such Contracts and different DLT platforms – describing what they are, how they work and methods of interaction between multiple smart contracts.[69]

The general standard on Blockchain/DLT is in the works, with the aim of providing internationally agreed ways of working with the technology to improve security, privacy and interoperability; which is relevant due to the number of SMEs across various sectors that are developing DLT-based products.[70] However, some scholars have recognized these challenges – as can be evidenced from the hybridized theories of regulation discussed in the previous section. They will be explained in greater detail below.

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[64] See COLLOMB and SOK, *Supra* Note 49, p.110.

[65] Cumming, Johan, Pant, 'Regulating the uncertainties of the crypto-economy: Managing Risks, Challenges and Regulatory Uncertainty', p.10, Journal of Risk and Financial Management, 24th July 2019.

[66] ISO/TR 23455: 2019, Blockchain and distributed ledger technologies — Overview of and interactions between smart contracts in blockchain and distributed ledger technology systems, URL: https://www.iso.org/standard/75624.html.

[67] Strategic Business Plan, ISO/TC 37, URL: https://isotc.iso.org/livelink/livelink/fetch/2000/2122/687806/ISO_TC_307__Blockchain_and_distributed_ledger_technologies_.pdf?nodeid=19772644&vernum=-2

[68] See KAKAVAND, *Supra* Note 59, p.26.

[69] *Supra* Note 66, Introduction and Scope, URL: https://www.iso.org/obp/ui/#iso:std:iso:tr:23455:ed-1:v1:en.

[70] *Supra* Note 67, p.1.

Firstly, is Reyes's 'Endogenous theory of DLT regulation' (2016). In addition to a detailed account of the DLT ecosystem, she also proposes a set of criteria for constructing a regulatory framework for DLT. In light of these, she proposes her own unique approach, which is:

> "……one designed to encourage organic regulation that both addresses potential market and governance failures and takes into account the unique nature of the technology at issue."[71]

The biggest positive from her article is that she clearly articulates the need to regulate DLT as a whole, as opposed to regulating it one-dimensionally from the perspective of virtual currency – which forms the basis for her proposal of this theory. Her reasons for regulating DLT on a whole are as follows:

> "….when promoting development in another system, whether through imposition of new regulations or otherwise, it is necessary to understand the ways in which local innovations and gains can be preserved as part of local economic and cultural power."[72]
>
> **[**emphasis added**]**

Therefore, she has already identified the balance which has to be struck by regulators between ensuring that regulation of DLT is not too restrictive to invalidate the advantages afforded to developers and participants on the network; and ensuring that the regulation is stringent enough to protect participants on the network from unwarranted harm. She proposes that regulators must enact a law/regulation via statute and then implement the statute in the form of modifying the code of DLT architecture so that it is endogenously incorporated in DLT or applications running on it. In this regard, she also holds that DLT regulation should be built upon the body of literature exemplified by Lessig and his concept of 'code-as-law'.[73]

This dual task of regulators to enact technology-assisted regulation (which she refers to as 'regulation through code') can only be achieved through cooperation between regulators and industry members.[74] While this theory is certainly practical to ensure the functionality of the ecosystem – it can only be put in place after a certain degree of collaboration takes place, hence it could actually benefit from the proposal put forth by this thesis, as we shall see in Chapter 4. Secondly, Finck's theory of polycentric co-regulation, supports Reyes's criticism of self-regulation in itself [75]– is proposed in the

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[71]   See REYES *Supra* Note 44, p.195.
[72]   See REYES *Supra* Note 44, p.224.
[73]   See REYES *Supra* Note 44, p.227.
[74]   See REYES *Supra* Note 44, p.228.
[75]   See FINCK, *Supra* Note 45, p.170.

form of a broad framework which can enable the EU to become a policy entrepreneur in contexts of technological change burdened with uncertainty. [76] In doing so, she recognises a lack of comprehensive EU policy on DLT (as we will see in Chapter 3), and identifies the nature of the DLT ecosystem. The aim of this theory is to take the tested concept of co-regulation and adapt it to this context by suggesting that processes leading up to norm-definition must be polycentric in nature and that the benefits of code ought to be leveraged at the law-making, implementation and enforcement stages.[77]

Co-regulation, in the EU context, is defined as a mechanism where the responsibility of attaining the objectives of the legislative authority is entrusted to parties which are not recognized in the field (such as SRO's, platform operators e.g.).[78] The collaborative intent of this process is due to the complex interaction between the state, market and the technology, where public regulators voluntarily involve private regulators in the creation and enforcement of norms – her version of co-regulation involves polycentricity and relies on code.[79] However, while she also seeks to achieve the same goal of collaboration between actors, she places a great degree of emphasis on the power of code and its role in effecting regulation – which I believe is not feasible as the ecosystem has not diffused to a certain extent – this will be explained further on in this section.

Lastly, Herian's theory of multistakeholder regulation (MS) firstly involves, consensus across jurisdictions in order to collectively define the nature and form regulation takes in a range of different marco-technical and marco-economic circumstances[80] and secondly, operates on a smaller scale within rather than across jurisdictions.[81] Due to the wide range on actors in DLT networks, he advocates for MS as he believes it can address a broad range of compliance needs.[82] For the short to medium term, Herian proposes a MS governance and regulatory model that straddles blockchain and internet regimes and seeks to draw experience from individuals who have been at the forefront of Internet governance.[83]

The main problems with this theory have been identified in this regard – an extremely broad group of stakeholders would be not be administrable (due to the complexity of actors); yet a narrower pool of stakeholders can raise questions to the legitimacy of the regime itself, due to power-sharing

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[76] See FINCK, S*upra* Note 45, p.172
[77] See FINCK, *Supra* Note 45, p.172
[78] See FINCK, *Supra* Note 45, p.172
[79] See FINCK, *Supra* Note 45, p.173
[80] See HERIAN, *Supra* Note 46, p.64.
[81] See HERIAN, *Supra* Note 46, p.65.
[82] See HERIAN, *Supra* Note 46, p.66.
[83] See HERIAN, *Supra* Note 46, p.67.

concerns.[84] It is important to note that in addition to this theory, his work also includes a criticism of code-based regulation (as employed by Reyes and Finck) – which is relied on to focus on the importance of regulating the technology itself, as opposed to regulating through the use of technology.

This is due to the fact that such theories require constant autonomous adjustments to changing sets of conditions and emergent sets of commands and protocols in order to effectively oversee such code-based regulatory systems – implying the requirement a higher level of efficiency which is in a constant state of action/reaction, threatening a degree of restraint which can stifle innovation.[85] These proposals also tend to assume without question the legitimacy and rationality of market regulation.[86]

These concerns mirror those shared by regulators as the Internet expanded 20 years ago. The understanding of what regulating DLT will entail, is occurring against a backdrop of continuing struggles to achieve stable regulation and governance within networks and in consideration of interoperability and the broader architecture of the Internet.[87] With these warnings in mind, it is natural for regulators to consider a 'wait-and-see' approach. This approach has been criticised by Herian as well, as it shows unwillingness by governments to muster the energy, let alone the resources, to challenge private self-interest in the sector[88] – as competition and markets can intercede and transcend regulatory frameworks.[89]

Such an approach can cause a repeat of the shortcomings and mistakes of Internet regulation which have led to the explicit dominance of big data business and the mass commercialisation of cyberspace on the one hand, and a parallel ungovernable 'dark net' on the other.[90] DLT not only continues the regulatory conundrums faced by the Internet and other networked technologies but problematises them further by creating novel choke points - such as nodes which wield a significant amount of computational power and Oracles.[91] The goal must be to ensure a greater degree of involvement and collaboration between DLT platforms from the smaller and medium sized firms, in order to create a diverse and interconnected. ecosystem

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[84] See HERIAN, *Supra* Note 46, p.66.
[85] See HERIAN, *Supra* Note 46, p.70.
[86] See HERIAN, *Supra* Note 46, p.71.
[87] See HERIAN, *Supra* Note 46, p.40.
[88] See HERIAN, *Supra* Note 46, p.41.
[89] See HERIAN, *Supra* Note 46, p.42.
[90] See HERIAN, *Supra* Note 46, p.43.
[91] See HERIAN, *Supra* Note 46, p.72.

As we are in such an early stage, we need to think about DLT regulation with a "desire to serve participants while being served by them"[92] – to effect collaborative outcomes across a diverse range of actors, in order for the public to benefit from the ecosystem. Furthermore, amidst the sheer volume of innovative proposals – most of which have not come to fruition, regulators must also consider whether regulating DLT is necessary in a given context[93] - as opposed to whether or not regulators must consider regulating the technology altogether.

Herian (2019) also supplements the above reasoning, by stating the following:

> "Instead, I argue, the desire of entrepreneurs ultimately identifies where regulators need to be looking, and regulators must, therefore follow the desire."[94]

This argument will be further extended against the concept of CAL in general, by highlighting the importance of regulating technical architecture through law, in the form of principles-based regulation, in Chapter 4. Furthermore, the aim will be to show that the abovementioned hybridized theories of regulation could be better applied after such a principles-based approach is successfully implemented.

2.4: Conclusion:

In this chapter, the aim has been to show the difference between the DLT ecosystem of today and an idealized version and what is required in regulatory terms to ensure a functioning ecosystem. These observations will be evaluated in light of existing regulatory attempts in Chapter 3.

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92   See HERIAN, *Supra* Note 46, p.44.
93   See HERIAN, *Supra* Note 46, p.45.
94   See HERIAN, *Supra* Note 46, p.73.

Chapter 3: Attempts at DLT regulation from the US, EU and Singapore – an analysis:

3.1 Introduction:

In this chapter, important regulatory developments from the USA and the EU will be analysed. These regions have been significantly impacted by the growth of virtual currency markets and DLT-based services and serve as a suitable starting point for applying the ideas presented by this thesis. An example of a regulatory attempt from outside these regions will be provided, namely Singapore – as it is the only regime which applies the concept of principles-based regulation to DLT.

The aim of such an analysis is twofold: firstly, to take a closer look at what aspects of DLT are being regulated. I use the term 'aspects' to denote both the features of DLT architecture (e.g. smart contracts) as well as various applications of DLT. Secondly, to critically analyse these existing regulatory attempts in light of the observations made in Chapters 1 and 2.

3.2. DLT regulation in the United States of America:

A large majority of the regulation in the USA addresses the virtual currency (cryptocurrency) markets, in light of incidents such as the Mt.Gox Bitcoin exchange collapse in 2013-14 resulting in the loss of several hundred million dollars of their customers' money[95] as well as the earlier examples concerning the use of the cryptocurrency for illegal purchases.[96] There are regulations which target the wider blockchain community,[97] regulating various aspects of blockchain technology. A majority of these laws discuss DLT from the perspective of blockchain given the impact of blockchain-based virtual currency in the USA. Due to the patchwork of DLT regulations in the USA, this section will be lengthier than the others.

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[95]   Dennis Chu, 'Broker-Dealers for Virtual Currency: Regulating Cryptocurrency Wallets and Exchanges', Columbia Law Review, Vol. 118, No. 8, pp. 2341, 2018.

[96]   See for example, Propper, 'Opioid Dealers Embrace the Dark Web to send deadly drugs by mail', <The New York Times, June 10, 2017>, URL at: https://www.nytimes.com/2017/06/10/business/dealbook/opioid-dark-web-drug-overdose.html. For more examples, see Notes 15-16, 21-22 of Chapter 1. A further discussion of criminal activity involving DLT platforms in the USA and other countries is in Section 2.5.

[97]   For a list of such regulation, see Heather Morton, 'Blockchain State Legislation', <National Conference of State Legislatures, March 28th, 2019>, URL at: https://www.ncsl.org/research/financial-services-and-commerce/the-fundamentals-of-risk-management-and-insurance-viewed-through-the-lens-of-emerging-technology-webinar.aspx

3.2.1 Federal and State regulation concerning virtual currency:

DLT regulation in the USA is a patchwork of laws[98] and Hughes (2017) does an excellent job in synthesizing the vast amount of literature on virtual currency regulation[99] by identifying the agencies involved in cryptocurrency regulation. Hughes' article differs from this overview, as he focuses on notable enforcement actions in the cryptocurrency space.[100] The federal agencies which have issued regulations on cryptocurrency are discussed below.

(a) The CFTC:

In September 2015, the CFTC legitimised virtual currencies by classifying them as a commodity.[101] While this development is not central to the thesis, it is a landmark moment in virtual currency (and DLT) based regulation in the USA. The Commission also spreads awareness about the risks associated with the virtual currency trade, e.g. by releasing a customer advisory on the risks associated with virtual currency pump-and-dump schemes.[102] The CFTC maintains general anti-fraud and manipulation enforcement authority over virtual currency cash markets as a commodity in interstate commerce.[103]

Regulatory initiatives taken by businesses are also being met with approval by the Commission - for example, a proposal to establish a self-regulatory organisation (SRO) of cryptocurrency firms was released by Cameron Winklevoss[104] and met with approval from the Commission in a public statement.[105] This organisation aims to foster financially sound virtual markets through a system of industry sponsored standards and sound practices (some of which include responsible financial

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[98]   Scott Hughes, 'Cryptocurrency Regulation and Enforcement in the U.S', p.1, 45 W. St. L. Rev. 1, 2017. URL at: http://www.scotthugheslaw.com/documents/CRYPTOCURRENCY-REGULATIONS-AND-ENFORCEMENT-IN-THE-US-2.pdf.

[99]   See HUGHES, *Supra* Note 98, p1.

[100]   See HUGHES, *Supra* Note 98 p.9, 12. (for example, the author discusses the Department of Justice's enforcement actions against Silk Road and CoinBase. Similarly, the Federal Trade Commission has taken enforcement action against American-based bitcoin miners who misrepresented the availability of their mining machines).

[101]   See HUGHES, *Supra* Note 98, p7. This was decided by the CFTC in the Coinflip Inc. case.

[102]   Office of Customer Education and Outreach, Commodity Futures Trading Commission, 'Customer Advisory: Beware Virtual Currency Pump-and-Dump Schemes'. URL at: https://www.cftc.gov/sites/default/files/2019-12/customeradvisory_pumpdump0218.pdf. The official statement from the CFTC, released on February 15, 2018, can be found here: https://www.cftc.gov/PressRoom/PressReleases/pr7697-18

[103]   *Supra* Note 102, p 2.

[104]   Cameron Winklevoss, 'A proposal for a self-regulatory Organization for the U.S Virtual Currency Industry', Gemini Crypto Exchange Blog, March 13, 2018, URL at: https://gemini.com/blog/a-proposal-for-a-self-regulatory-organization-for-the-u-s-virtual-currency-industry.

[105]   CFTC, 'Statement of CFTC Commissioner Brian Quintenz on a proposal by Cameron and Tyler Winklevoss for a virtual commodity SRO', March 13, 2018, URL at: https://www.cftc.gov/PressRoom/SpeechesTestimony/quintenzstatement031318

management, promotion of transparency and avoidance of conflicts of interest, marketplace conduct rules, surveillance), incentivize the detection and deterrence of manipulative and fraudulent acts and practices and ensuring all members comply with the sound practices listed above.[106]

These initiatives are important steps towards achieving cross-sector collaboration, which as discussed in Chapter 2, is the outcome that the hybridized theories of regulation discussed therein hope to achieve, in the context of regulating the entire DLT ecosystem. The sound practices above can be implemented to some extent by firms belonging to the wider DLT community. Due to the nature of the ecosystem, private regulators (such as this SRO) play an important role in governing DLT networks. It is hoped that the approval of the CFTC in this regard can mark the start of collaborative efforts between public and private regulators in the USA, not only the virtual currency space, but also the wider DLT community as well.

(b) FinCEN:

As mentioned earlier,[107] the FinCEN announced that the Bank Secrecy Act would apply to consumers and businesses engaged in the cryptocurrency ecosystem. Exchangers and administrators of cryptocurrency must register as a money service business (MSB) and comply with AML and KYC regulations.

The FinCEN has also stated that consumers of cryptocurrencies, miners and companies that develop software that enables users to trade cryptocurrencies are not MSBs, and the regulations do not specifically apply to these parties. [108] Thus, FinCEN acknowledges the existence of a wider blockchain community outside of virtual currency exchanges and regulates virtual currency in order to balance the interests of preventing terrorism while supporting innovation in financial technology.[109]

(c) The Securities Exchange Commission (SEC):

The SEC has issued an investor alert about the potential risks arising from investments in Bitcoin and other forms of virtual currency.[110] In 2017, the SEC released an investor bulletin on Initial Coin

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[106]   See WINKLEVOSS, *Supra* Note 104.
[107]   See HUGHES*, Supra* Note 98, p 8.
[108]   See HUGHES*, Supra* Note 98, p 9.
[109]   See HUGHES*, Supra* Note 98, p 9.
[110]   US Securities and Exchange Commission, 'Investor Alert: Bitcoin and other Virtual Currency-related Instruments', May 7 2014, URL at: https://www.sec.gov/oiea/investor-alerts-bulletins/investoralertsia_bitcoin.html. Similar alerts on Virtual Currency Ponzi schemes and a more recent alert on fraudulent digital asset trading websites (April 24,

Offerings (ICO) to educate investors on the process and the risks associated with investing in ICOs.[111] To assist operators of ICOs and token issuers determine whether their offering is subject to federal securities laws,[112] the SEC issued a framework for analyzing whether a digital asset has the characteristics of an "investment contract".[113]

In 2018, the SEC launched FinHub, a body staffed by commission members, intended to serve as a public resource for FinTech-related issues at the SEC, including matters dealing with distributed ledger technology (DLT), automated investment advice, digital marketplace financing and artificial intelligence/machine learning. It also serves as an internal resource within the SEC, coordinating the staff's work on FinTech related issues. The above-mentioned framework on digital assets, along with a guidance relating to the custody of digital assets, was issued by FinHub.[114] As quoted from a 2019 testimony by the Chairman and the Commissioners, the SEC is focused on issues presented by new technologies, and it is willing to help those who seek to innovate and raise capital in accordance with the federal securities laws and consistent with important investor protections.[115]

(d) The Internal Revenue Service (IRS):

In the IRS guidance document, IR-2014-36, it states that an individual who mines virtual currency is subjected to self-employment tax.[116] In the same document, the IRS classified cryptocurrencies as property for federal taxation purposes.[117] More clarity on how cryptocurrencies are taxed by the IRS is provided in IRS Notice 2014-21[118] which also provides an FAQ on the subject of cryptocurrency taxation.

2019), can be found at https://www.sec.gov/investor/alerts/ia_virtualcurrencies.pdf and https://www.sec.gov/oiea/investor-alerts-and-bulletins/ia_fraudulentdigitalasset respectively.

[111] US Securities and Exchange Commission, 'Investor Bulletin: Initial Coin Offerings', July 25, 2017, URL at: https://www.sec.gov/oiea/investor-alerts-and-bulletins/ib_coinofferings.

[112] Bill Hinman, Valerie Szczepanik, 'Statement on Framework for "Investment Contract" Analysis for Digital Assets', US Securities and Exchange Commission, April 3, 2019, URL at: https://www.sec.gov/news/public-statement/statement-framework-investment-contract-analysis-digital-assets?hootPostID=7604b0fbb8f5d3e5ac7%E2%80%A6.

[113] SEC, 'Framework for "Investment Contract" Analysis for Digital Assets', URL at: https://www.sec.gov/files/dlt-framework.pdf.

[114] 'Oversight of the Securities and Exchange Commission', Testimony by the SEC, 24th September 2019, URL: https://www.sec.gov/news/testimony/testimony09-24-2019#_ftn15.

[115] See SEC Testimony, *Supra* Note 114.

[116] See HUGHES, *Supra* Note 98, p 12.

[117] See HUGHES, *Supra* Note 98, p 12.

[118] Internal Revenue Service, Notice 2014-21, April 14, 2014, URL at: https://www.irs.gov/pub/irs-drop/n-14-21.pdf.

However, in its latest guidance on calculating tax owed on cryptocurrency holdings released in 2019[119] has raised some concerns on the IRS's stance on cryptocurrency.[120] According to this guidance, the IRS perceives a taxable event when a holder acquires control of the digital asset, rather than when they actively exercise their right to control it.[121] There is also dissatisfaction within the crypto community with the IRS as the updated guidance in 2019 was its first update since 2014.[122]

(e) State Regulation on Cryptocurrency:

As of 2019, 32 states have introduced legislation accepting or promoting the use of cryptocurrencies and DLT,[123] each with their own money services business license. Although there is some overlap, having every state audit a business every year creates a significant amount of waste, confusion, and inefficiencies[124] - resulting in several eminent firms leaving the US.[125] The URVCBA (Uniform Regulation of Virtual Currency Businesses Act) was proposed by the Uniform Law Commission as a means to harmonise the patchwork of state-wide cryptocurrency law in the USA. As discussed in the first chapter[126] this proposal was rejected by several states, as it failed to recognise the wider DLT community.[127]

The Office of the Comptroller of Currency (OCC), planned to issue a special charter for FinTech companies, in March 2017. This could have marked the beginning of a federal level license system for cryptocurrency firms.[128] However, this validity of this charter is currently being debated by the Second Circuit Court of Appeal, as the OCC has appealed against a lower court's decision which concluded that the OCC lacked the authority to issue such charters to non-banking companies.[129] To

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[119] Internal Revenue Service, 'Virtual currency: IRS issues additional guidance on tax treatment and reminds taxpayers of reporting obligations', October 9, 2019, URL at:https://www.irs.gov/newsroom/virtual-currency-irs-issues-additional-guidance-on-tax-treatment-and-reminds-taxpayers-of-reporting-obligations.

[120] Matthew Beedham, 'The IRS's latest cryptocurrency tax guidance shows it still doesn't get it', The Next Web, October 10, 2019, URL at: https://thenextweb.com/hardfork/2019/10/10/irs-cryptocurrency-tax-guidance-doesnt-get-it-mess/.

[121] See BEEDHAM, *Supra* Note 120.

[122] See BEEDHAM, *Supra* Note 120.

[123] Shelagh Dolan, 'How the laws and regulations affecting blockchain technology and cryptocurrencies, like Bitcoin, can impact its adoption', Business Insider, March 3, 2020, URL at: https://www.businessinsider.com/blockchain-cryptocurrency-regulations-us-global?international=true&r=US&IR=T.

[124] See HUGHES, *Supra* Note 98, p 16.

[125] See HUGHES, *Supra* Note 98, p 16.

[126] *Supra* Note 17.

[127] Wyoming and Missouri have also rejected the act, see Caitlin Long, 'Seismic News about State Virtual Currency Laws: ULC Urges States to Withdraw Model Act', Forbes, March 25, 2019, URL at: https://www.forbes.com/sites/caitlinlong/2019/03/25/seismic-news-about-state-virtual-currency-laws-ulc-urges-states-to-withdraw-model-act/#10ec1a395fda.

[128] See HUGHES, *Supra* Note 98, p 16.

[129] 'OCC Fintech Charter headed to the Second Circuit', Jones Day Law Firm, January 2020, URL: https://www.jonesday.com/en/insights/2020/01/occ-fintech-charter-headed-to-the-second

further support banks which are considering partnering with these companies to develop DLT-based solutions, the OCC also released a bulletin on risk-management guidance in third-party relationships[130] and has periodically revised this guidance in 2017[131] and in March 2020.[132]

A famous example of state-level cryptocurrency regulation is New York's BitLicense.[133] With a five-thousand-dollar license application fee, extensive disclosure requirements, the need to appoint a dedicated BitLicense-specific compliance officer – the license was criticised as prohibitively costly to small and medium size firms. This is supported by the fact that only four companies have received this license, all of which are large and established. [134] In December 2019, the state announced that it is planning to modify the approval process for new cryptocurrencies.[135]

The state of Wyoming became the first elected body in the world to define cryptocurrency as a "utility token" (a new type of asset class different from a security or a commodity).[136] This bill is one of five which have recently been turned into law for the purpose of attracting cryptocurrency business. Georgia and Arizona have introduced bills accepting cryptocurrency as a valid form of payment for state taxes and licenses.[137]

3.2.2 Federal and State Regulation on Blockchain/DLT:

Looking at the American cryptocurrency regulation, there is, in my opinion, a lack of harmonisation in the sense that regulators at the federal and state level have adopted different stances towards regulating the sector. For example, despite the existence of regulatory competition at the federal level, these agencies have recognised the difficulties faced in regulating this nascent market and have sought

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circuit#:~:text=The%20Situation%3A%20The%20Office%20of,Fintech%20Charters%22%20to%20nondepositor%20institutions.

[130] Eric Ubias, 'Compliance Implications of Recent DLT and Blockchain Related Developments for Financial Institutions', American Bar Association, July 1, 2019, URL at: https://www.americanbar.org/groups/business_law/publications/committee_newsletters/banking/2019/201907/fa_1/.

[131] See UBIAS, *Supra* Note 131.

[132] Office of the Comptroller of the Currency, 'Third-Party Relationships: Frequently Asked Questions to Supplement OCC Bulletin 2013-29', March 5, 2020, URL at: https://www.occ.gov/news-issuances/bulletins/2020/bulletin-2020-10.html.

[133] See HUGHES, *Supra* Note 98, p 13.

[134] David Adler, 'The BitLicense: Regulatory overreach or Prudent Response?', Fordham Journal of Corporate and Financial Law, March 26, 2018, URL at: https://news.law.fordham.edu/jcfl/2018/03/26/the-bitlicense-regulatory-overreach-or-prudent-response/.

[135] DeCamillo and Dey, 'New York Regulator Details Changes to Contentious BitLicense', Coindesk, December 11, 2019, URL at: https://www.coindesk.com/new-york-regulator-details-changes-to-contentious-bitlicense.

[136] Aaron Wood, 'US: Wyoming set Precedent by Creating New Asset Class for Cryptos, Hopes to Inspire Feds', Coin Telegraph, March 13, 2018, URL at: https://cointelegraph.com/news/us-wyoming-set-precedent-by-creating-new-asset-class-for-cryptos-hopes-to-inspire-feds.

[137] Aaron Wood, 'US: Georgia Next State in Line to Accept Crypto for Taxes, Licences', Coin Telegraph, February 24, 2018, URL: https://cointelegraph.com/news/us-georgia-next-state-in-line-to-accept-crypto-for-taxes-licenses.

to promote collaboration between public and private regulators to promote effective oversight. This is important because these businesses wield a significant degree of power in the DLT market and their co-operation will be essential to allow the state to protect customers on these networks.

Furthermore, these agencies have sought to clarify legal ambiguities surrounding the virtual currency space, in order protect investors and increase their awareness. However, at the state-level, as the examples of the BitLicense, the OCC charter and the URVCBA show, there has been an inability to create a stable regulatory environment at the state level – which can discourage firms from operating in these states.

This sub-section aims to show that there is a lack of consideration for the demands of the wider DLT ecosystem in American DLT regulation. For example, a report from the US Government Accountability Office (GAO), states that the complexity of US financial regulations is holding back DLT start-ups from releasing products and services which can cut costs for customers by reducing payment-related operational expenses and shrinking settlement times for online transactions.[138]

Many states have also attempted to change their regulation drastically in an attempt to attract crypto and DLT investors. While there is adequate legal basis for the execution of a smart contract (technology which can automate transactions in a DLT) in existing state and federal regulations[139], some states have drafted their own regulations with differing requirements creating unnecessary complications.[140] The above concerns aside, there are some examples of state regulation which could potentially attract firms. For example, a bill from Hawaii which promotes the use of blockchain in industries such as identity and access management, healthcare, legal, financial services, manufacturing and tourism[141] and establishes the Hawaii Blockchain Technology and digital currency working group.[142]

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[138]   Annaliese Milano, 'US Government Watchdog: Regulations are Hobbling DLT Innovation', Coin Desk, March 23, 2018, URL at: https://www.coindesk.com/us-government-watchdog-regulations-hobbling-dlt-innovation. A copy of the report can be found here: https://www.gao.gov/assets/700/690803.pdf.

[139]   Smart Contract Alliance, Chamber of Digital Commerce, 'Smart Contracts: Is the Law Ready?", September 2018, URL at: https://www.dlapiper.com/~/media/files/people/tank-margo/smart-contracts-is-the-law-ready-web.pdf?la=en&hash=003897A104F6A74DD9FC1C2E0FE2A4F16ADE500F.

[140]   See for example, Mike Orcutt, 'States that are passing laws to govern 'smart contracts' have no idea what they are doing', MIT Technological Review, March 29, 2018, URL at: https://www.technologyreview.com/2018/03/29/144200/states-that-are-passing-laws-to-govern-smart-contracts-have-no-idea-what-theyre-doing/. Other examples from Arizona, Tennessee and New York can be found at https://legiscan.com/AZ/text/HB2417/id/1588180, http://wapp.capitol.tn.gov/apps/Billinfo/default.aspx?BillNumber=SB1662&ga=110 and https://legiscan.com/NY/bill/A08780/2017 respectively.

[141]   Hawaii House Bill No.1481, URL at: https://www.capitol.hawaii.gov/session2017/bills/HB1481_HD1_.pdf.

[142]   See HUGHES, *Supra* Note 98, p.15-16.

Arizona[143] put forth HB No. 2216 which prohibits the use of DLT in electronic firearm tracking technology which, regardless of its effectiveness, is important because it is one of the few examples of regulation which discusses a specific use-case of DLT outside of virtual currency.[144] In Delaware, SB 69[145] was passed, amending the state's general corporation law, to allow corporations to utilize electronic databases and blockchain technology to maintain and distribute certain records. Nevada's Senate Bill No.398 prohibits a local government from taxing or imposing restrictions on the use of a blockchain.[146]

With regards to broader DLT regulation in general in the USA, I believe there is a lack of consideration for the wider community at both the federal (there is no federal level regulation which targets the wider DLT community) and state level (e.g. the definitional complications from smart contract regulation mentioned earlier). However, some regulations have been issued at the state level (as seen above) which not only recognise the multifaceted potential of DLT, but are also trying to provide incentives for investments from the broader DLT community.

3.3 DLT Regulation in Europe:

Regulation at the EU level has resulted in a more organised framework of laws (as opposed to the USA). This is evidenced from the EU's 'wait-and-see' approach,[147] which has resulted in the regulation being more organised and supportive of the development of the technology as a whole. Criminal activity involving virtual currencies, for example, is included in the amendment of the 5th AML directive.[148] In the USA, regulation on virtual currency is issued by multiple central-level agencies, creating complications.

Therefore, European DLT regulation is very clearly divided between a central authority (the EU) and the member states. This section will discuss DLT regulation at the EU level, along with discussing notable initiatives at the state level as well.

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[143] See HUGHES, *Supra* Note 98, p.16.
[144] Arizona House Bill No. 2216, URL at: https://www.azleg.gov/legtext/53leg/1R/bills/hb2216s.pdf.
[145] James Moloney, Alan Bannister, 'Delaware approves use of Blockchain in New DGCL Amendments', Securities Regulation and Corporate Governance Monitor, 31st July 2017, URL at: https://securitiesregulationmonitor.com/Lists/Posts/Post.aspx?ID=299
[146] Nevada Senate Bill No. 398, URL at: https://www.leg.state.nv.us/Session/79th2017/Bills/SB/SB398_EN.pdf
[147] *Supra* Note 45, Michele Finck, 'Blockchain Regulation and Governance in Europe', p.154, Cambridge: Cambridge University Press, 2019.
[148] DIR (EU) 2018/843 of the EU Parliament and Council, of 30th May 2018, to be transposed by member states by 10th January 2020.

3.3.1 EU Regulation on DLT:

A report published by the European Union Agency for the Operational Management of Large-Scale IT Systems in the Area of Freedom, Security and Justice[149] mentions important regulatory initiatives in this regard. For example, the EU Blockchain Observatory and Forum and the Blockchain Partnership were established[150] to prevent fragmented approaches and ensure interoperability and the wider development of Blockchain-based public services.[151] The objectives of the Forum include the monitoring of various EU blockchain initiatives, providing a source of blockchain knowledge along with a forum for information and opinion sharing and lastly, to make recommendations on the role the EU can play in developing the blockchain ecosystem. Conceived as a pan-European effort, the Forum is comprised of two working groups, consisting of 25 members each, who are EU-based industry experts appointed by the Forum on an open call basis.[152]

Twenty-one EU member states and Norway signed the Declaration on European Partnership on Blockchain in April 2018, to develop an infrastructural network known as the European Blockchain Services Infrastructure (EBSI).[153]The goal of this partnership is to make the EBSI accessible to support digital services deployed by the public and private actors – by identifying use-cases for Blockchain-based cross-border digital services and by developing a set of guiding principles and specifications for the EBSI.[154] A more recent initiative is the launch of the EU-backed International Association of Trusted Blockchain Applications (INABTA), which aims to develop a framework for DLT that supports collaboration between the public and private sector and regulatory convergence.[155] A dedicated administrative unit for Blockchain has also been set up within the Directorate General for Communications Networks, Contents and Technology to provide more structured solutions to regulate specific use cases.[156]

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[149] EU-LISA, 'Distributed Ledger Technology and Blockchain: Perspectives for eu-LISA and large-scale IT systems – Research and Technology Monitoring Report', p.19, December 2019, URL at: https://www.eulisa.europa.eu/Publications/Reports/DLTs%20and%20blockchain%20report.%20Dec%202019.pdf.

[150] European Commission, 'European Countries join Blockchain Partnership', 10th April 2018, URL at: https://ec.europa.eu/digital-single-market/en/news/european-countries-join-blockchain-partnership.

[151] European Commission, 'European Blockchain Observatory and Forum', Last updated: 9 November 2019, URL: https://ec.europa.eu/digital-single-market/en/eu-blockchain-observatory-and-forum. The objectives of the Forum are mentioned in Note 12 of Chapter 1.

[152] EU Blockchain Observatory and Forum, 'FAQ', URL: https://www.eublockchainforum.eu/faq

[153] See EU-LISA report,*Supra* Note 149, p.19.

[154] European Commission, 'European Countries join Blockchain Partnership', 10th April 2018, URL: https://ec.europa.eu/digital-single-market/en/news/european-countries-join-blockchain-partnership#:~:text=On%2010th%20of%20April%202018,services%2C%20with%20the%20highest%20standards

[155] See EU-LISA report, *Supra* Note 149, p.19.

[156] See EU-LISA report, *Supra* Note 149, p.19.

The Forum released a report on 'Legal and Regulatory Framework for Blockchain and Smart Contracts',[157] which states that such a framework would arise out of the "evolution of legal and regulatory tools" and "the natural evolution of the legal and regulatory frameworks to take account of the blockchain".[158] This report does align itself with principles similar to what are proposed in Chapter 4, by stating that:

> "Regulators should provide guiding principles to attract private-sector investors, ensure consumer protection and citizens' rights, and provide safeguards against anticompetitive practices."[159]

The first two years of the Forum's work were reviewed in May 2020 and this will be an indicator of how impactful these initiatives have been.[160] European level cryptocurrency initiatives are discussed in a report published by the Joint Research Centre of the European Commission in July 2019.[161] The European Parliament launched a FinTech taskforce with a dedicated group on DLT.[162]

Most importantly, the 5th AML Directive (DIR 2018/843) has been implemented in January 2020,[163] which ensures that crypto asset providers will fall under regulatory purview[164] with strict compliance requirements due to incidents such as the Panama Papers leak.[165] This is a landmark regulation as it impacts the behaviour of crypto firms, forcing them to either comply with these requirements or shift their operations to developing countries.

The development of DLT infrastructure will have to be in accordance with the principles of the GDPR. As DLT ledgers are immutable, a request for erasure of personal data will be hard to implement.[166] However, some firms have tried to innovate their way around this obstacle – for example, a

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[157] The European Blockchain Observatory and Forum, 'Legal and Regulatory Framework of Blockchain and Smart Contracts', 27th September 2019, URL at: https://www.eublockchainforum.eu/sites/default/files/reports/report_legal_v1.0.pdf.
[158] See Forum report, *Supra* Note 157, p.6.
[159] See Forum report, *Supra* Note 157, p.7.
[160] EU Blockchain Observatory and Forum, 'Reflections: Reviewing the first two years of the EU Blockchain Observatory', 29th May 2020, URL at: https://www.eublockchainforum.eu/news/reflections-reviewing-first-two-years-eu-blockchain-observatory
[161] European Commission – Joint Research Centre, 'Blockchain Now and Tomorrow', p.39-40, July 2019, URL at: http://publications.jrc.ec.europa.eu/repository/bitstream/JRC117255/blockchain_online.pdf.
[162] See JRC report, *Supra* Note 161.
[163] See JRC report, *Supra* note 161.
[164] Joseph Birch, 'New EU AML Compliance Laws could Disrupt the Crypto Industry', <Coin Telegraph, 18th January 2020>, URL at: https://cointelegraph.com/news/new-eu-aml-compliance-laws-could-disrupt-the-crypto-industry.
[165] See BIRCH, *Supra* Note 164.
[166] Shannon Liao, 'Major Blockchain Group says Europe should Exempt Bitcoin from new Data Privacy Rule', <The Verge, 5th April 2018>, URL at: https://www.theverge.com/2018/4/5/17199210/blockchain-coin-center-gdpr-europe-bitcoin-data-privacy.

partnership between two start-ups[167] to securely handle the results of the COVID-19 outbreak aims to be GDPR friendly by storing user data in the form of hash values which can only be interpreted by user authorization.[168]

3.3.2 Regulation on DLT by Member States:

EU Member States have been free to regulate the technology as a whole, with a great degree of freedom, as long as they comply with EU regulation. This has resulted in a patchwork of sorts (though not as fragmented as the USA), with countries like Gibraltar, Malta and Belarus going as far as establishing their own DLT Regulatory Frameworks.[169] Gibraltar is introducing new laws to reduce market manipulation in the DLT sector.[170] Malta, which was recently praised as the 'blockchain island',[171] has been unwilling to hand out Virtual Financial Asset (VFA) licences to firms under its regulatory framework – which is causing them pull out of the country.[172]

Estonia has embraced the technology, using it to verify records on government databases as well as in its famous e-Residency platform.[173] It has also partnered with Latvia and Lithuania in a Memorandum of Understanding to develop capital market innovations and new technologies with a special consideration of FinTechs and DLT.[174]

Belarus is the first country in the world to create an official regulatory framework for the Blockchain industry[175] - and has received praise[176] for recognising the challenges posed by DLT-based

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[167]   Marie Huillet, 'New Blockchain Solution to fight CoVid-19 complies with EU Privacy Regulation', <Coin Telegraph, 17th April 2020>, URL at: https://cointelegraph.com/news/new-blockchain-solution-to-fight-covid-19-complies-with-eu-data-privacy-regs.

[168]   See HUILLET, *Supra* Note 167.

[169]   See FINCK, *Supra* Note 45, p.163 for Malta. For Gibraltar see URL: http://www.gfsc.gi/dlt

[170]   Samuel Haig, 'Gibraltar to crack down on market manipulation in DLT sector', <Coin Telegraph, 12th April 2020>, URL at: https://cointelegraph.com/news/gibraltar-to-crack-down-on-market-manipulation-in-dlt-sector.

[171]   See 'Malta: A leader in DLT Regulation', Office of the Prime Minister, URL at: https://meae.gov.mt/en/Public_Consultations/OPM/Documents/PS%20FSDEI%20-%20DLT%20Regulation%20Document%20OUTPUT.PDF.

[172]   Stephen O'Neal, 'As Malta delays regulatory clarity, fewer firms remain on 'Blockchain Island', <Coin Telegraph, 3rd April 2020>, URL at: https://cointelegraph.com/news/as-malta-delays-regulatory-clarity-fewer-firms-remain-on-blockchain-island.

[173]   The World Bank Group, DLT and Blockchain, September 2017, p.33, URL at: http://documents.worldbank.org/curated/en/177911513714062215/pdf/122140-WP-PUBLIC-Distributed-Ledger-Technology-and-Blockchain-Fintech-Notes.pdf

[174]   See FINCK, *Supra* Note 45, p.161.

[175]   Darya Yafimava, 'Blockchain and Law: Regulations around the World', <Openledger Insights, 17th January 2019>, URL at: https://openledger.info/insights/blockchain-law-regulations/.

[176]   Max Thake, 'BlockShow releases findings on the best EU Countries for Blockchain Start-ups', <Medium.com, May 23rd 2018>, URL at: https://medium.com/nakamo-to/blockshow-releases-finding-on-the-best-european-countries-for-blockchain-startups-addfd67dd050. Belarus was ranked at number 10, on this survey which is also referred to in the next citation.

platforms[177] – for example, it was quick to determine the legal status of the blockchain, tokens, mining and smart contracts. The nation is planning to introduce a new law to seize digital currency from criminals.[178]

Liechtenstein has its own DLT framework, with the launch of the Token and VT Service Providers Act which defines a legal framework for all applications of the token economy – in January 2020.[179] This framework has attracted some firms which had exited Malta due to their poorly implemented regulations.[180]

Italy has recently passed laws,[181] which define DLT and Smart Contracts and grants legal validity to records/information stored on these platforms and has a detailed set of regulations on virtual currency.[182]

Luxembourg and Netherlands have issued cryptocurrency legislation in the form of ICO regulations.[183] The Netherlands has also sought to establish itself as a 'proving ground' for the proposed digital currency of the eurosystem[184] – and has also established a regulatory sandbox environment to benefit FinTech companies.[185]

A prominent regulatory tool used in Europe is that of the 'sandbox'. A regulatory sandbox can be defined as a setting in which innovators can test their product or business model while being temporarily exempted from a number of legal requirements.[186] This form of regulation has gained a lot of prominence in the UK, with sandboxes being established for the purpose of FinTech firms (by

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[177]   Ksenia Dobreva, 'Belarus Passes New Blockchain and Crypto Regulation: What it means for business and the world', <Openledger Insights, 10th December 2018, URL at: https://openledger.info/insights/belarus-passes-new-blockchain-and-crypto-regulations/.

[178]   'Belarus seeks power to take crypto from criminals', <Pymnts.com, 9th March 2020>, URL at: https://www.pymnts.com/blockchain/bitcoin/2020/bitcoin-daily-united-states-bill-seeks-regulate-crypto-belarus-seeks-power-criminals/.

[179]   'Law Establishing Legal Security and Trust in the Token Economy', <impuls-Lietchtenstein>, URL at: https://impuls-liechtenstein.li/blockchain-gesetz/.

[180]   See O'NEAL, *Supra* Note 172.

[181]   Federica Romanelli, 'Italian law defines Blockchain and Smart Contracts', February 26, 2019, URL at: http://www.federicaromanelli.com/italian-law-defines-blockchain-smart-contracts/, accessed on 21/12/2019. While this source is only from an informational point of view, I have chosen this particular source because it provides links to the official legislation (which is in Italian) - https://www.gazzettaufficiale.it/eli/gu/2018/12/14/290/sg/pdf.

[182]   Giulia Aranguena, 'Distributed Ledgers in Italy: Regulatory Framework and Pipeline', <Medium, October 31, 2018>, URL at : https://medium.com/legal-block/distributed-ledgers-in-italy-regulatory-framework-and-pipeline-7790a5c0fa7b, accessed on 21/12/2019.

[183]   See FINCK, *Supra* Note 45, p.150.

[184]   Danny Nelson, 'Dutch Central Bank wants to be European Union's CBDC Proving Ground', <Coindesk, 21st April, 2020>, URL at: https://www.coindesk.com/dutch-central-bank-wants-to-be-european-unions-cbdc-proving-ground.

[185]   De Nederlandse Bank, Regulatory Sandbox Report, URL at: https://www.dnb.nl/en/binaries/More-room-for-innovation-in-the-financial%20sector_tcm47-361364.pdf?2020042421.

[186]   See FINCK, *Supra* Note 45, p.158.

the FCA – Financial Conduct Authority of the UK), the broader DLT community and even a proposal to establish a 'global sandbox'.[187]

A major positive is that this technique exposes the technology to discussion in the regulatory arena, along with democratic supervision and control – in the sense that the state has some influence over this localised deployment of the technology.[188] On the other hand, the process of constant adjustment of the sandbox, together with the approval process for new entrants can be cumbersome.

Furthermore, sandboxes should be of benefit to the entire DLT community as a whole (as different platforms will ultimately interact with each other in some form) – including unlicensed entities who would ordinarily fall outside the scope of regulation.[189] This includes preventing outcomes where the wider DLT community is being affected by a narrow regulation focused on a single use-case (such as the American URVCBA).

While the benefits of sandboxes are numerous[190] – it is important to note that as a regulatory instrument, its applicability has been focused mainly on the FinTech sector.[191]

Once more experience and learnings are gained from the sandbox, the technology can be slowly expanded to consumer and cross-border markets after a thorough examination and controls have been put in place for possible risks and policy changes.[192] The development of sandboxes should be accelerated in order to provide a controlled testing environment for the growth of the technology.[193]

A heavy reliance on sandboxes also comes with its own concerns – such as transparency and equality.[194] From the example of the UK FCA discussed earlier – I believe that there is an extension of this concept that can potentially lead to its inclusion under a *Lex Cryptographia* – that of a 'cross-jurisdictional' or a 'global sandbox' – which apply the principles of sandboxing to technologies

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[187]   See FINCK, *Supra* Note 45, p.158-160.
[188]   See FENWICK, *Supra* Note 39, p.593.
[189]   Zetzsche, D., Buckley, R., Arner, D. and Barberis, J. (2017) 'Regulating a Revolution: From Regulatory Sandboxes to Smart Regulation', Fordham Journal of Corporate and Financial Law, 23(1), pp. 41, URL: https://doi.org/10.2139/ssrn.3018534
[190]   See ZETZSCHE, *Supra* Note 189, p.59-60.
[191]   See FINCK, *Supra* Note 45, p.158.
[192]   Ng, D. and Griffin, P. (2018) 'The Wider Impact of a National Cryptocurrency', p.1, Global Policy, June 2018. Available at: https://www.globalpolicyjournal.com/articles/world-economy-trade-and-finance/wider-impact-national-cryptocurrency.

[193] Guo, Y. and Liang, C, 'Blockchain application and outlook in the banking industry', Financial Innovation, 2(1), pp. 10, 2016, https://doi.org/10.1186/s40854-016-0034-9.
[194]   See FINCK, *Supra* Note 45, p.159.

outside of FinTech and to extend the concept of a 'sandbox' to multiple jurisdictions,[195] which could help to better replicate the impact of a DLT ecosystem in an actual market.

In my opinion, DLT regulation is more organised in the EU than in the USA - with numerous promising initiatives launched by member states concerning several use-cases of the technology. These efforts are further supported by EU-level initiatives, which acknowledge the importance of several concepts raised by this thesis – such as principles-based regulation (discussed in Chapters 1 and 4) and cross-sector collaboration (discussed in Chapters 1 and 2). However, as can be seen with the example of the 5th AML directive, these efforts tend to ignore important elements of DLT architecture.

3.4 DLT regulation in Singapore:

Singapore, through its financial regulator, the Monetary Authority of Singapore (MAS) has adopted a unique regulatory regime for the purpose of FinTech. The approach of the MAS, although restricted to FinTech, entails important concepts which are also discussed in this thesis. In 2015, it formed a Fintech & Innovation Group (FITG) which is responsible for regulatory policies and development strategies to facilitate the use of the technology.[196] This group has been provided the same level of hierarchy as a Financial Supervision Group – thereby signalling its importance.[197]

The MAS has also adopted a principles based approach with regards to financial supervision – which is it applies to FinTech regulation as well. The current guiding principles of financial supervision in Singapore, are "Risk-Focused", "Disclosure-Based", "Stakeholder-Reliant" and "Supportive of Enterprise", with the intent of creating a conducive environment to support innovation and entrepreneurship in the financial market.[198]

Risk-focused allows greater business latitude to financial firms that do not pose significant risks. Disclosure-based calls for firms to disclose accurate information for consumers to rely on, instead of a regulator assessing their suitability before they enter the market. Stakeholder-reliant calls for firms to self-regulate and self-supervise so as to minimize the need for regulatory intervention in the firm's business decisions. Lastly, Supportive of Enterprise – implies that the MAS aims to regulate and supervise the industry in a manner that does not hinder enterprise or innovation.

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[195]   See FINCK, *Supra* Note 45, p.160.
[196] PEI, Sai Fan. Singapore approach to develop and regulate FinTech. (2018). Handbook of blockchain, digital finance, and inclusion: Cryptocurrency, FinTech, InsurTech, and regulation. 1, p. 347. Research Collection Lee Kong Chian School Of Business. Available at: https://ink.library.smu.edu.sg/lkcsb_research/5911
[197] See PEI, *Supra* Note 196, p.347.
[198] See PEI, *Supra* Note 196, p.348.

In my opinion, MAS is also the only regulator that has accurately described the nature of regulatory intervention needed in the DLT ecosystem at this stage – with the intention of fostering innovation and cross-sector collaboration – albeit this observation has been restricted to the financial space. MAS recognized that at this stage of the development, the disrupters are still experimenting how the new technology could improve and in what areas of the financial services, and also the disrupters and incumbents are still exploring and strategizing whether they should treat each other as friends or enemies, or in some areas of financial services they should combine strength for mutual gain by collaborating and cooperation.[199] Lastly, MAS has also called for the use of regulatory sandboxes for FinTech companies.[200]

3.5 Conclusion:

In this Chapter, the aim was to analyse examples of DLT regulation from the USA, EU – due to the popularity of the technology in these regions – and Singapore, due to their regulatory approach. In general, while regulators are aware of the potential to scale the technology, a vast majority of the regulation remains focused towards virtual currency. However, the recognition of concepts that this thesis relies on – such as cross-sector collaboration and principles-based regulation are important positives to take away.

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[199] *Supra* Note 196, p.350.
[200] *Supra* Note 196, p.351.

CHAPTER 4: *LEX CRYPTOGRAPHIA* – A PRECURSOR TO A DLT-SPECIFIC BODY OF LAW*:*

4.1: *Lex Cryptographia* – an achievable proposition?

As has been stated earlier, regulators can neither afford to be too light-handed nor can they over-regulate and disharmonize the law, which is essentially the concept of the Collinridge dilemma, which states that if regulators want to achieve results, they should act early, but then the full range of risks and benefits is unknown; and if they wait until the risks and benefits are clear, the situation solidifies in a manner that makes it difficult and expensive to introduce regulatory changes.[201]

The aim of this chapter is to provide a regulatory solution which caters to the demands of the DLT ecosystem at present, in order to achieve some degree of cross-sector collaboration between actors, while at the same time ensuring that platform operators have the freedom to innovate. Drawing from the observations made in Chapter 2, we will begin with a critical analysis of 'code-as-law' (CAL) and attempt to justify why regulators are better suited to regulating technical architecture of the platform in the short term (as opposed to using the technology to regulate) in the short-term.

After explaining the purpose of such a regulatory approach, the role of principles-based regulation in achieving such an outcome will be elaborated, along with the principles themselves. These principles are intended to serve as a precursor to a DLT-specific body of law, which regulators can tailor according to the circumstances under which they interact with the technology.

4.2: *Code-as-law* - an ineffective strategy in the short-term:

Any attempt to manipulate a DLT platform by an actor on the network will definitely involve the use of malicious code to provide the actor in question with an unlawful gain. Therefore, I do not refute the possibility of CAL being used to some extent in the future of DLT regulation. Lessig states that different code architectures exhibit different values**,** which enables them to serve as a substitute for law in cyberspace as it can more subtly control and discipline behaviour.[202] One reason why these ideas are favoured, is because of the belief that DLTs are nothing more than a decentralised network like the internet.[203]

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[201] Anna Butenko and Pierre Larouche, 'Regulation for Innovativeness or Regulation of innovation?', Innovation and Technology, 7:1, p.70, 2015, URL: https://doi.org/10.1080/17579961.2015.1052643

[202] Lawrence Lessig, 'The Law of the Horse: What Cyberlaw may Teach', 11th June 1998, pg. 18.

[203] Primavera di Fillipi, Aaron Wright, 'Blockchain and the Law: The Rule of Code', p.175, 2018, Harvard University Press.

The central regulatory tool is the code itself – and regulatory instruments are not immune from power play.[204] This carries on from Herian's criticism of the concept in Chapter 2 and thus it is important to incorporate a perspective that includes policy actors in the prevailing approach that mainly considers tools/instruments, among which may be laws and technologies[205](in the context of DLT regulation; the main instrument proposed is a hybridization of law and technology).

CAL is unsatisfactory because of the sheer variety of functions that the code can be made to perform; it can be used to satisfy the law's desire, yet at the same time, it can be used to circumvent regulation (as seen in Chapter 1), hence it is of paramount importance that the law remains the authority.[206] Raab and De Hert further critically analyse CAL in context of privacy protection, which coincidentally enough is an issue surrounded by considerable debate in the context of DLT regulation – in the sense that it does not account for the importance and role of political institutions and policy in dictating this code.[207] Contrary to the claims of De Fillipi and others (as seen in Chapter 2), regulation of the protocol cannot arise organically, through self-regulatory means.

The use of CAL as a tool to effect regulation does not account for the role played by actors who give effect to such code, who participate in regulatory regimes in which such tools are embedded. Therefore, there is a need to understand the design process, the factors that affect their implementation and so on – rather than placing a great deal of trust in the power of code – which is the biggest shortcoming of CAL.[208] The misplacement of trust in the power of code is due to a lack of consideration towards technical architecture of the platform.

For example, DLT-based networks are often compared to the Internet, while discussing their regulation. Indeed, Wright and Filippi (2015) use the same example of the Internet to justify why the Blockchain (and other DLTs) can be subject to regulation:

> "While states initially had a hard time grasping how to regulate a global and decentralized network like the Internet, they eventually understood that, as long as there are centralized

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[204] Charles Raab & Paul de Hert, 'The Regulation of Technology: Policy Tools and Policy Actors', TILT Working Paper No. 003/2007, p.5, 15th November 2007, URL: http://ssrn.com/abstract=1080167.
[205] See RAAB and DE HERT, *Supra* Note 204, p. 5.
[206] See RAAB and DE HERT, *Supra* Note 204, p. 9.
[207] See RAAB and DE HERT, *Supra* Note 204, p. 10.
[208] See RAAB and DE HERT, *Supra* Note 204, p. 11.

chokepoints, regulation can be achieved, through the indirect regulation of the various intermediaries and online operators that actually run the network."[209]

They believe that even in a world dominated by DLTs, the existence of a powerful intermediary cannot be avoided and warn us of the retaliatory action that could be taken by states as they try to get a grip on the entire DLT ecosystem.[210] For example, the rise of the Libra cryptocurrency from Facebook, led to a series of regulatory crackdowns from nations across the world within two week of its announcement.[211]

This comparison also arises due to the fact that DLT platforms, for the moment, also depend on Internet connectivity, allowing ISPs (Internet Service Providers) to discern IP addresses and the data fed to the nodes.[212] The assumption is that only a small portion of users obfuscate their browsing activity,[213] thus subjecting them to the scrutiny of ISPs. This reliance on a conventional ISP can change and is by no means certain, hence they cannot assumed to be the intermediary through which DLT should be regulated – for example, with the emergence of DLT-based internet service providers.[214] These services currently have their own problems, such as user segregation due to competition between providers and the ability of these providers to protect users against malicious activities.[215]

Therefore, with the above arguments in mind, in the context of DLT regulation, CAL is currently not feasible due to a common feature on every DLT platform, known as a 'consensus protocol'. This concept can be defined as follows:

> "All these variants (of DLTs) differ in the way they choose to reach the consensus, which helps
>
> a distributed ledger to function fairly, securely and efficiently. A consensus protocol, which is
>
> the core of the distributed ledger, performs two tasks: it guarantees that the next block of the

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[209] Aaron Wright and Primavera De Filippi, 'Decentralised Blockchain Technology and the rise of *Lex Cryptographia*', <SSRN, March 10, 2015>, p. 51, URL at: https://ssrn.com/abstract=2580664 or http://dx.doi.org/10.2139/ssrn.2580664.

[210]   See WRIGHT and DE FILIPPI, *Supra* Note 209, p.51.

[211] Zetszche, Buckley, Arner, 'Regulating Libra: The Transformative Potential of Facebook's Cryptocurrency and Possible Regulatory Responses', p.5, (2019), UNSWLRS 47, URL:
 http://ssrn.com/abstract=3414401

[212]   See FINCK, *Supra* Note 45, p. 177.

[213]   See FINCK, *Supra* Note 45, p. 178.

[214]   Andrena, 'Decentralized internet on Blockchain', <Hackernoon, 29th April 2019>, URL: https://hackernoon.com/decentralized-internet-on-blockchain-6b78684358a.

[215]   Shobhit Seth, 'Can decentralized blochchain-based Internet become a reality', <Investopedia, 19th March, 2018>, URL: https://www.investopedia.com/tech/can-decentralized-blockchainbased-internet-become-reality/.

network is the only version of the truth, and it protects the network from adversarial influences on the nodes and the network. It allows the network to confirm the transactions without relying on the intermediary.[216]"

This protocol is unique to every DLT and is essential to its functioning – it provides the means for actors to reach a consensus. Code-based regulation will have to either be painstakingly and unfeasibly tailored for every platform in use (because each variant achieves the consensus through a different protocol; CAL will have to integrate seamlessly to ensure interoperability between platforms with different protocols) or will have to destroy this uniqueness by harmonizing the code across all platforms in order to enable them to conform to the regulation.

This would be a problem because, firstly, platform operators would have no incentive to co-operate with regulators as the uniqueness of their platform would be taken away and secondly, such a proposal cannot guarantee interoperability in the short-term, due to the lack of collaboration it will generate from platform operators. A concluding argument for the ineffectiveness of CAL for DLT regulation at present arises from the notion of 'Technological development', which can be better understood from Perez's (2009) definition of a 'technological revolution':

"….a technological revolution can more generally be defined as a major upheaval of the wealth-creating potential of the economy, opening a vast innovation opportunity space and providing a new set of associated generic technologies, infrastructures and organisational principles that can significantly increase the efficiency and effectiveness of all industries and activities.[217]"

Technological development (or change) involves a process of invention, innovation and diffusion of a technology (which in this case is DLT) into the economy. While some might argue that the implementation of 'code-as-law' would be a part of the diffusion process, I believe that it is an ideal situation which can only happen once "associated technologies, infrastructures and organisational principles" are developed for DLT (i.e. once DLT has diffused into the economy to an appreciable extent). This problem has actually been identified to some extent by a 2016 report made by the World

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[216]   Wahab, Memood, Survey of Consensus Protocols, October 2019, URL at:
       https://arxiv.org/ftp/arxiv/papers/1810/1810.03357.pdf

[217]Carlota Perez, 'Technological Revolutions and techno-economical paradigms', No.20, Working Papers in Technology Governance and Economic Dynamics, The Other Canon Foundation, Norway and Tallinn University of Technology, Tallinn, January 20, 2009. The author has also referred to Schumpeter (1911,1939,1961) and other noted economists in the course of providing her definition.

Economic Forum, which has identified three significant hurdles for the large-scale implementation of DLT, which are; "an uncertain and unharmonized regulatory environment, nascent collective standardization efforts and an absence of formal legal frameworks".[218]

We do not know whether many features of existing laws can be successfully applied[219] to the sheer range of possibilities which DLT affords us. Instead of telling regulators to wait or to suggest a radical regulatory mechanism/theory, my opinion echoes that of Judge Easterbrook – which is to "continue doing what you have been doing"[220] – which is to protect the interests of lawful stakeholders using conventional means, until a clearer picture of the ecosystem can be defined. My proposal for effecting this outcome is in the form of principles-based regulation, which I have termed as a precursor to a DLT-specific body of law, known as *Lex Cryptographia*.

4.3: Principles-based regulation as a short-term solution for present-day DLT regulation:

Regulating DLT does not have to be a fight of choosing between the rule of law (state-backed regulation) and the rule of code.[221] Instead, regulators must start with a rule of law before shifting towards whatever means of regulation is the best choice once the ecosystem loses its nascence. Amidst all this criticism, what I suggest is to simplify the entire exercise of DLT regulation for the short-term, until the ecosystem loses its nascence by the use of principles-based regulation; before exposing it to radical and hybridized strategies of regulation (such as the examples of polycentric and multi-stakeholder co-regulation discussed in Chapter 2).

Fenwick and Vermuelen (2018) describe what I believe is needed at this stage:

> "Only by encouraging greater participation and transparency in the construction of this new reality can we ensure that this decentralized world can reach its full potential and offer greater convenience, accountability, and trust."[222]

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[218] Financial Services Committee of the World Economic Forum in Collaboration with Deloitte, 'The future of financial infrastructure: An ambitious look at how blockchain can reshape financial services', August 2016, URL: http://www3.weforum.org/docs/WEF_The_future_of_financial_infrastructure.pdf

[219] Frank H. Easterbrook, "Cyberspace and the Law of the Horse," 1996 University of Chicago Legal Forum, p.208, 1996.

[220] See EASTERBROOK, *Supra* Note 219, p.210.

[221] Primavera di Fillipi, Aaron Wright, 'Blockchain and the Law: The Rule of Code', p.210, 2018, Harvard University Press.

[222] Fenwick and Vermuelen, 'Technology and Corporate Governance: Blockchain, Crypto and Artificial Intelligence', Working Paper no. 424/2018, European Corporate Governance Institute, November 2018.

I have discussed in brief the balance regulators need to strike in Section 4.1– ensuring the governance, safety and resilience of the system while not infringing on the innovation and development of this fast-evolving technology [223] - and how this balance is analogous to the Collinridge dilemma. Participation and transparency are important elements of this balance, which will have to constantly shift as the ecosystem expands. Regulators will face the task of constantly keeping up with the technology, while maintaining this balance. By striking this balance, the aim is to restrict or minimize undesirable behaviour as much as possible. Doing so achieves two results – it will encourage law-abiding operators to co-operate with governments and secondly, it will allow the market to grow as law-abiding users will rely on the products and services of the ecosystem – due to governmental protection.

One issue, amongst others, that will certainly play a large role in determining this balance, for DLT in general is that of data protection (e.g. the ongoing DLT-GDPR debate). Irrespective of use-case, there will be a record of the transactions made by every node on the chain, in line with the immutable nature of the ledger. Whether personal data can be inferred from such a record will depend on the actor and the platform. It also throws up jurisdictional issues as public chains have nodes all over the world – and involve a lot of data protection regulations.

I only introduce this aspect of data protection in brief – to look on a debate between the immutability of records on the ledger and 'the right to erasure', granted by the GDPR. While all data on a DLT is immutable, can an irreversible encryption constitute 'erasure'?[224] Formal rulemaking is cumbersome and time consuming[225] and this example shows how the existing regulatory infrastructure faces considerable difficulties in being able to sufficiently distinguish and harness beneficial innovation (concepts such as irreversible encryption and identifying users on the basis of a unique identification number on the chain are not directly addressed by the GDPR).[226]

Focusing on technical architecture is important, as elements such as computational power, forking, oracles and nodes (irrespective of how they are designed in a DLT) will remain constants in DLT platforms for the foreseeable future. Thus, these principles (or their subject matter) are not likely to

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[223] See BUTENKO and LAROUCHE, *Supra* Note 201, p.27.
[224] See HERIAN, *Supra* Note 46, p.47.
[225] Fenwick, Mark D.; Kaal, Wulf A. Ph.D.; and Vermeulen, Erik P.M. "Regulation Tomorrow: What Happens When Technology Is Faster than the Law?," American University Business Law Review, Vol. 6, No. 3 ()., p.572
[226] See FENWICK, *Supra* Note 225, p.573. For more concerns, see Matthias Berberich; Malgorzata Steiner, Blockchain Technology and the GDPR - How to Reconcile Privacy and Distributed Ledgers, 2 Eur. Data Prot. L. Rev. 422 (2016) and European Parliamentary Research Service, 'Blockchain and the GDPR: Can distributed ledgers be squared with EU data protection law', Panel for the Future of Science and Technology, 2019.

change or lose importance anytime soon[227]– they are intended to be applied in any relevant situation, as opposed to establishing a set of rules that should address all possible scenarios.[228]

With respect to illegal activity, the intention is that such principles would remain relevant as the technology develops, making it difficult for market participants to use unanticipated innovations to exploit loopholes that would be inevitable in a more precise rule.[229] The security of this technology still needs to be tested using authoritative standards.[230]

These principles also serve as goals for regulators to achieve in their own task of regulating DLT – as they focus primarily on preventing undesirable behaviour which occurs through the manipulation of technical architecture. As the example of the 5th AML Directive shows, these principles have been proposed to prevent the use of loopholes involving technical architecture – which is a legitimate concern.[231]These principles can also serve as a starting point to test the potential of new strategies – serving as an umbrella framework under which informal regulatory strategies (such as sandboxes) can be deployed.[232]

It is hoped that these principles will initially be adopted in the form of technical and organisational rules, adopted by public regulators (with the aim to establish co-operation with private regulators in the field – such as platform operators) in a formal rulemaking process to lend them some accountability.[233]   These principles aim to afford regulators the freedom to consider different possibilities of regulating the technology, without shifting too much power to the operators.[234]

All the above observations made in this Chapter are to provide a suitable context within which we can frame our principles in. Before moving on to the actual principles themselves, I would like to share two quotes - one by the former director of the Bank of China, Li Li-Hui, and another by Vitalik Buterin, the founder of Ethereum:

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[227]   See FENWICK, *Supra* Note 225, p.590.
[228]   See COLLOMB, *Supra* Note 49, p.32.
[229]   Hilary Allen, 'Regulatory Sandboxes', George Washington Law Review, p.601, vol.87, 26th June 2019, URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3056993.
[230]   Guo, Y. and Liang, C, 'Blockchain application and outlook in the banking industry', Financial Innovation, 2(1), pp. 10, 2016, https://doi.org/10.1186/s40854-016-0034-9.
[231]   See ALLEN, *Supra* Note 229, p.602.
[232]   See ALLEN, *Supra* Note 229, p.603.
[233]   See ALLEN, *Supra* Note 229, p.603.
[234]   See ALLEN, *Supra* Note 229, p.603.

"Regulators should be involved in the formulation of technical and legal rules for financial blockchain technology, and now is the best time".[235]

"Growing up libertarian and then going out into the world and noticing that actual regulators were nicer to me than many "cypherpunks" was very disorienting.[236]"

4.3.1: Principles which can function as a precursor to a DLT-specific body of law (i.e. *Lex Cryptographia*):

Because of the technical-subject matter of these principles and the importance of regulating such elements of technical architecture, it is recommended that they be given effect to in the form of DLT-specific technical, legal and organisational rules. The main advantage of these principles is that they can be effected immediately, without the need to test their applicability – as they have been designed to withstand the test of time, with respect to the evolution of DLT platforms – in my opinion (without any authority, based on the literature used in this thesis and the potential of the proliferation of new and radical use-cases) for the next five or ten years, depending on the pace at which the ecosystem will scale. I shall now list them out:

1) Stakeholder Reliant:

- **Regulators must ensure that all stakeholders who wish to co-operate with regulatory efforts self-regulate and self-supervise their own risk-taking activities, so as to minimize external interference with stakeholder decisions.**

This principle has been directly copied from the only regulatory effort in connection with DLT, which embraces the use of principles-based regulation – that of the MAS from Singapore.[237] The aim of this principle is to ensure that no-one stakeholder wields an unreasonable amount of power, to the extent that it can interfere in the decisions of other stakeholders. This in turn, can serve as a starting point for the launch of cross-sectoral collaborative efforts between state and private regulators.

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[235] See GUO, *Supra* Note 230, p.10.
[236] Vitalik Buterin, Twitter, 15th February 2018, URL: https://twitter.com/vitalikbuterin/status/963939788645478400?lang=en
[237] See PEI, *Supra* Note 196, p.348.

2) Computational Power:

- **Regulators must impose limits/restrictions on the amount of computational power which can be accessed by actors and operators.**

This principle is the technical equivalent of the first principle – and seeks to create regulatory cognizance of this technical element in order to supplement the first principle. Computational power is required in any DLT, in order to process a greater volume of transactions. The aggregation of computational resources, especially in the case of Bitcoin and Ethereum (virtual currency networks are examples of DLT networks where computational power plays a crucial role – as miners on these chains are utilised depending on the degree of power they possess) – has led to an unprecedented degree of centralization, in a decentralized network. For example, four mining pools control 50% of the Bitcoin chain, whereas two mining pools combined control the same amount of nodes on the Ethereum chain.[238]

This issue of computational power is also closely tied to the next principle of forking – as an excess of computational power can cause forks. The importance of computational power has been grossly understated by regulators. An important obstacle in this regard is determining which state authority would handle this issue – as this feature can be used for competition purposes as a tool of influence, yet it can also be used to manipulate the platform, as the 51% attack example shows.

Furthermore, from the earlier example of DLT based internet providers, the lack of a centralised intermediary implies that the nodes could be tracked on the basis of computational power that they exhibit, which can be challenging as it is different from conventionally tracking actors on the Internet, if the platform does not rely on a centralised ISP. As developments such as quantum computing come to light, the concept of 'computational power' will certainly be an important topic in the context of DLT regulation in the future.

3) Forking:

- **Any DLT specific regulatory framework must at the very least, provide a legal definition of what constitutes 'forking'.**

A hard fork is when nodes of the newest version of a DLT no longer accept the newest version of the DLT; which creates a permanent divergence from the previous version of the ledger. Adding a new

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[238] See DE FILIPPI, *Supra* Note 221, p.180.

rule to the code essentially creates this fork– which reveals another shortcoming of CAL – an increased likelihood of 'forks' within the DLT.[239]

As a technical feature, there is no off-chain equivalent to the concept of a hard fork. While scholars mostly study the concept of forking in relation to virtual currencies, any DLT, irrespective of its use-case, with nodes, a ledger and a consensus protocol, has the propensity to fork. However, I leave it at this, because anything beyond a definition of the concept can only be left to public regulators – as their interaction with this feature will depend on the nature of DLT platforms they seek to regulate within their jurisdiction.

4) Risk-based approach to innovation:

- **Regulators need to adopt a risk-based approach to innovation in the DLT sector and only when the risk posed by new innovations in this field becomes material, should regulation concerning such innovation be implemented.[240]**

A Schumpterian focus[241] on the wide variety of technological innovations available in this context (for example, the debate on the legal status of an irreversible encryption), is what state regulators must pay attention to. Earlier in this chapter, the importance of the Data Protection debate, in the context of DLT regulation – was discussed. While most scholars tend to pick a side in this debate,[242] I only include this issue because it is an essential topic to be addressed with respect to DLT regulation. Importantly, rather than considering this question as a re-evaluation of the rights of a data subject in the context of a DLT – regulators must also recognise the potential development of new technological innovations in addressing these problems.

Despite the fact that scholars consider the DLT landscape problematic to regulate because of its decentralised nature – they must remain aware of the power of technological innovation in this field – as the examples of DLT-ISPs, Blockchain forensics and deanonymization show – mechanisms have evolved to place a check on the unrestricted freedom afforded to actors on DLT – and can be utilized by regulators instead of attempting to modify the architecture of the system itself.

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[239]   Jake Frankenfield, 'Hard Fork', <Investopedia, 25th November 2019>, URL: https://www.investopedia.com/terms/h/hard-fork.asp.

[240] See PEI, *Supra* Note 196, p.352.

[241]   Carlota Perez, 'Technological Revolutions and techno-economical paradigms',p.2, No.20, Working Papers in Technology Governance and Economic Dynamics, The Other Canon Foundation, Norway and Tallinn University of Technology, Tallinn, January 20, 2009.

[242]   See FINCK and HERIAN, *Supra* Note 45 and 46 – both examples include chapters on the applicability of the GDPR to DLT.

4.5 Conclusion:

This chapter outlines my proposal, which I believe all regulators and scholars must consider in the shot-term, while discussing the future of DLT regulation. The purpose of writing 3 supporting chapters for this proposition was to establish what the current trends in regulating the technology are – and what needs to change about these. The aim of this Chapter was to provide a solid reason not to rely on CAL and instead why regulatory efforts must be focused on technical architecture and how these efforts can be better directed to the task of regulation by adopting principles-based regulation.

Chapter 5: Conclusion – Regulating DLT for the immediate future:

5.1: *Lex Cryptographia* – A 'new' look at a new technology:

Over the course of this thesis, the aim has been to examine the current trends in DLT regulation, with the intent of pointing out drawbacks within them, which could hinder the entire exercise of DLT regulation. During a time period where regulators are doubtful as to whether they ought to be regulating the technology as a whole in the first place, most scholars have chosen to make predictions on how the ecosystem will develop and how regulators should react. However, a few have suggested the use of radical and hybridized forms of regulation for the DLT ecosystem, which call for establishing some degree of cross-sectoral organisation and are based on the use of technical architecture to effect regulation.

With the literature review, in comparing these theories with the predictive accounts of the ecosystem, we had reached the conclusion that the technology had not diffused to an appreciable extent to use such solutions, which share the common goal of promoting cross-sector collaboration amongst operators to create a stable regulatory environment.

The purpose of a *Lex Cryptographia* is to create a regulatory environment that can be subjected to the use of such theories. In doing so, it aims to remedy two remedy two drawbacks which have been identified in Chapters 2 and 3 – a lack of inclusiveness towards the wider DLT community and more importantly, a lack of consideration for the unique technical architecture of the platform.

As we had seen in the USA, there is a lack of harmonization at the state level, which is causing some complications. In the EU however, while DLT regulation is much more comprehensive and does not suffer similar drawbacks to the USA, an important drawback is that it does not address important elements of technical architecture. Despite these above 'drawbacks' – there are numerous positives which can be taken from the analysis of existing regulatory attempts. For example, they showcase the importance of concepts utilised in the central proposition of this thesis – such as principles-based regulation and cross-sectoral collaboration, acknowledged by Singapore and the EU (in Singapore, actual principles were listed – albeit with regards to financial supervision; whereas in the EU only the importance of principles-based regulation is acknowledged).

The purpose of using principles-based regulation is to provide a short-term measure till the technology diffuses to the extent that which CAL (or any other novel regulatory solution) will be feasible across all platforms. In Chapter 4, the proposal of using principles, along with its short-term advantages with respect to incentivising cross-sector collaboration as opposed to CAL, which has been the regulatory tool of choice for scholars in the context of DLT regulation was explored.

A DLT ecosystem will definitely become a reality in the future, as it is subject to waves of innovation. In this early stage, it is possible to regulate the use of this technology, in a manner that promotes the establishment of a secure and stable environment for platform operators to innovate. The outlook of a vast majority of the scholarly literature and existing regulatory attempts have mostly been focused on the long-term. However, due to the currently indeterminable impact of the technology, it is evident that a more short-term focus is required, with the intention of incentivising collaboration across sectors, due to the decentralised nature of the technology.

It is for this reason, that the use of principles, in the form of DLT-specific technical and organisational rules (which incorporate international standards) is advocated for the short-term regulation of the technology. Contrary to existing trends in DLT regulation, a *Lex Cryptographia* represents a 'new' look at a new technology – a look that is grounded in traditional state-backed law, as opposed to utilising technical architecture as the primary means of regulating the technology.