Building Castles in the Sky?: The Myth of Decentralized Finance and the Necessity of Legal Ordering

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ABSTRACT

Continuous boom-bust cycles in the digital assets ecosystem, including the 'Crypto Winter' of 2022-2023, suggest that legal ordering—in the form of external and/or embedded regulation—for crypto, digital assets, and decentralized finance (DeFi) is necessary to mitigate the threats posed by ill-designed crypto projects, safeguard investors against financial misconduct, and support the balanced future development of the market going forward. While a comprehensive international framework for the regulation of digital assets and crypto appears to be emerging, both the international guidance and domestic approaches so far exclude fully decentralized systems. The regulation and governance of 'true' DeFi thus remains a significant topic of discussion. A central ambition of DeFi protagonists is to create peer-to-peer financial systems and applications that are self-executing and independent of state action. Yet, the paradox of decentralized practices and communities is that they require some centralized, shared understanding of how members within that community should behave—the rules and protocols that will hold them together in a kind of aporia. While DeFi protagonists may finally have the technological innovations that enable the creation of such systems, questions remain as to how these normative orders will and should be governed. Indeed, the development of governance rules, processes, and procedures could be the building blocks for the construction of a legitimate legal order beyond the state. But without state institutions to facilitate governance functions such as the administration of justice, dispute resolution, and market supervision, questions remain as to how DeFi can effectively address these challenges in a way necessary for the market to develop successfully going forward.

INTRODUCTION

Across 2022, the global crypto and digital assets markets crashed. This was despite waves of optimism for various cryptocurrencies and high market expectations for the development of decentralized finance (DeFi), a novel way of providing financial services without traditional centralized intermediaries.[1] DeFi is a way of providing financial services: it seeks to eliminate the need for traditional centralized intermediaries, such as banks, brokers, and custodians.[2] As such, it is intended to enable the development of a more advanced system that can be censorship-free, fully automated, with low operation costs and less counterparty risk.[3] Most DeFi applications are built on public and permissionless blockchains such that participants would be able to use the protocols across jurisdictions, regardless of their location or socioeconomic status.[4] This is a compelling and seductive proposition for libertarians and financial inclusion advocates alike. Staunch DeFi protagonists, therefore, have been proselytizing the innovation of DeFi, seeing it as a future alternative to mainstream traditional finance (TradFi) and having the potential to rewire how financial systems work.[5] However, given its evolutionary history since inception in 2008, including the most recent meltdown of the crypto market in 2025 and the 'Crypto Winter' of 2022-2023, the proposition now deserves sober consideration. The move towards regulation subsequent to the Crypto Winter has been significantly influenced by the shift from Biden's administration to Trump's second presidency, including most recently the disbandment of the U.S. National Cryptocurrency Enforcement Team,[6] the establishment of the new

1 Douglas W. Arner et al., *The Financialisation of Crypto: Designing an International Regulatory Consensus*, 53 COMPUT. L. & SEC. REV. 1, 1-2 (2024).

2 Alexandra Born et al., *Decentralised Finance – A New Unregulated Non-Bank System?*, EURO. CENTRAL BANK (July 18, 2022), https://www.ecb.europa.eu/pub/financial-stability/macroprudential-bulletin/focus/2022/html/ecb.mpbu202207_focus1.en.html [https://perma.cc/3QJM-MKHF]; DAVID GOGEL, *DeFi Beyond the Hype: The Emerging World of Decentralized Finance*, THE WHARTON SCHOOL OF THE UNIVERSITY OF PENNSYLVANIA, (May 2021), https://wifpr.wharton.upenn.edu/wp-content/uploads/2021/05/DeFi-Beyond-the-Hype.pdf [https://perma.cc/9LFL-SHAT]; Agustín Carstens, Jon Frost & Hyun Song Shin, *A Foundation of Trust*, IMF (Sep. 2022), https://www.imf.org/en/Publications/fandd/issues/2022/09/A-foundation-of-trust-Carsten-Frost-Shin [https://perma.cc/ML64-JV9L].

3 Katerina Stroponiati et al., *Decentralized Governance in DeFi: Examples and Pitfalls*, DAPPRADAR BLOG (Oct. 29, 2020), https://dappradar.com/blog/decentralized-governance-in-defi-examples-and-pitfalls [https://perma.cc/5VPQ-MT97].

4 Dirk A. Zetzsche, Douglas W. Arner & Ross P. Buckley, *Decentralized Finance*, 6 J. FIN. REGUL. 172, 172-74 (2020).

5 *See, e.g.*, Philipp Sandner, *Decentralized Finance Will Change Your Understanding of Financial Systems*, FORBES (Feb. 22, 2021, 08:56 AM), https://www.forbes.com/sites/philippsandner/2021/02/22/decentralized-finance-will-change-your-understanding-of-financial-systems/ [https://perma.cc/2KHC-XRDE].

6 MacKenzie Sigalos, *DOJ Ends Crypto Enforcement Team, Shifts Focus to Terrorism and Fraud*, CNBC (Apr. 8, 2025), https://www.cnbc.com/2025/04/08/doj-ends-crypto-enforcement-team-shifts-focus-to-terrorism-and-fraud.html [https://perma.cc/5PLF-436K].

Crypto Task Force,[7] and the endorsement of the GENIUS Act,[8] all of which signal a more crypto-friendly approach over enforcement-based policies.

While DeFi experienced rapid growth, it remains a relatively recent addition to the global financial system.[9] The idea of a decentralized system originates from Satoshi Nakamoto's whitepaper in 2008 based on the idea of blockchain, a peer-to-peer (P2P) electronic transaction mechanism that facilitates what it envisaged and has become a widely known cryptocurrency – Bitcoin – in the subsequent year.[10] DeFi began to take shape with the launch of the Ethereum blockchain and its associated crypto-asset, Ether (ETH) in 2015, which are considered the foundation of P2P financial services beyond the simple functionality of Bitcoin.[11] This supports the operation of 'smart contracts' – a set of automatically executed, pre-defined protocols – that run on blockchains, empowering the development of the DeFi ecosystem.[12]

However, as more crypto intermediaries moved into the space to further develop the ecosystem,[13] DeFi gradually transformed into a 'shadow financial system'[14] with a wide range of digital products and services available. These crypto intermediaries often work analogously to brokers in traditional finance, providing trading, investment, and custodial services for DeFi investors. Prior to 2023, many also offered significantly higher annual returns than most TradFi institutions to boost investment and lure potential customers. A low-interest rate environment, government-mandated lockdowns, and a range of generous handouts and government furlough schemes bolstered disposable income and made it conducive for individuals to step into the new world of crypto investments. As more people put their money into cryptocurrencies and other digital assets, with a fair degree of

7 Nikhilesh De, *SEC Commissioner Hester Peirce on the New Crypto Task Force*, COINDESK (Mar. 15, 2025), https://www.coindesk.com/policy/2025/03/14/sec-commissioner-hester-peirce-on-the-new-crypto-task-force [https://perma.cc/UCB9-6DQG].

8 THE WHITE HOUSE, *Fact Sheet: President Donald J. Trump Signs GENIUS Act into Law* (July 18, 2025), https://www.whitehouse.gov/fact-sheets/2025/07/fact-sheet-president-donald-j-trump-signs-genius-act-into-law/ [https://perma.cc/8JU4-VC7L] [hereinafter THE WHITE HOUSE].

9 Erik Feyen, Yusaku Kawashima & Raunak Mittal, *Crypto-Assets Activity Around the World: Evolution and Macro-Financial Drivers* (World Bank Grp., Pol'y Rsch., Working Paper No. 9962, 2022), https://openknowledge.worldbank.org/bitstream/handle/10986/37115/Crypto-Assets-Activity-around-the-World-Evolution-and-Macro-Financial-Drivers.pdf [https://perma.cc/S6F6-EZS2].

10 Sirio Aramonte, Wenqian Huang & Andreas Schrimpf, *DeFi Risks and the Decentralisation Illusion*, BIS Q. REV. (Dec. 2021), https://www.bis.org/publ/qtrpdf/r_qt2112b.pdf [https://perma.cc/YW3Y-55LH] (*see also* Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*, BITCOIN.ORG (Oct. 31, 2008), https://bitcoin.org/bitcoin.pdf [https://perma.cc/CRL5-HWZJ]).

11 Born et al., *supra* note 2.

12 Aramonte, Huang & Schrimpf, *supra* note 10, at 22.

13 *See generally* Douglas W. Arner et al., *The Financialization of Crypto: Lessons from FTX and the Crypto Winter of 2022-2023* (Univ. H.K. Fac. L., Rsch. Paper No. 2023/19, 2023), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4372516 [https://perma.cc/J7SZ-RFXM].

14 Raphael Auer et al., *Banking in the Shadow of Bitcoin? The Institutional Adoption of Cryptocurrencies* 8, 20 (Bank for Int'l Settlements, BIS Working Papers No. 1013, 2022), https://www.bis.org/publ/work1013.pdf [https://perma.cc/3W8S-3GBP].

'fear-of-missing-out' (FOMO) driven by the boom of Bitcoin and a host of other cryptocurrencies across 2020-2022, the ensuing implosion of the Terra/Luna algorithmic stablecoin system in 2022 cost participants extraordinary sums of money.

The burst of the most recent crypto bubble in 2022 and the fear of global recession with soaring inflation rates wreaked havoc on the crypto market as well as the development of DeFi.[15] This series of catastrophic events adversely impacted various crypto firms that boomed during the Covid-19 pandemic and led to the insolvency of a number of them, including Celsius Network, Voyager Digital, and Three Arrows Capital.[16] Adding fuel to this was the rising fear that contagion in the crypto industry could pose a spillover risk into traditional finance and even the global financial system, which could worsen economic impacts on a global scale.[17] Nonetheless, the faltering of these very centralized entities did not stop the majority of DeFi antagonists going forward. DeFi has continuously operated and progressed amid changing socio-economic conditions, demonstrating the long-standing ambition of the developers to reimagine finance through on-going development efforts. On the other side of DeFi, crypto tokens still have significant speculative potential as they are a critical part of realizing decentralized payments. In an inherently profit-driven capitalist economy, as long as there is potential for profits, it is usually inevitable to see the participation of profit-seeking intermediaries and individuals who focus primarily on crypto speculation. This eventually creates a storm of hype that not only implies a continuing demand for DeFi transactions but also accelerates ensuing regulatory and developing efforts that will make the ecosystem more viable and robust.

Despite the attractiveness of the arguments in favor of decentralization over the past fifteen years of its evolution, the crypto and DeFi ecosystem has experienced a series of booms and busts, as well as extensive fraud, manipulation, and incompetence. Concerns over its growing interlinkages with TradFi also call to attention the risks it may pose on the financial system. As such, the experience of the crypto and DeFi ecosystem suggests that proper regulation is necessary to mitigate the threats posed by ill-designed crypto projects, to safeguard investors against financial fraud,

15 Jonathan Ponciano, *Crypto Winter Watch: All The Big Layoffs, Record Withdrawals and Bankruptcies Sparked by the $2 Trillion Crash*, FORBES (Aug. 18, 2022), https://www.forbes.com/sites/jonathanponciano/2022/08/18/crypto-winter-watch-all-the-big-layoffs-record-withdrawals-and-bankruptcies-sparked-by-the-2-trillion-crash/ [https://perma.cc/E77H-UL7V].

16 Reuters, *Factbox-Crypto Firms Run into Hardships*, U.S. NEWS (July 14, 2022, 08:45 AM), https://www.usnews.com/news/technology/articles/2022-07-14/factbox-crypto-firms-run-into-hardships [https://perma.cc/ST52-W5WN].

17 OECD, WHY DECENTRALISED FINANCE (DEFI) MATTERS AND THE POLICY IMPLICATIONS 47-48 (2022), https://www.oecd.org/en/publications/why-decentralised-finance-defi-matters-and-the-policy-implications_109084ae-en.html [https://perma.cc/GL7U-NNQK].

misconduct, and contagion risks as well as to support the balanced future development of the market going forward.[18] While a comprehensive international framework for the regulation of digital assets and crypto appears to be emerging, both the international guidance and domestic approaches tend to exclude fully decentralized systems. The regulation and governance of true DeFi thus remains an important topic of discussion, and the focus of this article.

An ambition of DeFi protagonists is to create P2P financial systems and applications that are independent of state action. Given the myriad inefficiencies in traditional finance and the opportunities that a decentralized system could provide for the creative economy, financial inclusion, the growth for small and medium-sized enterprises (SMEs), and development finance, among others, there is merit in considering how best to develop such systems. Yet, the paradox of decentralized practices and communities is that they require some centralized, shared understanding of how members within that community should behave – the rules and protocols that will hold them together in a kind of aporia. Many decentralized systems in fact operate with an underlying hierarchical system that involves founders, core developers, and governance token holders in the key decision-making process.[19] There will be a stronger tendency for concentration of control within the Decentralized Autonomous Organizations (DAOs) if governance tokens can be traded, from which a user may become the controlling majority through acquiring a certain amount of tokens, thereby eroding the expected democratic governance of a DAO.[20] While DeFi protagonists may finally have the technological innovations that enable the creation of such systems, questions remain as to how these normative orders will and should be governed. Indeed, the development of governance rules, processes, and procedures could be the building blocks for the construction of a legitimate legal order beyond those of states. But without the state's institutions to facilitate governance functions such as the administration of justice, dispute resolution, and market supervision, questions remain as to how DeFi projects will fill this void.

The challenge that DeFi faces, therefore, lies fundamentally in its notion and desire for both decentralization and disintermediation – the enabling of financial transactions without a traditional trusted third party. This means

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18 Arner at al., *The Financialization of Crypto: Lessons from FTX and the Crypto Winter of 2022-2023*, *supra* note 13, at 3-4.

19 Vanessa Villanueva Collao, *Decentralized (?), But Far from Disorganized: A Comparative Analysis of Legal Wrappers and the Evolving Structure of DAOs*, (May 2, 2025), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5143035 [https://perma.cc/MR6T-A3RJ].

20 Yannis Bakos & Hanna Halaburda, *Will Blockchains Disintermediate Platforms? The Problem of Credible Decentralization in DAOs* 17-18 (2023), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4221512 [https://perma.cc/8E8M-6HAS].

that it should be capable of dealing with internal failures when problems occur so that the ecosystem can be viable in the long term and, as most ardent DeFi protagonists hope for, become an alternative to mainstream traditional finance. Interestingly, however, this does not seem to be the case. When crypto firms become insolvent, they tend not to search for solutions within DeFi, but file for insolvency proceedings in a state institution – the court. Investors who lose their money following the collapse of crypto firms turn to regulators and courts, filing lawsuits to sue the companies that freeze their accounts and to recoup some of their funds.[21] This turn to the state calls into question the feasibility of conceptual and practical governance autonomy, particularly when it comes to the operation and administration of justice.

Assessing the creation and constitution of normative orders is a common exercise among legal academics, and particularly those versed in the episteme of legal pluralism. However, their approach is often to note and prescribe what may need to be achieved for a legal system to come into being. Their perspective is from without rather than within. In this article, we invert that process and engage directly with DeFi protagonists who are constructing this decentralized system and let them narrate. As they create these new systems and applications, we seek to understand how DeFi protagonists envisage administering these systems and protecting rights within, where they draw their inspiration from, and how they anticipate their system interacting with other systems. We hypothesized that engaging with DeFi protagonists would yield one of two results: either we would learn something novel about approaches to governance in this space that is not currently within public debate or, alternatively, that TradFi specialists may need to intervene and provide guidance for greater oversight. Our findings were somewhere in the middle.

As a preliminary matter, while participants were cognizant of many of the risks inherent to DeFi, there was wide divergence. First, in the conceptualization of DeFi and, second, how to address those risks depending on the conceptualization adopted. In this article, we first present our findings on how DeFi protagonists currently envisage contracting governance. Our analysis of the interviews yielded four main findings, revolving around the features of DeFi, perceived centralized elements in the system, recent government responses around crypto regulation, and the future development of DeFi. After summarizing our findings, we argue, first, that DeFi suffers from a decentralization paradox. By this, we mean that participants acknowledge that there will always be some form of

21 *See* Jody Godoy, *Explainer: Can Crypto Holders Recoup Losses in Court?*, REUTERS (June 24, 2022, 05:21 AM), https://www.reuters.com/business/finance/can-crypto-holders-recoup-losses-court-2022-06-24/ [https://perma.cc/Y6UM-VVGJ].

centralization within DeFi's design, given that there must be some form of consensus on rules as to how, for example, smart contracts must operate to facilitate transactions. Second, DeFi does not need to reject or oppose all state-based institutions to achieve its goal of a more libertarian and efficient financial system. Indeed, while DeFi protagonists may use technology to facilitate innovation in the operation of financial systems, this does not address the need for the provision of services for the administration of justice. This includes dispute resolution, policing and investigation, particularly in relation to fraud and criminal activities, and the protection of assets.

The article is structured as follows. Following this introduction, Part Two introduces DeFi, a discussion of the hypothesis of decentralization, and questions whether true DeFi exists, with an overview of the types of risk that have emerged in the DeFi ecosystem since its genesis. Part Three considers the range of evolving approaches to the governance and regulation of DeFi by state regulators, highlighting that these generally exclude true DeFi, but do not clearly define what this is or how to address it if it were to emerge. Part Four asks whether true DeFi exists, focusing on the findings from our study with DeFi protagonists. This includes an account of our research design and methodology. In this Part, we also discuss the particular example of Tornado Cash and the challenges it highlights as an example of true DeFi. In Part Five, we conclude with discussion of definitions and approaches to truly decentralized finance, focusing on both the role of internal ordering in the context of embedded regulation and external ordering in the context of regulation and supervision, including embedded supervision.

Through this study, we seek to grapple with several major questions: What are the necessary components for constructing a legitimate decentralized system beyond the state? How should a decentralized system be governed? How can consumer protection and accountability within DeFi be enhanced? What will be the major difficulties in the future development of DeFi?

RISKS IN DEFI

DeFi, in simple terms, typically refers to the provision of financial services through self-executing smart contracts and decentralized applications built on blockchain. It is usually seen as a replication of the existing financial system, but with a higher degree of transparency and interoperability.[22] In its extreme version, it is meant to be financed without

22 Fabian Schär, *Decentralized Finance: On Blockchain- and Smart Contract-Based Financial Markets*, 103(2) FED. RSRV. BANK OF ST. LOUIS REV. 153 (2021),

the need for external intermediaries, even to the extent of being fully autonomous: this is 'true' DeFi. Its protocols typically have four characteristics: (i) financial services or products; (ii) trust-minimized operation and settlement; (iii) non-custodial design; and (iv) programmable, open, and composable architecture.[23] The operation of DeFi, based on cryptographic proof, is trust-minimized, meaning that transactions are executed according to the predetermined rules of a DeFi protocol without the need for a trusted third party.[24] The non-custodial design prevents external parties from altering or expropriating the assets issued or managed by DeFi services, thus helping to protect the possessions of account holders.[25] By having a programmable and highly composable multi-layered infrastructure, anyone can build on, rehash, or develop independent projects by forking parts of the stack using open-source code.[26] The use of open interfaces also allows third parties to 'extend and verify the integrity and security of the service'.[27]

As a nascent and still evolving financial form, however, DeFi faces several technological and operational fragilities. These vulnerabilities, if not properly addressed, may pose risks to the ecosystem as a whole and undermine its viability in the long run. In this section, we identify five principal vulnerability categories that will need to be addressed: governance risk, operational fragilities, liquidity and maturity mismatches, leverage, and complex interconnectedness.[28] We begin with a discussion of the central propositions of DeFi and tokenomics.

The DeFi Hypothesis

DeFi has been advocated as a more efficient and secure system for financial services owing to its frequently cited features of transparency, security, and immutability in data storage, which are enabled by the distributed ledger technology (DLT) on which DeFi is built. In distributed ledgers, where the data storage points are all connected in a network of CPU nodes, each of the new transactions is broadcast to all nodes and recorded in a block through proof-of-work – a consensus mechanism that is utilized

https://www.stlouisfed.org/publications/review/2021/02/05/decentralized-finance-on-blockchain-and-smart-contract-based-financial-markets [https://perma.cc/4SQ5-7634].

23 SUMEDHA DESHMUKH, SHEILA WARREN & KEVIN WERBACH, DECENTRALIZED FINANCE (DEFI) POLICY-MAKER TOOLKIT 6 (2021), https://www3.weforum.org/docs/WEF_DeFi_Policy_Maker_Toolkit_2021.pdf [https://perma.cc/UU27-R6X9].

24 *Id.* at 7; Nakamoto, *supra* note 10, at 1; Aramonte, Huang & Schrimpf, *supra* note 10, at 21.

25 DESHMUKH, WARREN & WERBACH, *supra* note 23, at 7.

26 *Id.*; Schär, *supra* note 22, at 155-56.

27 DESHMUKH, WARREN & WERBACH, *supra* note 23, at 7.

28 *See* FIN. STABILITY BD., THE FINANCIAL STABILITY RISKS OF DECENTRALISED FINANCE 37 (2023), https://www.fsb.org/wp-content/uploads/P160223.pdf [https://perma.cc/Y3J9-MGKA].

to prove the expenditure of a specific CPU effort.[29] All transaction information, except the identities of the traders, is publicly announced to all nodes, which then validate, and accept it in a block bundle before continuing work on extending the chain. This greatly enhances transparency in financial transactions compared against a traditional trust-based model. Once nodes satisfy the proof-of-work, they timestamp the entire block and link it chronologically to the previous block, making it permanent in principle unless they redo the work in that block and all subsequent ones.[30] The unknown number of active nodes within a block bundle and the blockchains of data also serve as in-built protections against pre-planned cyberattacks, offering greater security to financial transactions.[31] Given the unique characteristics of transparency, data immutability, and enhanced security in DeFi, it offers an appealing technological solution to the issue of trust in traditional finance.

While proof-of-work has been a pioneering mechanism for adding new blocks to a blockchain through transaction validation, most current blockchain networks have adopted a more promising alternative—the proof-of-stake mechanism—which is similar to a voting system where participants pledge a stake of tokens as collateral to get a chance to be selected as the next transaction validators.[32] This greatly reduces energy consumption in the mining process as participants no longer need to solve complex mathematical problems as in proof-of-work and is considered more viable in the long run.[33]

Challenges to the Myth of DeFi

Since its inception, the crypto and DeFi ecosystem have experienced a series of boom-bust cycles, exhibiting the full range of risks and misbehaviors seen in TradFi. In many cases, these risks have emerged because of either human behavior or centralization. We consider these in more detail in the context of DeFi projects, whether truly decentralized or otherwise.

29 Nakamoto, *supra* note 10, at 3.

30 *Id.*

31 Dirk A. Zetzsche, Ross P. Buckley & Douglas W. Arner, *The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain*, EUR. BANKING INST. 12 (EBI Working Paper Series No. 14, 2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3018214 [https://perma.cc/Q5WR-8R2E].

32 Tessa Campbell & Simon Chandler, *Proof of Work vs. Proof of Stake: Comparing Blockchain Consensus*, BUSINESS INSIDER (Nov. 25, 2024), https://www.businessinsider.com/personal-finance/investing/proof-of-stake-vs-proof-of-work [https://perma.cc/8GS9-N8P6].

33 *Id.*

A. Governance Risk

Emergent governance frameworks in DeFi are typically unclear, obscure, untested, and have easy-to-manipulate arrangements, which could mislead users about the performance and security of actual DeFi activities.[34] The decentralized nature of the network gives rise to the risk of moral hazard due to the difficulty in establishing and enforcing accountability among those who launch DeFi projects through open protocols.[35] This can expose investors to financial losses by fraud, rug-pulls, and other illegal actions by project developers and programmers.

The DeFi governance frameworks are also prone to high concentrations of voting powers within protocols.[36] Governance tokens, which give holders voting rights in how to decide, pass, and implement initiatives, are usually owned only by a small group of actors.[37] As such, there is a significant risk of experiencing undesirable decisions that are against the intentions of participants. It also calls into question whether DeFi is in fact a decentralized system if the decision-making power is in the hands of a small number of token holders.

B. Operational Fragilities

Operational fragilities categorize most of the risk in DeFi. They refer to some features of DeFi that, intentionally or otherwise, give rise to operational disruptions, outages, and failures, thus impeding reliable delivery of relevant products and services.[38] Most of these vulnerabilities stem from the underlying technology of DeFi – its blockchain technology, smart contracts, and oracles and bridges, with blockchain representing the predominant risk. Blockchain's nascence makes it prone to technological issues, such as outages, consensus failure, and network congestion, all of which can impact the delivery of DeFi services.[39] The outages of Solana caused by client bugs and an incompetent system to deal with an inundation of transaction spams are an example of operational fragility, which led to system breakdown and forced system reboot and upgrade.[40]

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34 FIN. STABILITY BD., *supra* note 28, at 17.

35 OECD, *supra* note 17, at 12.

36 *Id.* at 59.

37 FIN. STABILITY BD., *supra* note 28, at 12-13.

38 *Id.* at 17.

39 *Id.* at 18.

40 Lostin, *A Complete History of Solana Outages: Causes, Fixes, and Lessons Learnt*, HELIUS (Feb. 23, 2025), https://www.helius.dev/blog/solana-outages-complete-history [https://perma.cc/J9UK-GGYS].

I. Smart Contract Risks

Smart contract risks as they relate to DeFi are typically in the form of technical insecurities.[41] Smart contracts are simply automatically executing computer code: they are permanent, immutable, and non-reversible once triggered.[42] They may or may not be contracts. They certainly are not smart, by definition in fact. Their inherent risks can manifest as a fraudulent transaction or a coding error, which, for instance, would allow hackers to manipulate token prices,[43] steal funds,[44] or drain investors' crypto holdings from the protocol[45] by exploiting these loopholes – although attackers might return the funds in some cases.[46]

II. Oracle Risks

Oracles are automated algorithms that provide protocols with external data[47] and execute off-chain operations.[48] The risk occurs when oracles do not work as expected or are corrupted due to errors or malicious attacks. Oracle manipulation usually involves an artificial influence of data feed inside and outside of the DeFi system, through which attackers may attempt to generate yield by manipulating asset prices on a protocol.[49]

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41 Marco Huber & Vinzenz Treytl, *Risks in DeFi-Lending Protocols – An Exploratory Categorization and Analysis of Interest Rate Differences*, *in* DATABASE AND EXPERT SYSTEMS APPLICATIONS – DEXA 2022 WORKSHOPS 258, 261 (Gabriele Kotsis, A Min Tjoa, Ismail Khalil, Bernhard Moser, Alfred Taudes, Atif Mashkoor, Johannes Sametinger, Jorge Martinez-Gil, Florian Sobieczky, Lukas Fischer, Rudolf Ramler, Maqbool Khan, Gerald Czech eds., 2022).

42 FIN. STABILITY BD., *supra* note 28, at 8, 18.

43 *See* Fran Velasquez, *DeFi Exchange Mango's $114M Exploit Was 'Market Manipulation,' Not a Hack, Ex-FBI Special Agent Says*, COINDESK (Oct. 20, 2022), https://www.coindesk.com/tech/2022/10/20/defi-exchange-mangos-114m-exploit-was-market-manipulation-not-a-hack-ex-fbi-special-agent-says/ [https://perma.cc/4UU7-7UGU]; Justin Baer, *A Trader Says Code Allowed Him to Withdraw Millions from a Crypto Exchange. Prosecutors Say He Crossed a Line*, WALL ST. J. (Feb. 21, 2023), https://www.wsj.com/articles/a-trader-says-code-allowed-him-to-withdraw-millions-from-a-crypto-exchange-prosecutors-say-he-crossed-a-line-9f6ddbd7 [https://perma.cc/QJ95-JZR6].

44 *See* Joshua Wong & Joon Ian Wong, *A Coding Error Led to $30 Million in Ethereum Being Stolen*, QUARTZ (July 20, 2022), https://qz.com/1034321/ethereum-hack-a-coding-error-led-to-30-million-in-ethereum-being-stolen [https://perma.cc/MZ6T-FHNL].

45 Shaurya Malwa, *DeFi Protocol Qubit Finance Exploited for $80M*, COINDESK (May 11, 2023, 11:41PM), https://www.coindesk.com/markets/2022/01/28/defi-protocol-qubit-finance-exploited-for-80m/ [https://perma.cc/H3MG-KKLH].

46 Nic Carter & Linda Jeng, *DeFi Protocol Risks: The Paradox of DeFi*, *in* REGTECH, SUPTECH AND BEYOND: INNOVATION AND TECHNOLOGY IN FINANCIAL SERVICES (Bill Coen & Diane Maurice eds., 2021, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3866699 [https://perma.cc/WP89-4VDJ].

47 CAMPBELL R. HARVEY, ASHWIN RAMACHANDRAN & JOEY SANTORO, DEFI AND THE FUTURE OF FINANCE 24 (2021).

48 FIN. STABILITY BD., *supra* note 28, at 18.

49 *CFTC Partners with SEC and DOJ to Bring Coordinated DeFi Enforcement Action Targeting Oracle Manipulation*, JONES DAY (Feb. 1, 2023), https://www.jonesday.com/en/insights/2023/02/cftc-partners-with-sec-and-doj-to-bring-coordinated-defi-enforcement-action-targeting-oracle-manipulation [https://perma.cc/LJY3-9F26].

III. Blockchain Bridges

Blockchain bridges are used to connect protocols across various blockchains and facilitate the transfer of information and tokens between them.[50] They hold or collect assets from one blockchain and release them in another for the same value. This is typically referred to as a 'wrapped token' and allows investors to transact across blockchains or protocols.[51] The holding of a large amount of funds make cross-chain bridges a target for theft or misappropriation, such as the stealing of $625 million of crypto from blockchain-based online games run by Axie Infinity.[52] This can also impact the original chain as it can cause a collapse in the value of wrapped tokens on the destination chain.[53]

C. Liquidity and Maturity Mismatches

A liquidity mismatch is arguably one of the most worrying vulnerabilities in DeFi, as illustrated in the recent downfall of many DeFi lending platforms.[54] The ratio of liquid assets held by firms to the total deposits they receive is a measure of liquidity risk,[55] and a liquidity mismatch usually stems from 'a different liquidity and maturity profile of liabilities and assets of relevant entities.'[56] This is particularly problematic in stablecoin issuers,[57] lending intermediaries,[58] and exchange platforms.[59] Crypto platforms may maintain little to no loss-absorbing capacity as they are currently not subject to liquidity or risk management requirements that

50 *Blockchain Bridges*, ETHEREUM.ORG (Aug. 25, 2025), https://ethereum.org/en/bridges/ [https://perma.cc/4ZPX-EXAE].

51 FIN. STABILITY BD., *supra* note 28, at 19.

52 David Ingram & Jason Abbruzzese, *Hackers Steal More Than $600 Million From Maker of Axie Infinity*, NBC NEWS (Mar. 29, 2022), https://www.nbcnews.com/tech/tech-news/hackers-steal-600-million-maker-axie-infinity-rcna22031 [https://perma.cc/4HMP-CJEV].

53 FIN. STABILITY BD., *supra* note 28, at 19.

54 Examples include Celsius Network and Voyager Digital, which experienced a liquidity crunch before going into insolvency. *See* Stacy Jones, *How the Celsius Liquidity Crunch Is Linked to Lido's Staked Ethereum*, DECRYPT (June 13, 2022), https://decrypt.co/102812/celsius-liquidity-crunch-lido-staked-ethereum-steth [https://perma.cc/2YDV-NF8P]; Ryan Browne, *Binance, Other Crypto Firms Line up Bids for Bankrupt Voyager Digital After FTX Collapse*, CNBC (Nov. 25, 2022, 07:53 AM), https://www.cnbc.com/2022/11/25/binance-others-line-up-bids-for-bankrupt-voyager-after-ftx-collapse.html [https://perma.cc/2H35-YDJ7].

55 *Global Financial Stability Report: Shockwaves from the War in Ukraine Test the Financial System's Resilience*, IMF 70 (Apr. 2022), https://digitallibrary.un.org/record/4019918 [https://perma.cc/H3DF-9P9K]

56 FIN. STABILITY BD., *supra* note 28, at 1.

57 U.S. DEP'T OF THE TREASURY, REPORT ON STABLECOINS 1 (2021), https://home.treasury.gov/system/files/136/StableCoinReport_Nov1_508.pdf [https://perma.cc/HJP4-56R2].

58 Sirio Aramonte, Andreas Schrimpf & Hyun Song Shin, *Non-Bank Financial Intermediaries and Financial Stability*, BANK FOR INT'L SETTLEMENTS 1,4 (BIS Working Papers No. 972, 2022), https://www.bis.org/publ/work972.pdf [https://perma.cc/6KZH-CSTV].

59 Giulio Cornelli et al., *Crypto Shocks and Retail Losses*, BANK FOR INT'L SETTLEMENTS (BIS BULL. NO. 69 2023) https://www.bis.org/publ/bisbull69.pdf [https://perma.cc/9AUY-MPXQ].

are typically applied to traditional banking.[60] In order to attract more investments, some of them will offer high yields to investors and use their collateral to make investments. As a result, they tend to maintain a reserve much less than the total amount of investment and benefit from a liquidity premium when inflows exceed outflows.[61] In times of an adverse shock that will likely prompt a redemption of funds, the platform may struggle to make repayments due to limited liquid assets, thus raising the possibility of runs and causing an operational failure.[62]

D. Leverage

Leverage involves the use of borrowed funds to invest with an expectation of increasing the initial return of an investment.[63] In DeFi, leverage typically requires the use of collateral, either in the form of collateralized loans or flash loans.[64] Users can obtain a loan by having their crypto holdings held as collateral in a DeFi lending platform, and subsequently using these loans to purchase more crypto-assets while maintaining exposure to the underlying collateral.[65] The concerns for leverage in DeFi lie primarily in the externalities that stem from excessive leverage. High leverage in crypto markets can exacerbate procyclicality[66] – the tendency of financial variables to fluctuate during a business cycle.[67] Loans in DeFi are typically over-collateralized as funds borrowed in one instance can be reused and serve as collateral in another transaction.[68] This allows investors to build a progressively large overall exposure to volatile crypto-assets, which can be problematic when crypto values begin to fall, as leveraged investors may liquidate a large amount of their holdings, thereby further aggravating a downward price spiral.[69]

60 Pablo D. Azar et al., *The Financial Stability Implications of Digital Assets*, FED. RSRV. BD. (Fin. & Econ. Discussion Series, 2022), https://www.federalreserve.gov/econres/feds/files/2022058pap.pdf [https://perma.cc/ZP4L-9TQC].

61 FIN. STABILITY BD., *supra* note 28, at 20.

62 *Id.*

63 Ryan Tian, *A Deep Dive into Leverages in DeFi Borrowing, Margin Trading, Leveraged Tokens and Options: FinNexus*, COINMARKETCAP, https://coinmarketcap.com/alexandria/article/a-deep-dive-into-leverages-in-defi-borrowing-margin-trading-leveraged-tokens-and-options-finnexus [https://perma.cc/LLL9-J5N8].

64 HARVEY, RAMACHANDRAN & SANTORO, *supra* note 47, at 57.

65 Cornelli et al., *supra* note 59, at 1.

66 Aramonte, Huang & Schrimpf, *supra* note 10, at 29.

67 *Jean-Pierre Landau: Procyclicality – What It Means and What Could Be Done*, BIS REVIEW 94/2009 (May 4, 2009), https://www.bis.org/review/r090805d.pdf [https://perma.cc/9VDC-WKHQ].

68 Cornelli et al., *supra* note 59, at 4.

69 Born et al., *supra* note 2.

E. Risk of Complex Interconnectedness

The growing interconnectedness between DeFi and the crypto-asset ecosystem can amplify the speed and breadth of any distress within the DeFi ecosystem.[70] This is exemplified by the crash of stablecoin TerraUSD in 2022, which caused another stablecoin, Tether, to temporarily lose its peg.[71] It also caused a huge blow to the deposits on Anchor, Terra's lending and borrowing protocol, and the price of its native token ANC,[72] while also allegedly accelerating the insolvency of a number of other crypto trading platforms.

Interlinkages can also extend beyond DeFi protocols to outside the ecosystem as the crypto firms expand into broader financial markets.[73] Trading platforms have often expanded beyond simple self-executing independent systems to become complex interlinked systems, often dominated by a small number of controllers. They are now dominating in DeFi by offering trading, borrowing, and lending services that facilitate consumers' investment in DeFi products. These trading platforms are where on- and off-ramps take place. They have close ties with TradFi through, for instance, real-life payments as a substitute for fiat, or as a recipient of some traditional banking services such as lending, trading, and clearing services.[74] They also connect retail consumers to DeFi via fintech apps, develop their own crypto projects via the operation of hedge funds, and even expand their reach to other businesses, thus establishing a highly intertwined set of connections with consumers and different sectors.[75] Such interlinkages can be problematic as they make two-way spillovers between DeFi and TradFi platforms possible should a shock to the crypto market occur, which could result in unpredictable losses to investors, the DeFi ecosystem, and the global economy.[76]

Building a Conceptual Framework

These experiences lead toward two central questions: first, how to regulate the digital assets ecosystem to address the problems which have emerged; and second, does true DeFi exist? We address the first question in Part III and the second in Part IV.

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70 Cornelli et al., *supra* note 59, at 1.

71 Omkar Godbole, *Tether Finds Stable Dollar Peg After Terra's Collapse*, COINDESK (May 11, 2023), https://www.coindesk.com/markets/2022/07/26/tether-finds-stable-dollar-peg-after-terras-collapse/ [https://perma.cc/6SBU-S7PZ].

72 Krisztian Sandor & Ekin Genç, *The Fall of Terra: A Timeline of the Meteoric Rise and Crush of UST and LUNA*, COINDESK (Apr. 15, 2024), https://www.coindesk.com/learn/the-fall-of-terra-a-timeline-of-the-meteoric-rise-and-crash-of-ust-and-luna.

73 FIN. STABILITY BD., *supra* note 28, at 24.

74 *Id.* at 25-27.

75 *Id.*

76 *Id.* at 22, 25-26.

REGULATORY APPROACHES: EXISTING AND PROPOSED

In parallel with the rapid growth of crypto-related activities around the globe over the past fifteen years since the launch of Bitcoin in 2009, crypto and digital assets have been a continuing focus of regulatory attention. As Gary Gensler, former Chair of the US Securities and Exchange Commission (SEC) put it, '[i]n crypto, there is lots of innovation, but plenty of hype.'[77] Most regulators agree that there is a regulation gap in cryptocurrency[78] and that greater supervision of crypto-related activities in the decentralized world would be imperative to enhancing investor protection and safeguarding the market against existential risks.[79]

With the emergence of traditional financial products and services in the crypto markets and the evolution of 'systemically important crypto intermediaries' (SICIs) that resemble traditional intermediaries, the crypto ecosystem has undergone a process of 'financialization,' which is characterized by the concentration of crypto intermediaries and their rising oligopoly or monopoly power in the market.[80] Despite the intention to be fully decentralized finance, the crypto ecosystem has evolved with centralized elements and has displayed similar failures and externalities, as well as economic motivations and objectives of market participants, that exist in TradFi.[81] Such developments, which have increasingly mirrored TradFi, should also come with an appropriately designed legal, regulatory, and supervisory system, following not only the principle of 'same function, same risk, same rules' but also 'new risks, new rules' that targets new risks exclusive to partial decentralization.[82] Through addressing the risks and inefficiencies in the ecosystem, an international regulatory consensus with bespoke regulation would be imperative to driving the DeFi ecosystem forward, which has been emerging across major economies.[83]

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77 Chair Gary Gensler, *Prepared Remarks of Gary Gensler on Crypto Markets at Penn Law Capital Markets Association Annual Conference*, U.S. SEC. & EXCH. COMM'N (Apr. 4, 2022), https://www.sec.gov/news/speech/gensler-remarks-crypto-markets-040422 [https://perma.cc/9QQA-9QBW].

78 Joshua Oliver, *The Lawless World of Crypto Scams*, FIN. TIMES (Sep. 18, 2022), https://www.ft.com/content/5987649e-9345-4eae-a4b8-9bfb0142a2ab [https://perma.cc/W8E3-LX3G].

79 *Fact Sheet: White House Releases First-Ever Comprehensive Framework for Responsible Development of Digital Assets*, THE WHITE HOUSE (Sep. 16, 2022), https://business.cch.com/BFLD/WhiteHouseReleases.pdf [https://perma.cc/L8TE-9ZSR].

80 Arner et al., *The Financialisation of Crypto: Designing an International Regulatory Consensus*, *supra* note 1, at 1-18.

81 *Id.* at 26.

82 *Id.* at 23-24.

83 *IMF Policy Paper: Elements of Effective Policies for Crypto Assets*, IMF (Feb. 23, 2023), https://www.imf.org/en/Publications/Policy-Papers/Issues/2023/02/23/Elements-of-Effective-Policies-for-Crypto-Assets-530092 [https://perma.cc/36S4-FZXG].

Major jurisdictions such as Switzerland[84], Japan[85], the U.S,[86], the United Kingdom (UK)[87], Singapore[88], Hong Kong[89], the United Arab Emirates (UAE)[90], and the European Union (EU)[91] have been actively engaging in developing a feasible and legally-bound regulatory framework for virtual assets (VAs) and crypto-related activities without compromising continuous innovations. At the same time country approaches continue to vary, reflecting political agendas and the interests that best suit their domestic situations. This could be problematic in devising a globally applicable framework with the same set of rules and principles for a quintessentially borderless industry. Indeed, the inherent nature of DeFi—as a transnational and inclusive financial technology that traverses borders—makes it difficult to have an approach that can confine its activities to one jurisdiction or make it subject to the same set of standards. Notwithstanding, there has been a spectrum of national responses that lay out their regulatory priorities for cryptocurrencies and virtual asset service providers (VASPs).[92]

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84 *Annual Report 2021*, FINMA (Apr. 5, 2021), https://www.finma.ch/en/~/media/finma/dokumente/dokumentencenter/myfinma/finma-publikationen/geschaeftsbericht/20220405-finma_jahresbericht_2021.pdf [https://perma.cc/7MR9-7LGX].

85 *Regulating the Crypto Assets Landscape in Japan*, FSA (Dec. 7, 2022), https://www.fsa.go.jp/en/news/2022/20221207/01.pdf [https://perma.cc/PU26-Z4B2].

86 Paul Tierno, *Crypto Legislation: An Overview of H.R. 3633, the CLARITY Act*, CONGRESS.GOV (Sep. 30, 2025), https://www.congress.gov/crs-product/IN12583 [https://perma.cc/S9MU-2GSZ].

87 *The Financial Services and Markets Act 2000 (Regulated Activities and Miscellaneous Provisions) (Cryptoassets) Order 2025*, HM TREASURY, https://assets.publishing.service.gov.uk/media/680f6387faff81833fcae94b/0302425_draft_RAO_SI.pdf [https://perma.cc/7Q8X-DFUP].

88 *A Guide to Digital Token Offerings*, MONETARY AUTH. OF SING. (May 26, 2020), https://www.mas.gov.sg/-/media/mas/sectors/guidance/guide-to-digital-token-offerings-26-may-2020.pdf [https://perma.cc/T3HS-ZZ5W]; *Consultation Paper: Proposed Regulatory Measures for Digital Payment Token Services*, MAS (Oct. 26, 2022), https://www.mas.gov.sg/-/media/mas/news-and-publications/consultation-papers/2022-proposed-regulatory-measures-for-dpt-services/consultation-paper-on-proposed-regulatory-measures-for-digital-payment-token-services-v3.pdf [https://perma.cc/8G65-X8FE].

89 *Discussion Paper on Crypto-Assets and Stablecoins*, H.K. MONETARY AUTH. (Jan. 2022) https://www.hkma.gov.hk/media/eng/doc/key-information/press-release/2022/20220112e3a1.pdf [https://perma.cc/CZ3V-PC27].

90 *Law No. (4) of 2022 Regulating Virtual Assets in the Emirate of Dubai*, VARA (Mar. 9, 2022), https://rulebooks.vara.ae/sites/default/files/en_net_file_store/VARA_EN_338_VER1.pdf [https://perma.cc/CXX7-TVFT].

91 European Parliament and Council of the European Union, Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets, and amending Regulations (EU) No 1093/2010 and (EU) No 1095/2010 and Directives 2013/36/EU and (EU) 2019/1937, 2023 O. J. (L 150), 1-166, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R1114 [https://perma.cc/G3F4-4NYU] [hereinafter Regulation (EU) 2023/1114].

92 *Bitstamp Crypto Pulse*, BITSTAMP, https://www.bitstamp.net/s/documents/BitstampCryptoPulseReport_Q12022.pdf [https://perma.cc/M4BA-26J7].

By the end of 2023, this had arguably come together into an increasingly coordinated approach at the international level.[93] In the aftermath of the unprecedented crash of Terra/Luna, which wiped away billions of investors' funds and caused a spillover effect to the broader crypto sector, regulatory attention has increased at the international level via the Group of 20 (G20), Financial Stability Board (FSB), International Monetary Fund (IMF), International Organization of Securities Commissions (IOSCO), and Financial Action Task Force (FATF) on Money Laundering in particular.[94] Arguably, there is now an emerging international consensus in terms of approaching regulation of crypto and digital assets, focusing on problems which have emerged in the ecosystem over the series of cycles and crises since its inception, reflecting what Jon Frost et al have termed a 'functional approach'.[95] These functions—as discussed elsewhere—largely mirror (ironically) TradFi regulatory functions, namely: monetary stability, financial stability, market efficiency, consumer and investor protection, market integrity, and growth and development, plus an additional framework governing stablecoins.[96]

The pressing need for an international consensus on an appropriate regulatory approach for DeFi has prompted global financial standard-setting organizations to issue relevant guidelines for major economies to consider.[97] Establishing effective oversight on anti-money laundering and counter-terrorist financing (AML/CTF) risks in DeFi is a key theme highlighted by the FATF and addressed in national frameworks.[98] The 'same risks, same rules' principle, as suggested by IOSCO, the EU via the Markets in Crypto-Assets (MiCA), and the FSB, is also a widely recommended approach for DeFi regulation, which has been adopted by many major economies so far.[99] Other emerging approaches include the punitive 'regulation by

93 Arner et al., *The Financialization of Crypto: Lessons from FTX and the Crypto Winter of 2022-2023*, *supra* note 13.

94 Arner et al., *The Financialisation of Crypto: Designing an International Regulatory Consensus*, *supra* note 1, at 1-2.

95 *See* Matteo Aquilina, Jon Frost & Andreas Schrimpf, *Decentralized Finance (DeFi): A Functional Approach*, 10 J. FIN. REGUL. 1 (2024), https://doi.org/10.1093/jfr/fjad013 [https://perma.cc/TY77-Q8XJ].

96 Arner et al., *The Financialization of Crypto: Lessons from FTX and the Crypto Winter of 2022-2023*, *supra* note 13, at 2-3.

97 *Final Report with Policy Recommendations for Decentralized Finance (DeFi)*, IOSCO (Dec. 2023), https://www.iosco.org/library/pubdocs/pdf/ioscopd754.pdf [https://perma.cc/E5C5-3THM].

98 *Targeted Update On Implementation Of The Fatf Standards On Virtual Assets And Virtual Asset Service Providers*, FATF (June 2025), https://www.fatf-gafi.org/content/dam/fatf-gafi/recommendations/2025-Targeted-Upate-VA-VASPs.pdf.coredownload.pdf [https://perma.cc/HJL5-TFWM].

99 *PwC GlobalCrypto Regulation Report 2025: Navigating the Global Landscape*, PwC (Mar. 5, 2025), https://legal.pwc.de/content/services/global-crypto-regulation-report/pwc-global-crypto-regulation-report-2025.pdf [https://perma.cc/23C4-2JAD]. *See also Digital Assets Regulation: Insights from Jurisdictional Approaches Insight Report*, WEF (Oct. 2024), https://www3.weforum.org/docs/WEF_Digital_Assets_Regulation_2024.pdf [https://perma.cc/CB8D-ZJ23].

enforcement' approach in the U.S. under the Biden administration, a licensing and registration regime as implemented in Hong Kong, an 'activity-based' regulation of crypto intermediaries, plus a stablecoin regulatory framework. These approaches will be discussed in turn.

It is noteworthy that all these approaches, to a great extent, intend to regulate DeFi in the same way as TradFi or conventional corporations, which misalign with the risks, governance, and business models of DAOs and can be practically pushing DeFi to be more centralized and hierarchical in nature in implementation.[100]

As a general matter, however, truly decentralized systems are either excluded or not directly covered. MiCA delineates its applicable scope to only 'natural and legal persons and certain other undertakings' that engage in centralized or partly-decentralized crypto-related activities and services, but not those that are 'fully decentralized' without any intermediary.[101] The definition of 'fully decentralized,' however, remains ambiguous except the criterion that there is no intermediary involved. The Bank for International Settlements (BIS) and Commodity Futures Trading Commission (CFTC) also provide some defining elements of DeFi. The former sees it as a 'competitive, contestable, composable and non-custodial financial ecosystem' that operates without a central intermediary and a safety net.[102] The CFTC characterizes it by a web of automated financial networks without a single point of failure.[103] Again, there remain some grey areas of what constitutes DeFi and whether some real-life cases that we are seeing can be treated as true DeFi. Potential regulatory approaches applicable to true DeFi are either missed out or not directly covered.

Regulation Based on the 'Equivalence' Principle

Some jurisdictions have proposed a regulatory framework based on the 'equivalence principle,' meaning that the crypto sector should be subject to the same set of regulatory requirements currently imposed on traditional finance.[104] This is underpinned by the belief that DeFi and crypto-related

100 Iris H-Y Chiu, *The Application of the Markets in Crypto-Asset Regulation to Decentralised Finance*, 38 J. INT'L BANK. L. & REGUL. 1, 10, 14 (2023), https://discovery.ucl.ac.uk/id/eprint/10178608/ [https://perma.cc/8R6Q-E7Y2].

101 Regulation (EU) 2023/1114, *supra* note 91.

102 Raphael Auer et al., *The Technology of Decentralized Finance (DeFi)*, BANK FOR INT'L SETTLEMENTS 3, (BIS Working Papers No. 1066, 2023), https://www.bis.org/publ/work1066.pdf [https://perma.cc/8HSX-V6BR].

103 U.S. COMMODITY FUTURES TRADING COMM'N, DECENTRALIZED FINANCE 6 (2024), https://www.cftc.gov/media/10106/TAC_DeFiReport010824/download.

104 *Policy Considerations For Decentralised Finance*, ABU DHABI GLOB. MKT. 16 (Discussion Paper No. 1 2022), https://assets.adgm.com/download/assets/Discussion+Paper+No+1of+2022+Decentralised+Finance+Apr+2022+FINAL.pdf/b0f6b50e7a5111ef9660565e25f269aa [https://perma.cc/R7UF-G5JD]; FINANCIAL STABILITY IN FOCUS: CRYPTOASSETS AND DECENTRALISED FINANCE, BANK OF ENGLAND

services do not change the fundamentals of financial services.[105] They perform an equivalent economic function as those in mainstream TradFi, the only difference being in the way that the financial services are delivered – through a trusted third party in TradFi and P2P without the need for an intermediary in DeFi.

In the UK, the Financial Policy Committee at the Bank of England is incorporating crypto regulation into the existing regulatory arrangements for TradFi and adapting the regulatory perimeter to ensure an equivalent regulatory outcome for both sectors.[106] It suggests an expansion of the responsibility of existing micro- and macro-prudential regulators to cover the monitoring of conduct and market integrity in the crypto sector and greater cooperation of these regulators in coordinating supervisory efforts.[107]

Similarly, the Financial Services Regulatory Authority (FSRA) of Abu Dhabi embraces the principle of 'equivalent risk, equivalent rules.'[108] This requires robust requirements and regulations to be imposed on DeFi participants in the same way as on TradFi stakeholders, particularly if the role of DeFi controllers and the nature of such activities are fundamentally the same as those in TradFi.[109] For instance, VASPs offering insurance to investors via DeFi protocols would be required to obtain a Financial Services Permission for Effecting Contracts of Insurance, Carryout Out Contracts of Insurance, Insurance Intermediation, and/or Insurance Management,[110] and be subject to other similar obligations placed on a TradFi firm that provides the same type of insurance. It also recognizes the need to adapt the existing measures to the new mode of financial services provision in DeFi so that an equivalent regulatory outcome as the obligations placed in TradFi can be guaranteed.[111] Besides, the FSRA adopts an approach that treats DeFi controllers as playing a similar role as individuals or intermediaries in TradFi firms.[112] It suggests that DeFi

24 (2022), https://www.bankofengland.co.uk/-/media/boe/files/financial-stability-in-focus/2022/cryptoassets-and-decentralised-finance.pdf [https://perma.cc/3TN6-8L7W].

105 *Final Report with Policy Recommendations for Decentralized Finance (DeFi)*, *supra* note 97, at 3, 17. *See also FSB Global Regulatory Framework For Crypto-Asset Activities Umbrella Public Note To Accompany Final Framework* FSB 3 (July 17, 2023), https://www.fsb.org/uploads/P170723-1.pdf [https://perma.cc/UU2X-7ZQK].

106 BANK OF ENGLAND, *supra* note 104, at 4.

107 *Id.*

108 *Policy Considerations For Decentralised Finance, supra* note 104, at 16.

109 *Id.*

110 *Application for Financial Services Permission*, ABU DHABI GLOB. MKT (2020), https://www.adgm.com/documents/setting-up/application/application-forms/fsra-ibs-insurance-business-supplement-v02-09-20.pdf [https://perma.cc/X9W7-HMY5].

111 *Policy Considerations For Decentralised Finance*, *supra* note 104, at 16-17.

112 *Id.* at 18.

controllers should have a high management capability and be made accountable for the safe and sound operation of DeFi protocols.[113]

The Monetary Authority of Singapore (MAS) is approaching the regulation of crypto service providers in the same way as they do to banks.[114] As the MAS puts it, 'all the stuff that we expect banks to do, we expect [crypto service licensees] to do.'[115] It expects licensed crypto service providers to monitor their customers on a continual basis to ensure that their transactions are congruent with their risk profiles and to comply with its guidelines on risk management and cyber hygiene to mitigate technological risks.

IOSCO released a series of recommendations in a major report in 2023, outlining a consensus to adopt a functional economic approach across its membership to the regulation of DeFi, crypto-assets, and related platforms and service providers over a one-size-fits-all prescriptive taxonomy.[116] IOSCO takes an outcomes-focused, principles-based approach to risk identification, assessment, and mitigation. Its approach is informed by a mapping of IOSCO standards to DeFi products, services, arrangements, and activities, which enables IOSCO to examine and assess how its existing policy framework aligns with key risks identified in DeFi.

The 'Whole-of-Government' Approach

An executive order signed by then U.S. President Joe Biden in March 2022 on Ensuring Responsible Development of Digital Assets confirms the first 'whole-of-government'[117] approach to address the perils of VAs and harness their potential benefits. The proposed comprehensive framework has six major priorities: (1) consumer and investor protection; (2) promoting financial stability; (3) countering illicit finance; (4) U.S. leadership in the global financial system and economic competitiveness; (5) financial inclusion; and (6) responsible innovation.[118] The report encouraged a coordination of efforts from a range of national agencies, including the CFTC, Securities and Exchange Commission (SEC), Consumer Financial Protection Bureau (CFPB), and the Federal Trade Commission (FTC), to

113 *Id.* at 18-19.

114 *"MAS' Approach to the Crypto Ecosystem" - Summary of Keynote Interview by Mr Ravi Menon, Managing Director, Monetary Authority of Singapore, at the Financial Times' Crypto & Digital Assets Summit on 27 April 2022*, MONETARY AUTH. OF SING. (Apr. 27, 2022), https://www.mas.gov.sg/news/speeches/2022/mas-approach-to-the-crypto-ecosystem [https://perma.cc/L8KR-CXXJ] [hereinafter *MAS Approach to the Crypto Ecosystem*].

115 *Id.*

116 *Policy Recommendations for Decentralized Finance (DeFi) Consultation Report*, IOSCO (Sep. 2023), https://www.iosco.org/library/pubdocs/pdf/IOSCOPD744.pdf [https://perma.cc/3MHY-CN5F].

117 THE WHITE HOUSE, *supra* note 8.

118 *Id.*

redouble investigation and enforcement actions against suspected noncompliance behaviors in the digital assets space and scrutinize consumer complaints against market abuses and deceptive practices.[119] These regulatory agencies were also expected to increase information and data sharing transnationally with other enforcement agencies for easier detection of market malpractices and illicit activities, enhance research efforts in digital assets, and offer technical assistance to firms to support the development of innovations and cutting-edge technologies.[120]

In reality, however, little took place in this respect, leaving a de facto approach of regulation by enforcement. Between 2021 and 2024, the SEC had instituted a series of investigations and charges against crypto firms and their chief operators for intentional fraud and noncompliance with federal securities law, targeting especially those that allegedly offered unregistered securities to the public.[121] Some notable cases include the charges against Samuel Bankman-Fried for defrauding equity investors through his trading platform FTX,[122] Terraform Labs and its CEO Do Kwon for fraud and misleading disclosure of a host of crypto asset securities,[123] and the founders of HyperFund for operating a pyramid scheme in disguise.[124] Crypto firms Genesis and Gemini were also charged for the unregistered offer and sale of crypto assets to retail investors.[125] All these arrests, coupled with many other similar cases, forcefully intercept the entities and hold the operators responsible for their alleged misconduct. Such punitiveness also demonstrates the likelihood of extending America's classic tough-on-crime approach to DeFi and the crypto industry, with the aim of fighting crypto crimes and providing deterrence. The enforcement actions, usually taken in hindsight, could penalize the perpetrators for their wrongdoings but are unable to recoup investor losses or mitigate harm, and are now generally seen as ineffective in either protecting against risks or supporting appropriate market development.

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119 *Id.*

120 *Id.*

121 *Press Releases*, U.S. SEC. & EXCH. COMM'N, https://www.sec.gov/newsroom/press-releases [https://perma.cc/VC9J-CHW4].

122 *SEC Charges Samuel Bankman-Fried with Defrauding Investors in Crypto Asset Trading Platform FTX*, SEC (Dec. 13, 2022), https://www.sec.gov/newsroom/press-releases/2022-219 [https://perma.cc/RPB4-ZX62].

123 *SEC Charges Terraform and CEO Do Kwon with Defrauding Investors in Crypto Schemes*, SEC (Feb. 16, 2023), https://www.sec.gov/newsroom/press-releases/2023-32 [https://perma.cc/4QNG-FV6W].

124 *SEC Charges Founder of $1.7 Billion "HyperFund" Crypto Pyramid Scheme and Top Promoter with Fraud* SEC (Jan. 29, 2024), https://www.sec.gov/newsroom/press-releases/2024-11 [https://perma.cc/9G2V-PYF8].

125 *SEC Charges Genesis and Gemini for the Unregistered Offer and Sale of Crypto Asset Securities through the Gemini Earn Lending Program*, SEC (Jan. 12, 2023), https://www.sec.gov/newsroom/press-releases/2023-7 [https://perma.cc/XYZ9-37NM].

The latest development of the U.S. crypto regulation concerns the passing of the Digital Asset Market Clarity Act 2025 (CLARITY Act), ascertaining the central role of the CFTC in regulating crypto assets and associated intermediaries while delineating the authority of the SFC over the crypto market.[126] This is seen as an attempt to address the previously unclear oversight of crypto activities among several national agencies which have overlapping regulatory responsibilities.[127] The issue that arises with such legislation is the strong inclination of Congress to define and regulate the crypto industry with existing financial laws, which suggests a tendency of the U.S. government to retrofit the current system rather than tailor-making one for crypto.[128] This, again, calls into question whether regulating crypto in the TradFi way could truly address the risks and issues that are largely distinctive to the DeFi ecosystem.

Going forward, the Trump administration, which aspires to become the *'*crypto capital of the planet*'*,[129] appears in fact to be pursuing a more *'*whole-of-government*'* effort to build a clear framework for digital assets, crypto, and DeFi going forward, although it is highly unlikely to use this terminology.

Licensing and Registration Regimes: Similar Risk, Similar Regulation

The latest thematic report published by the FSB considers implementation of international standards, focusing on the licensing and registration frameworks for the issuance of crypto assets and global stablecoins.[130] Restrictions posed to crypto-related activities and companies after a license is obtained vary across jurisdictions, which are outlined in the report to provide a point of reference for further policy consideration.[131]

Hong Kong—as well as a range of other jurisdictions around the world—has been actively pursuing the regulation of VASPs and the crypto

126 Paul Tierno, *supra* note 86.

127 Adrien K. Anderson, et. al., *Clarifying the CLARITY Act: What To Know About the House Crypto Market Structure Bill and Its Path to Law* (Aug.26, 2025), ARNOLD & PORTER, https://www.arnoldporter.com/en/perspectives/advisories/2025/08/clarifying-the-clarity-act [https://perma.cc/J4BV-4E4Y].

128 Aaron K. Washington et al., *Democratic DeFi Proposal Highlights Competing Visions for Cryptoasset Market Structure Regulation* (Oct. 15, 2025), https://www.skadden.com/insights/publications/2025/10/democratic-defi-proposal [https://perma.cc/9PYZ-8JX6].

129 Kimberley Kruesi, *Trump Calls For US To Be 'Crypto Capital Of The Planet' In Appeal to Nashville Bitcoin Conference*, AP NEWS (Jul. 28, 2024, 06:57 AM), https://apnews.com/article/donald-trump-bitcoin-cryptocurrency-stockpile-6f1314f5e99bbf47cc3ee6fc6178588dNEWS [https://perma.cc/99SB-KSHC].

130 *Thematic Review on FSB Global Regulatory Framework for Crypto-asset Activities: Peer Review Report*, FSB 38-41, at 16 (Oct. 16, 2025) https://www.fsb.org/uploads/P161025-1.pdf [https://perma.cc/6NU4-G638].

131 *Id.*

sector through licensing and registration.[132] The proposed Amendment Bill of AML/CTF renders VA exchanges a regulated activity and requires any person or business seeking to conduct a business involving the provision of VA services to obtain a VASP license from the Securities & Futures Commission (SFC) before carrying on transactions.[133] The Hong Kong Monetary Authority (HKMA) is currently considering expanding the scope of licensing of the existing stored value facilities to include payment-related stablecoins and crypto-assets due to the risk they may pose to financial stability.[134] Issuers who would like to issue a crypto-asset in Hong Kong that fulfils the parameters of the Payment Systems and Stored Value Facilities Ordinance are subject to the mandatory licensing regime under the HKMA.[135] Foreign businesses intending to carry out such activities across the territory would need to incorporate a company under Hong Kong law, and this would be the entity that applies to and holds the license from the HKMA if granted.[136] Only having a branch or office of a foreign corporation in the territory would not be considered as meeting the requirement of 'an entity incorporated in Hong Kong'.[137]

In Singapore, the MAS has also outlined the licensing process for VASPs hoping to conduct businesses in the country. It suggests that a stringent licensing process would help to ensure that players have strong risk management capabilities and governance structures that can cope with issues arising in the crypto sector.[138] Licensed VASPs are expected to carry out risk assessments of new products and technologies and to develop a comprehensive framework to detect ML/TF activities. As of February 2025, thirty digital payment token (DPT) licenses have been granted to players including Circle, a fintech company, Hashkey Group, a crypto exchange, and DBS Vickers, an established financial institution.[139]

'Activity-Based' Versus 'Entity-Based' Regulatory Approaches

From the standpoint of financial stability, the focus has often been on activity versus entity-based approaches.

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132 *Discussion Paper on Crypto-Assets and Stablecoins*, *supra* note 89, at 19.

133 *Legal Service Division Report on Anti-Money Laundering and Counter Terrorist Financing (Amendment) Bill 2022*, LEGIS. COUNCIL, (July 08, 2022), https://www.legco.gov.hk/yr2022/english/hc/papers/hc20220708ls-54-e.pdf [https://perma.cc/EU4N-VPGH].

134 *Discussion Paper on Crypto-Assets and Stablecoins*, *supra* note 89.

135 *Id.* at 20-21.

136 *Id.* at 28.

137 *Id.*

138 *MAS Approach to the Crypto Ecosystem*, *supra* note 114.

139 *The Latest List of Licensed Cryptocurrency Providers in Singapore (2025*), FINTECH SINGAPORE (Feb. 04, 2025), https://fintechnews.sg/latest-list-licensed-cryptocurrency-providers-in-singapore/ [https://perma.cc/X58C-53A2].

In the European Financial Stability and Integration Review 2022 published by the European Commission, a greater emphasis on an 'activity-based' approach, as opposed to an 'entity-based' approach, is recommended for crypto regulation.[140] Activity-based regulation 'constrains an activity on a standalone basis while entity-based regulation 'constrains a combination of activities at the entity level'.[141] The European Commission suggests that the bridging link between TradFi and DeFi would be the easiest access point for regulation—the process of using fiat currency to purchase crypto assets.[142] Apart from policing this link, it also proposes regulation of the project team behind DeFi applications.[143] They consider smart contracts essentially a substitute for regulated intermediaries in TradFi and suggest regulating the founding team behind this man-made software whose identities are usually known to the public.[144]

The SFC and the HKMA also adopt an activity-based approach to regulate the crypto sector in Hong Kong. In the joint circular issued by the SFC and HKMA on intermediaries' VA-related activities in January 2022, the SFC and the HKMA proposed a VA selling and advisory restriction and a VA-knowledge test as two additional investor protection measures that aim to mitigate associated risks.[145] The selling restriction denotes that except for a limited suite of VA-related derivative products that are allowed to be offered to retail investors, other VA products are considered 'complex products' that can only be offered to professional investors[146]—which are defined in the Basic Law as any recognized company, intermediary, authorized financial institution and issuer, registered scheme, and government institution performing the functions of a central bank or any multilateral agency.[147] Similarly, the restriction on VA advisory services constrains the provision of this service only to professional investors rather than retail investors.[148] Under this measure, VA service providers would be responsible for conducting a knowledge test to examine if retail investors have sufficient knowledge of VA investments and risks of VA-related

140 *European Financial Stability and Integration Review 2022*, EUR. COMM'N (Apr. 7, 2022), https://finance.ec.europa.eu/system/files/2022-04/european-financial-stability-and-integration-review-2022_en.pdf [https://perma.cc/5BPE-T3WG].

141 Claudio Borio, Stijn Claessens & Nikola Tarashev, *Entity-Based VS Activity-Based Regulation: A Framework and Applications to Traditional Financial Firms and Big Techs*, BANK FOR INT'L SETTLEMENTS (Fin. Stability Inst. Occasional Paper No. 19, 2022), https://www.bis.org/fsi/fsipapers19.pdf [https://perma.cc/PW8P-UELB].

142 *European Financial Stability and Integration Review 2022*, *supra* note 140.

143 *Id.*

144 *Id.*

145 *Joint Circular on Intermediaries' Virtual Asset-Related Activities*, SFC (Dec. 22, 2023), https://apps.sfc.hk/edistributionWeb/gateway/EN/circular/intermediaries/supervision/doc?refNo=23EC66 [https://perma.cc/233E-FNTT].

146 *Id.*

147 Securities and Futures Ordinance (2003), Cap. 571, Sch 1, § 1(1) (H.K.).

148 *Joint Circular on Intermediaries' Virtual Asset-Related Activities*, *supra* note 145.

products prior to authorizing a transaction on their behalf.[149] They should also make sure their customers have sufficient net worth to bear the risks and potential losses of their trade if it takes a turn for the worse.[150]

Both Singapore and Abu Dhabi adopt similar restrictions to retail investors in the crypto sector. In Singapore, the MAS considers it highly risky and unsuitable for retail investors to dabble in cryptocurrencies, recognizing that they might not have sufficient knowledge regarding the risks of DPT services.[151] It also bans the provision of any investment incentives to retail customers and the use of credit facilities in DPT transactions.[152] In Abu Dhabi, the FSRA is considering the prohibition of DeFi offering activities to retail investors or imposing restrictions to constrain their exposure to such activities to minimize the potential risks associated with these customer groups.[153] For professional clients and financial institutions, provided that they are more well-informed and more capable of protecting themselves, they take a relatively lenient approach and allow their access to recognized protocols with fewer conditions.[154]

Generally speaking, the trend is thus towards activity-based approaches as a baseline but with the evolution of more entity-based approaches as complex crypto conglomerates and systemically important crypto infrastructure emerge.

Mitigating AML/CTF Risks, Cyber Threats, and Crypto-Related Scams

Pseudonymous financial transactions conducted in a largely unregulated side of the decentralized space that lacks market oversight have rendered DeFi vulnerable to cyber threats and unlawful financial activities.[155] Crypto investors have been exposed to malicious scams that cause distress and monetary losses.[156] Tracing the international network of faceless scammers behind every fraud case and cracking down on major fraud syndicates are an uphill task, given the borderless and anonymous nature of the crypto

149 *Id.*

150 *Id.*

151 *Proposed Regulatory Measures for Digital Payment Token Services*, *supra* note 88*; MAS Strengthens Regulatory Measures for Digital Payment Token Services*, MONETARY AUTH. OF SING. (Nov. 23, 2023), https://www.mas.gov.sg/news/media-releases/2023/mas-strengthens-regulatory-measures-for-digital-payment-token-services [https://perma.cc/X9LH-3TER].

152 *Id.*

153 *Policy Considerations For Decentralised Finance*, *supra* note 104.

154 *Proposed Regulatory Measures for Digital Payment Token Services*, *supra* note 88.

155 *Assessment of Risks to Financial Stability from Crypto-Assets*, FIN. STABILITY BD. (Feb. 16, 2022), https://www.fsb.org/wp-content/uploads/P160222.pdf; **U.S. DEP'T OF THE TREASURY**, 2022 NATIONAL TERRORIST FINANCING RISK ASSESSMENT (2022), https://home.treasury.gov/system/files/136/2022-National-Terrorist-Financing-Risk-Assessment.pdf [https://perma.cc/L95R-CN4D].

156 Joshua Oliver, *The Lawless World of Crypto Scam*, FIN. TIMES (Sep. 19, 2022), https://www.ft.com/content/5987649e-9345-4eae-a4b8-9bfb0142a2ab [https://perma.cc/2TKG-FHZM].

business.[157] The exacerbating cyber risks and fraud cases associated with DeFi thus hasten calls for regulation.[158] In light of this, regulators have recognized the need to develop a comprehensive framework that helps detect and block suspicious activities in DeFi while also mitigating any associated risks.

The FATF has been engaged in an extensive process of development of international regulatory standards for ML/TF risks of crypto, digital assets, and DeFi. These have now been addressed in the context of the FATF's Forty Recommendations,[159] which have been monitored for jurisdictional implementation in the FATF's annual review process.[160]

In the U.S., the SEC renamed the Cyber Unit in the Division of Enforcement to Crypto Assets and Cyber Unit and added twenty positions in the unit for dealing with cyber-related threats and investor protection, taking the tally to fifty dedicated positions.[161] Expanding the unit will better equip the SEC to detect unlawful behaviors in the digital space and identify disclosure and control issues in relation to cybersecurity.[162] The unit aims to leverage its expertise to safeguard investors and the crypto markets against potential risks, and to probe into securities law violations with respect to (1) crypto asset offerings; (2) crypto asset exchanges; (3) crypto asset lending and staking products; (4) DeFi platforms; (5) non-fungible tokens (NFTs); and (6) stablecoins.[163] The U.S. government has been reviewing existing laws against unlicensed money transmitting and considering extending their application to VASPs, which aims to hold cybercriminals and other malign actors accountable for their illicit activities that pose national security risks.[164]

Cryptoasset exchange providers and custodian wallet providers in the UK are required to register with the Financial Conduct Authority (FCA) under the AML/CFT regime and to comply with relevant requirements as set out in the Money Laundering, Terrorist Financing and Transfer of Funds Regulations ("MLR Regulations") before carrying on cryptoasset activity

157 *Id.*

158 Hazem Mulhim, *Opinion: Why Crypto Businesses Need Anti-Money Laundering Regulations*, WORLD ECON. F. (Sep. 21, 2022), https://www.weforum.org/agenda/2022/09/why-crypto-businesses-need-anti-money-laundering-regulations/ [https://perma.cc/W732-9JXP].

159 *International Standards On Combating Money Laundering And The Financing Of Terrorism & Proliferation The FATF Recommendations*, FATF (June 2025), https://www.fatf-gafi.org/en/publications/Fatfrecommendations/Fatf-recommendations.html [https://perma.cc/TTC9-43GN].

160 *Targeted Update on Implementation of the FATF Standards on Virtual Assets and Virtual Asset Service Providers*, supra note 98.

161 *SEC Nearly Doubles Size of Enforcement's Crypto Assets and Cyber Unit*, SEC (May 3, 2022), https://www.sec.gov/news/press-release/2022-78 [https://perma.cc/T7RR-66XX].

162 *Id*.

163 *Id.*

164 Arner et al., *The Financialisation of Crypto: Designing an International Regulatory Consensus*, *supra* note 1.

within the UK.[165] Firms need to have appropriate Know Your Customer (KYC) guidelines, sources of funds, and proof of funds checks to register successfully with the FCA, which helps to prevent illicit money from getting into the system.[166] However, this regulation only applies to UK-based crypto firms and not foreign firms, which raises a major concern in the industry that this might encourage firms to go offshore to sidestep this onerous regulatory measure set by the FCA for registration.[167]

The EU has also reached a provisional agreement on enhancing AML/CTF efforts by extending the scope of the existing travel rule on transfers of funds in TradFi to transfers of crypto assets.[168] The travel rule originates from a wire transfer regulation in 2015 that aimed to prevent and detect ML/TF through obliging payment service providers to include information on the payer and the payee in transfers of funds.[169] The extended version of the travel rule requests crypto service providers to obtain and make accessible the information about the originator and beneficiary of crypto transfers in a way similar to what payment service providers do in wire transfers.[170] This increases the traceability of crypto asset transfers and allows relevant authorities to better identify and block suspicious transactions, thus helping the EU mitigate the risks associated with ML/TF.[171]

In Hong Kong, the Financial Services and the Treasury Bureau have proposed the amendment of their AML/CTF Ordinance, trying to bring exchanges that offer VAs but do not qualify as securities within the regulatory oversight of the SFC.[172] The amendment bill seeks to apply proper customer due diligence and record-keeping requirements to VASPs

165 *Cryptoassets: AML/CTF Regime*, FIN. CONDUCT AUTHORITY (Jan. 15, 2024), https://www.fca.org.uk/firms/financial-crime/cryptoassets-aml-ctf-regime [https://perma.cc/5L4X-STH6]; *Prevention of Money Laundering/Combating Terrorist Financing: 2020 Revised Version, Guidance for the UK Financial Sector, Part II: Sectoral Guidance*, JOINT MONEY LAUNDERING STEERING GRP. (July 2020), https://www.jmlsg.org.uk/wp-content/uploads/2020/07/JMLSG-Guidance_Part-II_-July-2020.pdf [https://perma.cc/5MGP-VGPP].

166 Lucy Frost, *PRIMER: UK Crypto Regulation*, INT'L FIN. L. REV. (July 13, 2022), https://www.iflr.com/article/2acqrpffhs6x6h1aqql8g/primer-uk-crypto-regulation [https://perma.cc/6K3R-RCYK].

167 *Id.*

168 *Anti-Money Laundering: Provisional Agreement Reached on Transparency of Crypto Asset Transfers* EUR. COUNCIL (June 29, 2022, 11:00 PM), https://www.consilium.europa.eu/en/press/press-releases/2022/06/29/anti-money-laundering-provisional-agreement-reached-on-transparency-of-crypto-asset-transfers/ [https://perma.cc/JJ64-V2CC].

169 Regulation (EU) 2015/847, Information Accompanying Transfers of Funds and Repealing Regulation (EC) No 1781/2006, 2015 O.J. (L 141) 1.

170 *Anti-Money Laundering: Provisional Agreement Reached on Transparency of Crypto Asset Transfers*, *supra* note 168.

171 *Id.*

172 Etelka Bogardi & Amy Chung, *Hong Kong is Moving to a Robust Regulatory Framework for Crypto*, REGULATION ASIA (Apr. 20, 2022), https://www.regulationasia.com/hong-kong-is-moving-to-a-robust-regulatory-framework-for-crypto/ [https://perma.cc/RJ22-45QJ].

when they conduct transactions,[173] similar to what has been proposed by the MAS and Abu Dhabi Global Market in mitigating AML/CTF risks.[174]

Regulatory Framework Targeting Stablecoins

The G20 and FSB, in the wake of the announcement of the proposed Libra global stablecoin by a consortium led by Facebook in 2019, have developed a comprehensive framework of regulatory guidance for jurisdictions around the world. These guidelines are now in the process of implementation in a range of jurisdictions, including the U.S. These frameworks seek to address a range of issues, from monetary stability to financial stability to consumer protection and beyond.

In Hong Kong, the HKMA aims to regulate stablecoins using the proposed licensing requirements. Various stablecoin-related activities, including (1) issuing, creating, or destroying stablecoins; (2) managing reserve assets to ensure stabilization of a stablecoin's value; (3) validating transactions and records; (4) storing the private keys providing access to stablecoins; (5) facilitating the redemption of stablecoins; (6) transmission of funds; and (7) executing transactions in stablecoins, would fall under the proposed regulatory ambit and be subject to licensing arrangements.[175] The Bill was passed in July 2025 and has now become the Stablecoin Ordinance under the Basic Law (Cap. 656).[176]

Both the EU and Singapore consider a secure backing for stablecoin and a sufficient liquidity reserve as necessary to address issues of high volatility that could cause unexpected losses to investors.[177] The EU goes one step further to set forth a comprehensive framework in MiCA's proposal targeting stablecoin regulation. It suggests that stablecoin issuers should be obliged to offer every stablecoin holder a claim free of charge and have a sufficient liquidity with a 100% reserve ratio in which a part of it is in deposits.[178] It also aims to forbid the development of asset-referenced tokens (ARTs) backed by non-European currency due to concern over the EU's monetary sovereignty. It requires all ART issuers to have a registered office

173 LEGIS. COUNCIL, *supra* note 133.

174 *Policy Considerations For Decentralised Finance*, *supra* note 104; *Proposed Regulatory Measures for Digital Payment Token Services, supra* note 88.

175 *Discussion Paper on Crypto-Assets and Stablecoins*, *supra* note 89.

176 *Stablecoins Ordinance*, H.K. MONETARY AUTH. (July 2025), https://www.hkma.gov.hk/media/eng/doc/key-functions/ifc/stablecoin-issuers/Explanatory_Notes_on_Licensing_of_Stablecoin_Issuers_eng.pdf [https://perma.cc/7RJ2-65YA].

177 *Digital Finance: Agreement Reached on European Crypto-Assets Regulation*, EUR. COUNCIL (June 20, 2022), https://www.consilium.europa.eu/en/press/press-releases/2022/06/30/digital-finance-agreement-reached-on-european-crypto-assets-regulation-mica/ [https://perma.cc/G4Q2-MPWW]; *Proposed Regulatory Approach for Stablecoin-Related Activities, supra* note 88.

178 *Anti-Money Laundering: Provisional Agreement Reached on Transparency of Crypto Asset Transfers*, *supra* note 168.

in the EU so that they can be under appropriate supervision and scrutiny of EU regulators.[179]

The U.S. has passed a long-awaited bill in June 2025 to create a federal regulatory framework specifically for stablecoin, which was subsequently signed into law in July. Known as the GENIUS Act (Guiding and Establishing National Innovation for U.S. Stablecoins Act of 2025), the Act requires stablecoins to be 1:1 backed by permitted reserves, including fiat and currency, central bank reserves, deposits and assets approved within the existing regulatory framework.[180] The disclosure process becomes more transparent as issuers, who would be subject to the Bank Secrecy Act and its AML rules, are required to make monthly, public disclosure of their reserves composition and comply with marketing rules.[181] The Act also offers a state regulatory option for issuers with fewer than $10 billion stablecoins, given that the state's regulatory approach is 'substantially similar' to the federal's regime,[182], and prioritizes stablecoin holders' claims over all creditors in the event of insolvency.[183]

Despite conflicts of interest allegations arising due to Trump's ownership of a few crypto ventures[184], the adoption of this bipartisan Act reflects great strides towards a clearer and more robust regulatory framework for stablecoins within U.S. jurisdiction. It accepts stablecoins as a legal tender and requires payment stablecoins to be dollar-pegged and reserve-backed, eliminating algorithmic stablecoins such as Tether and Terra-Luna from the market. The Act also attempts to establish a unified, federal-level regulatory framework to address the existing fragmented regulation that contains a mix of federal and different state-level legislations, as well as tailor-made AML/CTF rules that may fit the DeFi ecosystem more practically. The guidelines delineate what issuers should do and how their businesses would be governed, clarifying many grey areas that fill the existing governance void.

The IOSCO Framework

IOSCO, in its 2023 Final Report with Policy Recommendations for Decentralized Finance, builds on its 2022 consultation to provide a set of

179 *Id.*

180 Paul Tierno, *Anti-Money Laundering: Provisional Agreement Reached on Transparency of Crypto Asset Transfers: An Overview of S. 919, GENIUS Act of 2025a*, CONGRESS.GOV (May 19, 2025), https://www.congress.gov/crs-product/IN12522 [https://perma.cc/7B9W-RL8Q] [hereinafter *GENIUS Act*].

181 THE WHITE HOUSE, *supra* note 8.

182 *GENIUS Act*, *supra* note 180.

183 THE WHITE HOUSE, *supra* note 8.

184 Hannah Lang, *US Senate Passes Stablecoin Bill in Milestone for Crypto Industry*, REUTERS (June 18, 2025), https://www.reuters.com/sustainability/boards-policy-regulation/us-senate-passes-stablecoin-bill-milestone-crypto-industry-2025-06-17/ [https://perma.cc/KP4R-EN44].

principle-based and outcomes-focused recommendations and guidance for DeFi regulation as they develop their own regulatory frameworks. It also serves to inform its member regulators and governments the recent development, events, trends, and risks in DeFi, as well as their implications for investors and market participants. It, however, does not address the question of truly decentralized finance.

The report clarifies the misconception that DeFi products, services, and activities are materially different from those offered in traditional financial markets. In fact, they substantially mirror the operation of the traditional financial markets, with the only difference being the means with which such activities are carried out—the former uses DLT to varying degrees. Another misconception concerns the human elements involved in the decentralized financial system. Activities in DeFi are not carried out in a fully automated manner as what is commonly perceived by participants. Instead, there is significant human involvement in the delivery of DeFi products and services, as well as in the design, deployment, operation, and maintenance of the codes that implement a DeFi protocol, which demonstrates a close resemblance to the operation of the traditional markets. With this regard, ISOCO suggests that any individuals and entities that participate in the DeFi market should be treated based on the 'same activity, same risk, same regulation/regulatory outcome', regardless of their organization form or the technologies used, which is also the guiding principles of the nine recommendations being made.[185]

The overarching recommendations and guidance for DeFi seeks to achieve investor protection and market integrity that are the same as, or consistent with, the requirements set out in traditional finance markets. A summary of the nine recommendations are as follows:

1. Regulators should examine DeFi products, services, activities, and arrangements occurring within their jurisdictions to produce an informed response and seek to understand the DeFi arrangement at the enterprise, functional, and technical levels.

2. Regulators should identify the responsible persons or entities (Responsible Persons) who can exercise control or sufficient influence over a particular financial product, service, or activity, to be subject to the applicable regulatory framework.

3. The framework used to regulate and supervise the DeFi markets should be consistent with IOSCO Standards and seek to achieve regulatory outcomes of investor protection and market integrity that are the same as those in traditional financial markets.

185 *Final Report with Policy Recommendations for Decentralized Finance (DeFi)*, *supra* note 97.

4. Regulators should require the Responsible Persons to identify and address conflicts of interest, particularly those arising from their roles and capacities of products and services offered.

5. Regulators should ask the Responsible Persons to identify and mitigate material risks in their DeFi arrangements and activities through a well-established risk management framework and consider requiring more robust measures to address the sufficiently acute ones that cannot be effectively addressed.

6. To enhance investor protection and market integrity, regulators should request the Responsible Persons to accurately disclose to users and investors clear and comprehensive information material of the products and services offered.

7. Regulators should apply their enforcement power to inspect and monitor DeFi-related activities, subject the Responsible Persons to the enacted regulatory framework where applicable, and detect, sanction, and correct violations of such laws.

8. Regulators should actively promote cross-border cooperation and information sharing with relevant authorities in other jurisdictions with regard to DeFi services, activities, and arrangements to facilitate on-going supervision of regulated persons and entities and enable extensive support for enforcement investigations and related proceedings.

9. Regulators should understand the interconnections among DeFi arrangements, the broader crypto-asset market, and the traditional financial markets, and identify further regulatory touchpoints.

This report has made great strides towards a consistent and internationally applicable framework for DeFi governance. Notably, it delineates the regulatory outcomes that an effective framework should seek to achieve and explicitly acknowledges the human elements involved in the decentralized system, which resonate with the 'decentralization illusion' and refute the idealism for the application of a fully automated, non-intervening system that is detached from TradFi markets in the real world. To keep up with the fast-changing DeFi ecosystem, IOSCO updates its recommendations accordingly on a regular basis and monitors the regulation implementation progress of its member states.[186] This ensures greater consistency of the national policies with regard to the arising issues concerning market integrity and consumer protection.[187]

There have been voices that call for the identification of a legally responsible person that can be held accountable for when DeFi fails.

186 *Thematic Review Assessing the Implementation of IOSCO Recommendations for Crypto and Digital Asset Markets*, INT'L ORG. OF SECS. COMM'N 20 (Oct. 2025), https://www.iosco.org/library/pubdocs/pdf/IOSCOPD801.pdf [https://perma.cc/4QRW-K9QY].

187 *Id.* at 5.

Currently, this is largely achieved by the registration scheme that various jurisdictions such as the EU, Singapore, and Hong Kong have implemented. The registrars will typically be perceived as the legally responsible persons for their DeFi projects, and they will become the targets of an enforcement action if one is to be carried out. Building on the outcome of the existing registration scheme for DeFi, the IOSCO report aligns with a view to identify a legally responsible person and further elaborates on the assessment criteria of determining the Responsible Persons for regulatory purposes. Such determination should be based on the control and influence they have in the provision of financial products, financial services, or engagement in financial activities, regardless of their organization form and its degree of decentralization. This typically includes founders, developers, issuers of governance or voting tokens, DAOs or DAOs' participants, persons with custody over user funds etc. The guideline to identify the Responsible Persons for DeFi regulation openly recognizes human involvement in a 'decentralized' system and breaks the deadlock over the fundamental question of who or what should be accountable for its operation. This closes an existing legal gap in DeFi governance and is likely to facilitate enforcement actions against non-compliant activities in the market.

Most DeFi products and arrangements are categorized within the scope of securities, and regulators are advised to analyze the applicability and adequacy of the conventional securities regulation to DeFi products and services that show close resemblance to or behave like substitutes for securities. Premised on the idea that DeFi does not materially differ from TradFi, recommendations for regulators to require the identified Responsible Persons to establish an effective risk management framework, adhere to disclosure requirements, and address potential conflicts of interest would all intend to establish a functional governance framework for DeFi that stems from prevailing practices applicable in TradFi markets, with an aim to achieve the same intended regulatory outcomes. This merely puts the old wine in a new bottle, trying to embed DeFi as part of the broader TradFi market, without addressing many of the newly emerging risks from the use of novel technologies and its internal vulnerabilities.

But what about true DeFi?

True DeFi?

An increasing range of countries and jurisdictions are in the process of closing the existing regulation gap of crypto markets. The major domestic and international initiatives with respect to digital assets regulation have all noted the importance of coordinating international efforts on and cooperating with international bodies to develop a global regulatory

framework for crypto markets and services.[188] Developing and implementing a comprehensive regulatory framework with the aim of mitigating potential risks brought by cryptoassets is happening rapidly across the world, with the increasing transformation of crypto and digital assets into a regulated segment of the financial sector.

To date, what we have been seeing is a primarily centralized regulatory approach against decentralized systems—what about cryptographic solutions that may inherently prevent the abuse and misuse of DeFi, rather than resorting to a centralized entity that can only intervene after incidents occur? One solution is the on-chain KYC system that stores verified users' information on the blockchain for later proof and that minimizes the number of times a user discloses their sensitive information across different parties.[189] A notable paradigm is the Self-Sovereign Identity (SSI) model, which includes the Decentralized Identifiers and Verifiable Credentials that make use of cryptographic signatures to express credentials digitally through generating zero-knowledge proofs, a cryptographic method that allows users to prove to a verifier without revealing their personal identifiable information every time.[190] An extension of SSI is the zero knowledge KYC (zkKYC) solution concept. Upon providing proof to show eligibility of using the digital identity wallet, holders of Verifiable Credentials can generate a zkKYC token that represents their identity to the verifier and is only readable by the Government when inspection is needed.[191]

These cryptographic solutions may serve as the first line of defense to minimize risks of AML/CTF from within the system but still rely on a centralized entity such as the government or a business to intervene and inspect suspecting cases. Other proposed regulatory approaches that regulate crypto largely through the lens of the government, rather than the actual DeFi participants, will very likely face strong opposition from true DeFi protagonists, who might have opted for DeFi due to their discontent with the existing mainstream financial system that is heavily regulated by the government. It is also noteworthy that among countries that have been

188 Arner et al., *The Financialisation of Crypto: Designing an International Regulatory Consensus, supra* note 1; BANK OF ENGLAND, *supra* note 104; *Anti-Money Laundering: Provisional Agreement Reached on Transparency of Crypto Asset Transfers*, *supra* note 168; *Proposed Regulatory Measures for Digital Payment Token Services*, *supra* note 88.

189 *On-Chain KYC: Can Privacy and Regulation Coexist?*, COINBACKYARD (Feb. 11, 2025), https://www.coinbackyard.com/cryptocurrency/on-chain-kyc-privacy-regulation/ [https://perma.cc/JC3R-9EXW].

190 Pieter Pauwels, *zkKYC: A Solution Concept for KYC Without Knowing Your Customer, Leveraging Self-Sovereign Identity and Zero-Knowledge Proofs*, INT'L ASS'N CRYPTOLOGIC RSCH (June 2021), https://eprint.iacr.org/2021/907 [https://perma.cc/E6WD-6H8D].

191 *Id.*

actively engaged in crypto regulation, there is not a unified approach adopted in all these jurisdictions.[192]

However, most of these regulatory approaches exclude what could be termed 'true' DeFi. This is significant, as under the DeFi hypothesis, one of the major intended goals of DeFi is to remove the centralized element as present in TradFi and allow P2P financial transactions without intermediaries.

This raises two questions: does true DeFi exist? And if so, how to best approach the question of legal ordering, based on the premise that finance is subject to certain issues requiring regulatory intervention in order to function properly.

We address the first question in the following Part and the second question in Part V.

DOES TRUE DEFI EXIST? EVIDENCE FROM DEFI PARTICIPANTS

One could surmise from the discussion thus far that DeFi presents some innovation and, in other parts, much similarity with TradFi. Yet, as a nascent field, it still presents regulators and supervisors with a conceptual challenge as to how they should approach designing regulation for this field. There are questions as to its true novelty and the ways in which it forms a part of or intersects with the existing financial order. Opinions and approaches remain divergent.

To investigate this question of governance and regulation of truly decentralized systems, our research adopts a qualitative approach to draw on in-depth semi-structured interviews conducted with ten DeFi practitioners from different areas of expertise, including regulators, lawyers, engineers, academics, and financial consultants (Table 1). Seven participants were first recruited through purposive sampling, with the use of personal connections of our research team members, and the other three participants were recruited through snowball sampling, who were able to be reached upon the recommendations from the first group of informants. These ten participants were selected because of their extensive knowledge in DeFi and their active engagement in related affairs for at least three years. The involvement of DeFi practitioners with a diversity of experiences not only helps recount a fuller picture of the development of DeFi from different perspectives but also allows us to grasp the variations concerning the governance and regulation approaches that they deem appropriate. Ethical approval for this research was obtained from our university, and we followed the university's ethical guidelines closely throughout the research

192 Kathryn White, Arushi Goel & Sandra Waliczek, *Cryptocurency Regulation: Where Are We Now, And Where Are We Going?* (Mar. 28, 2022), https://www.weforum.org/stories/2022/03/where-is-cryptocurrency-regulation-heading/ [https://perma.cc/LC47-UUT6].

process. Interviews were conducted between April and June 2023. Each interview lasted between forty and seventy-five minutes and was conducted virtually via Zoom by two members of the research team. All interviews were audio-recorded and transcribed, which were subsequently coded to extract key themes and concepts for further discussion.

In this Part, we share what DeFi protagonists contemplate on the development of governance and regulation for DeFi now and moving forward. We then highlight three examples of what are generally seen as 'true' DeFi.

Interview	Month/Year	Area of Expertise related to DeFi
A1	April 2023	Law
A2	April 2023	Law
A3	June 2023	Policy / Finance
A4	May 2023	Policy / Finance
A5	May 2023	Policy
A6	June 2023	Finance / Higher Education
A7	May 2023	Finance / Higher Education
A8	June 2023	Finance
A9	May 2023	Policy / Finance
A10	May 2023	Computer Engineering

Table 1: List of Informants.

Expert Interview Structure

We used five main categories of inquiry for our interviews, comprising a total of ten questions. The first section was designed to understand participants' stance on DeFi and their reasons for that. The second section inquired into what concerns they had regarding the potential risks in DeFi and what they thought could be done to enhance both investor protections and accountability within the ecosystem. The third section was about the governance model and regulatory approaches that participants saw fit for DeFi. The fourth section asked about participants' views concerning the growing interconnectedness between TradFi and DeFi, whether they deemed it beneficial or problematic to the financial system as a whole, and the last section inquired about participants' visions of the future development of DeFi and the difficulties that they foresee.

Findings

Our analysis of the interviews yielded four main findings, revolving around the features of DeFi, perceived centralized elements in the system, recent government responses around crypto regulation, and the future development of DeFi.

A. Merits and Risks of DeFi

All participants acknowledged the merits of DeFi as a significant innovation with the capability to transform aspects of the existing financial system positively. This is particularly the case in relation to transactional inefficiencies in marketplaces and the use of intermediaries, whereby DeFi could be helpful for mitigating overall concentration and systemic risks in the financial system and improving its resilience. DeFi was also praised for its potentially emancipatory effects as its envisaged P2P network could enhance financial inclusion by offering an array of (cross-border) financial services, something particularly useful where users perceive their governments and financial systems to be corrupt and unreliable. DeFi enabled self-management of finance which could also be an important tool for a faster-moving and digital economy.

What concerned participants, however, were the inherent risks associated with DeFi. Many of them expressed their concerns over willful wrongdoings, such as fraud, rug pulls, scams, insider hacking, and market manipulation by project developers or of crypto exchanges, especially after a series of collapses of some large crypto trading platforms that resulted in substantial losses. This, coupled with a knowledge gap regarding DeFi investment, could fundamentally undermine consumer protection. Technological risks and privacy issues were also of significant concern due to a seemingly nascent and immature technology. These risks stemmed from smart contract bugs, technology malfunctioning, and a not-so-well-thought-out structure on balancing. Such technological failures can give rise to an accountability dilemma whereby it is difficult to determine where responsibility for resultant losses should lie.

B. Presence of Centralized Elements

All participants recognized that there were significant centralized elements in the existing DeFi system, and, except for one participant who suggested that true decentralization could be achieved through the adoption of decentralized identity to control reputation, all others agreed that these elements were likely to be inevitable when constructing a legitimate decentralized system, if not necessary:

> 'Around 85% of DeFi infrastructure is highly centralized. Pure 100% decentralization is the ideal situation, but it is not going to be the real case' (Interview A10).

> 'Only very few systems will be able to achieve full decentralization. Complete decentralization is merely theoretical. Most of those DeFi systems comprise elements of centralization' (Interview A4).

These statements echo the idea from Aramonte, Huang and Schrimpf that the term 'decentralized' is illusionary and there is always an element of centralization in DeFi platforms that allows for the rectification of 'algorithm incompleteness'.[193] A participant further explained why the existence of human elements would be important for DeFi as it would help prevent accountability issues:

> 'This (true decentralization) is problematic because no human can be put to jail when things happen, meaning that the existing legal approach ceases to be effective. If DeFi becomes pervasive and has unintended consequences, it becomes a dangerous system' (Interview A4).

Another informant regarded the accountability issue as analogous to the Tesla self-driving cars:

> 'Accountability is the fundamental challenge in DeFi because we cannot hold a smart contract accountable. Just like for Tesla self-driving cars where we don't know who should be accountable if the cars take the wrong decision. DeFi does not fit into the existing framework where there is always a counter-party so the idea behind [it] is very difficult to implement in [the] real world' (Interview A7).

Speaking of the issue of accountability in decentralized systems, most informants associated it with criminal charges, sanctions, and a set of rules imposed on crypto exchanges and firms, which are consequences and typical practices in the governance of TradFi but, from the perspective and initial design of a truly decentralized model, are not supposed to exist, at least not in the same form as what we are having in TradFi and the criminal justice system. Thinking of the accountability issue habitually with this TradFi mindset, in addition to the cognizance of the centralization of DeFi, suggests that the key feature of disintermediation in DeFi is difficult to let

193 Aramonte, Huang & Schrimpf, *supra* note 10.

go of and the implicit need to look for an agent that can be held accountable as in TradFi. There thus arises a conundrum of governing decentralized systems in the TradFi structure and the underlying belief that, as one informant put it, DeFi needs to grow out of the 'lunatic fringe' and connect with existing infrastructures to make real impacts.

When we mentioned that many investors ultimately resorted to state-based courts to find a remedy for the loss or harm that they might have suffered following the bursting of crypto bubbles, the collapse of exchanges, fraud, or the ensuing 'crypto winter' as opposed to seeking relief from non-state-based authorities and mechanisms, most participants agreed that it was understandable and did not find it overly surprising. They regarded this as an instinctive way or human nature to resolve problems, as the courts were typically the institution that dealt with issues arising within society. When things went wrong, they opined, people tended to select the easiest or most common way to deal with problems, which, in this case, would be to seek help from lawyers and the courts, at the expense of supporting or developing new mechanisms for the administration of justice.

Some participants stressed the importance of not treating code as law, and the importance of acknowledging that most people are only comfortable with a society-accepted party for the interpretation of code, which is akin to how the law works:

> 'It makes sense that people go to the court. Having a system outside of state control or seeking code as law is not realistic' (Interview A5).

> 'Code is never law. When there is a dispute, we seek help from others to help us reach a solution…Code may cover everything that happens and will automatically execute, but we need a fallback where things can be interpreted, such as explaining the actual intent of what was agreed or written down in the form of code. The need for interpretation will ultimately be done by society-accepted parties that have the power to take final decisions' (Interview A7).

Given the borderless nature of DeFi, some participants suggested using international arbitration instead of state-based or national arbitration for disputes that could not be resolved by a DAO or its on-chain process. We return to these ideas of the need for external ordering in Part V.

We also asked participants what the scenario would be like if market participants needed to deal with issues within the DeFi ecosystem without any state intervention. Three participants proposed coding a potentially workable dispute resolution mechanism in the protocols to have things resolved by design, while concurrently acknowledging that none of the

relevant proposals and experiments were fully developed or close to being ready for use at scale. We return to this idea, in the context of the concept of embedded regulation, in Part V.

C. Government Responses

Regarding the collapse of Terra Luna and a number of crypto intermediaries and trading platforms, most participants believed that governments should not overreact. Project failures should be seen as opportunities for governments to learn and start constructing sensible and sustainable regulation that is not based on a knee-jerk reaction. These are necessary for making great strides towards a more mature and comprehensive development of DeFi. One participant took the example of the dot-com bubble burst in the late 1990s to illustrate this:

> 'Collapses are sometimes necessary to redirect things. Those collapses are analogous to the dot-com bubble burst, which doesn't mean it goes away. It may consolidate into a more viable long-term outcome, one of which may be having regulators stepping up to establish a regulatory framework' (Interview A4).

Another participant suggested that it is more important to have a balanced approach that allows both innovation and experimentation to take place without unnecessarily stifling them. In their words:

> 'It is wrong to think that they (governments) should now regulate everything. It is more important that they allow innovation to take shape' (Interview A7).

Among some of the existing regulatory approaches proposed or being implemented by large economies and international regulatory bodies, most participants endorsed MiCA's proposal by the EU, which entered into force in EU jurisdictions in June 2023. They agreed with its risk-based supervision and controls grounded in the principle of 'same risk, same activity, same rules'. This is based on the rationale that similar financial activities that generate the same risks should be regulated in the same way as in traditional finance. However, several participants also noted the conundrum of applying 'same regulation' because some risks and vulnerabilities are DeFi-specific and the existing regulatory framework would not be fit-for-purpose.

Some participants doubted the 100% reserve ratio requirement proposed by the Basel Committee for stablecoins and some digital assets.[194] One

194 *Second Consultation on the Prudential Treatment of Cryptoasset Exposures*, BIS (Sep. 30, 2022), https://www.bis.org/bcbs/publ/d533.pdf [https://perma.cc/J5D3-D8E2].

critiqued that this approach created an illusion that the crypto sector posed higher risks compared to other traditional institutions, but ignored the fact that banks had the greatest risk for AML and bank runs, such as in the context of Silicon Valley Bank that collapsed in March 2023:

> 'Banks are not subject to that (the 100% capital requirement), but there will be runs on them. Banks feel like the crypto sector is the devil but actually they have the highest risk for AML, and they go down from time to time' (Interview A1).

Another participant added that this approach should not only be about the capital reserve but also about requiring well-supervised banks rather than small, unsupervised banks to hold the reserve.

> 'It should not only be about 100% capital reserve, but also asking well-supervised banks to hold it. Putting the reserve in unsupervised banks will create more risk, especially when they default' (Interview A4).

D. Visions of DeFi

Most participants believed that DeFi would benefit the existing financial system by pushing new technology and innovation as it continues to progress and become more intertwined with TradFi. Another participant also compared it with the dot-com bubble burst:

> 'TradFi will evolve similarly to the beginning of the dot-com boom, where we had a situation that companies added something dot-com to their name a few years after it was introduced. At that time, nobody foresaw the real value of the Internet and the survivors at the beginning. The same holds true for crypto and digital assets' (Interview A6).

He suggested that DeFi would eventually help to improve antiquated back-end systems in TradFi over the long run, such as enhancing efficiency through atomic settlement and enabling a shortened escrow period property through tokenization. But all of these improvements will take time to develop and be realized. At this stage, it is still too early to see the actual effects of DeFi on the traditional system or how it might transform the system in a positive way. In the short term, however, it is more likely to be problematic because of the divergence in the demand of traditional incumbents and the DeFi community, as well as the time society needs to adapt to a new system that has different functions and modes of operations.

In terms of the difficulties that they foresee regarding the future development of DeFi, they believe that the inherent risks associated with the system would be the fundamental hurdle requiring further exploration

to identify solutions. Some participants stressed the importance of building a system that can drive changes and dropping idealistic ideas about DeFi, as well as excessive avarice and tendencies towards speculation:

> 'We need to let go of some idealistic ideas and be pragmatic on the implementation side. This is how we can scale impact. It is nice to build something outside of the real world, but this won't drive change' (Interview A7).

> 'The fundamental hurdle is to get away from the overwhelming desire to issue equity-like tokens. Most DeFi protocols are about getting profits and are treated as business revenue for the founders. This is not a way to build sustainable business because they end up caring too much about the tokens than the actual usage' (Interview A8).

It is worth considering the actual use cases of DeFi applications and whether they are meant to support a system and benefit end users, rather than just speculation as what we have mostly been seeing. Except as an investment asset for people who have spare cash and sufficient understanding, more needs to be done for DeFi to also drive changes and facilitate actual financial services for households and businesses.

Lastly, one other concern was whether and how DeFi could remain fair and equitable as large market players that carry more weight begin to move into the ecosystem. It remains to be seen how they might change the structure of DeFi and to what extent they could manipulate or rig the system.

True DeFi?

To return to our central theme, does true DeFi exist? Our qualitative research suggests the answer is that it is – at best – uncommon. However, we would argue that, generally speaking, there are a small number of generally agreed examples. These both highlight issues as well as underscore the rarity of actual examples. We consider three briefly here: Bitcoin, Uniswap and Tornado Cash. Ethereum provides a foundation for understanding how true DeFi could be made possible in blockchain networks.

A. Bitcoin

Bitcoin is the first decentralized cash system created for purely P2P electronic payments that utilize DLT to record and secure all payments and transactions among users based on cryptographic proof instead of trust.[195]

195 Nakamoto, *supra* note 10.

With its own Bitcoin blockchain, a public ledger that transparently records transactions between parties across the P2P network, the system is put to test using its native token Bitcoin (BTC) for transactions. The Bitcoin blockchain uses proof-of-work, a consensus mechanism, to function, where miners in the network compete with each other to solve computationally complex puzzles to add new blocks to the chain with the latest verified transactions.[196] Bitcoin and its Bitcoin blockchain serve as the settlement layer (Layer 1) of a multi-stacked DeFi architecture, which are fundamental for storing ownership information and the foundational layer that allows for trustless execution and dispute resolution.[197] While the Bitcoin blockchain has the potential to be deployed for the launch of other DeFi applications, it comes with questions such as intensive energy consumption in mining[198] and reduction in payment security when mining resources and block rewards diminish.[199]

Despite the prevailing issues with the Bitcoin blockchain as technology continues to evolve, its disintermediated, P2P transaction mechanism that operates beyond jurisdictions has been considered a successful, in fact the paradigmatic example, and pioneer of decentralized finance.[200] However, even in the context of Bitcoin, there are questions about whether it is truly decentralized and immune from the challenges of centralization and human behavior characteristic of TradFi. The emergence of a small number of dominant crypto exchanges as well as the speculative nature of the Bitcoin market suggest that it mirrors the issues of TradFi. The power of Bitcoin developers in network control and the presence of Bitcoin Core[201] – a foundation software for Bitcoin and its blockchain established by its creator – also challenge the notion that Bitcoin is decentralized and without third-party interference in governance. After all, it is a human production that needs some kind of intermediary to maintain, update and enforce the system.

In practice, Bitcoin largely does seem to operate on a decentralized basis. However, in order to become decentralized, it requires not only careful design but also the almost immediate exit of its creator, under

196 Simon Chandler & Tessa Campbell, *What is Proof of Work (PoW) in Cryptocurrency?*. BUS. INSIDER (Nov. 25, 2024), https://www.businessinsider.com/personal-finance/investing/proof-of-work [https://perma.cc/CU3H-6TB9].

197 Schär, *supra* note 22.

198 Alex De Vries, *Bitcoin Boom: What Rising Prices Mean for the Network's Energy Consumption*, 5 JOULE 509 (2021).

199 Raphael Auer, *Beyond the Doomsday Economics of "Proof-of-Work" in Cryptocurrencies*, BIS (Working Paper No. 765, 2019), https://www.bis.org/publ/work765.htm [https://perma.cc/TQM5-A4PE].

200 Zetzsche, Arner & Buckley, *supra* note 4.

201 Rahul Nambiampurath, *Bitcoin Core, Explained: What It Is and Who's in Charge*, COINTELEGRAPH (Oct. 29, 2024), https://cointelegraph.com/learn/articles/bitcoin-core-explained [https://perma.cc/7GHF-572E].

circumstances which remain unknown. It thus highlights the potential of DeFi but also the challenges for it to actually happen.

B. Ethereum

Ethereum is also a Layer 1 open-source blockchain platform that enables developers to build and execute their decentralized applications and smart contracts, where they can create their own arbitrary rules for governance, transaction arrangements and state transition functions.[202] Its native token ETH is embedded in the settlement layer and is typically used to pay the transaction fees – more technically known as gas fees.[203] Unlike Bitcoin that deploys the proof-of-work mechanism, the Ethereum blockchain has shifted to the proof-of-stake mechanism in 2022, which gives every participant, commonly known as validators, within the consensus protocol a weight proportional to the total amount of tokens they stake as collateral in the ledger.[204] This is considered a more sustainable mechanism as it significantly reduces energy consumption and computing power in the process.[205]

Despite having a decentralized operational structure in Ethereum's architecture, beneath its promising façade lie centralization issues that spotlight its level of decentralization in governance, including the dominance of multiple clients, concentration of power and unbalanced distribution of liquid staking.[206] Questions also remain as to whether the power that developers have in the governance of their launched applications is at odds with the intention of decentralization.

Ethereum thus provides an example of a general purpose blockchain which was created by a small group of developers, but which has evolved to become effectively decentralized and remained to be the most widely used blockchain network by existing DeFi applications as of this writing.[207] The following two examples that we consider as true DeFi are both Ethereum-based.

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202 Vitalik Buterin, *Ethereum: A Next-Generation Smart Contract and Decentralized Application Platform*, ETHEREUM.ORG (2014), https://ethereum.org/content/whitepaper/whitepaper-pdf/Ethereum_Whitepaper_-_Buterin_2014.pdf [https://perma.cc/KKN8-LE6P].

203 Raphael Auer et al., *The Technology of Decentralized Finance (DeFi)*, 6 DIGIT. FIN. 1, 55-95 (2024).

204 *Id.*

205 Scott Ruoti, *What Is Proof-of-Stake? A Computer Scientist Explains*, WORLD ECON. F. (Sep. 16, 2022), https://www.weforum.org/stories/2022/09/proof-of-stake-computer-scientist-explains/ [https://perma.cc/AY72-TLMY].

206 *Ethereum Is Not Decentralized It's Centralized*, COINSCAPTURE (Oct. 13, 2023), https://coinscapture.medium.com/ethereum-is-not-decentralized-its-centralized-e430d17fd582 [https://perma.cc/Q9W3-F8AY].

207 Sourabh Parihar, *Top 10 Blockchain Platforms in 2025 for Smart Contracts*, THE CRYPTO TIMES (Apr. 24, 2025), https://www.cryptotimes.io/articles/review/top-10-blockchain-platforms-in-2025-for-smart-contracts/ [https://perma.cc/FK56-53QH].

C. Uniswap

Uniswap is an exemplar of decentralized exchange (DEX) running on the Ethereum blockchain. Since its roll-out in November 2018, it has been gaining significant traction, reaching approximately $3.3 billion in daily trading volume and becoming the first exchange to hit $3 trillion in total trading volume, which accounts for almost a quarter of the overall DEX market share.[208] This unprecedented milestone makes Uniswap top the DEX list by trading volume,[209] reflecting its success and dominance in the DeFi space as well as a pronounced rally of crypto tokens in the post-crypto winter era.

The Uniswap Protocol is the key infrastructure that enables the trading of cryptocurrencies without the presence of centralized intermediaries. Decentralization in transactions is enabled through the smart contract known as an automated market maker (AMM) that allows users to become liquidity providers and swap tokens against those within the liquidity pool.[210] The Protocol is the first successful AMM technology widely applied in the market and is not controlled by any individual or entity.[211] Through analyzing the token pairs – the exchange rate between two cryptocurrencies – based on demand and supply within the pool, the AMM is able to determine the real-time value of a token and provide information regarding the most efficient swap with the lowest token price at that time.[212] The function of the AMM system works analogously to the conventional order book model in TradFi where traders list buy and sell orders. With its application in the decentralized space, users can participate directly in the liquidity pool and conduct transactions under their own command. The open-source feature of the Protocol also allows any users to become a liquidity provider by swapping and/or listing tokens, who would be compensated subsequently by default to incentivize liquidity pooling.[213]

If we consider Uniswap as an example of 'true' DeFi, the determining features lie in both the nature of financial activities and the structure of operation. Transactions should be open to any user, disintermediated, and executed under a user's command and exclusively on-chain, which could be

208 Deekshith Pinto, *Uniswap First Decentralized Exchange to Cross $3 Trillion in Trading Volume*, COINGAPE (May 12, 2025), https://coingape.com/uniswap-first-decentralized-exchange-to-cross-3-trillion-in-trading-volume/ [https://perma.cc/QL76-JFAJ].

209 Ezra Reguerra, *Decentralized Exchange Volume Hits Record High of $462B in December*, COINTELEGRAPH (Dec. 30, 2024), https://cointelegraph.com/news/dex-all-time-high-monthly-volume-462-billion [https://perma.cc/547R-XLSV].

210 Aramonte, Huang & Schrimpf, *supra* note 10.

211 *Wells Submission on Behalf of Uniswap Labs*, UNISWAP (May 21, 2024), https://blog.uniswap.org/wells-notice-response.pdf [https://perma.cc/6ZJ4-R8PR].

212 *How Does the Uniswap Protocol Work?*, UNISWAP (May 9, 2025), https://support.uniswap.org/hc/en-us/articles/8671577468813-How-does-the-Uniswap-protocol-work [https://perma.cc/PTD2-MHD2].

213 *Id.*

characterized by having the transaction data sufficiently recorded on a distributed ledger.[214] It also allows for self-custodial wallets and has no involvement or, if not impossible, only minimal intervention of the platform provider. The operation of 'true' DeFi should be clearly distinguishable from centralized exchange platforms in the DeFi ecosystem, which custody clients' assets, provide interfaces for buying and selling of cryptoassets, and manage transaction orders through the order book data.

However, Bongaerts et al. suggest that even though Uniswap values decentralization, its seemingly decentralized operating mechanism is a window-dressing strategy that masks the underlying centralized elements.[215] This is reflected through the highly concentrated voting power of the Top1 and Top2 voters who collectively control 65% of the total votes cast, as well as the substantial influence of Andreessen Horowitz (a16z) – an early investor and the largest venture capital in Uniswap – due to the large amount of UNI tokens it possesses and its active participation in governance together with its affiliate network of delegate that always vote in line with it.[216] This demonstrates a tension between the ideal and reality of decentralization, thereby questioning whether genuine decentralization in governance is feasible in practice.

Similar to its counterparts such as Binance[217] and BarnBridge DAO[218], Uniswap as one of the largest DEXs in the market had also been under regulatory scrutiny of the SEC and was issued a Wells notice in 2024 that accused the company of operating as an unregistered securities broker and exchange.[219] The case was subsequently dropped in early 2025 without any enforcement action, which Uniswap referred to as 'a win for DeFi'.[220] While the process and outcomes of SEC's investigation remain largely confidential, the reprieve granted to Uniswap suggests a distinction between the Uniswap case and the others that ended up being brought to trial. Possible reasons behind such exemption are threefold. First, Uniswap does not seem to have been involved in organizational investment scams or Ponzi schemes intentionally designed to defraud users. Although crypto scams on Uniswap still persist, they were largely the result of the listing of scam

214 Auer, *supra* note 199.

215 Dion Bongaerts et al., *Vote Delegation in DeFi Governance*, ARXIV (Mar. 13, 2025), https://arxiv.org/pdf/2503.11940 [https://perma.cc/NSK7-HPSS].

216 *Id.*

217 Consent Order, Securities and Exchange Comm'n v. Binance Holdings Ltd., No. 1:23-cv-01599-ABJ (D.D.C. 2023) [Doc. No. 71].

218 In re Tyler Ward, SEC Release No. 11261 (Dec. 22, 2023), https://www.sec.gov/files/litigation/admin/2023/33-11261.pdf [https://perma.cc/QA4P-796Z].

219 *A Win for DeFi – SEC Closes Investigation into Uniswap Labs*, UNISWAP (Feb. 25, 2025), https://blog.uniswap.org/a-win-for-defi [https://perma.cc/78HW-BZF3].

220 *Id.*

tokens by malicious actors.[221] The nature of these incidents is distinguishable from cases such as Terraform Labs[222] and FTX[223], whose founders were found guilty of orchestrating multiple fraudulent schemes through their crypto trading companies at the expense of consumer rights and the financial systems. Second, Uniswap strategically positions itself as a software company rather than a financial intermediary, which bolsters its defense against the allegation that it operates as an unregistered securities exchange.[224] This also questions the applicability of traditional securities law in a case where the subject of investigation identifies itself outside of the conventional scope of a financial market actor, neither as a broker, clearing firm, exchange, nor any other agencies that are subject to the regulation of securities law. Third, the structural design of the Uniswap Protocol sets it apart from the centralized exchanges that are largely investment-driven. The self-custodial design suggests that users are fully in control of their assets and swaps through the private keys in their self-custodial wallets.[225] Uniswap never takes possession of users' tokens during a swap nor intervenes any transaction executed by a user, which underpins its role more as a provider and maintainer of a decentralized trading platform rather than a centralized cryptocurrency exchange like Binance and Coinbase. Its native token UNI, despite allegedly being offered as an unregistered security, is distributed primarily as governance tokens to specific groups of users for non-investment purposes and is not publicly available for sale to investors.[226] Although Uniswap's distribution of UNI during the early liquidity mining stage could remain a regulatory vulnerability, its subsequent and existing token distribution does not seem to violate the *Howey* test.[227] The absence of direct sales of UNI and Uniswap's central control over the distributed tokens also distinguishes it from other liability cases such as *SEC v. LBRY*[228] and *SEC v. Ripple*,[229] both of which involved active profit-seeking public offering and marketing efforts without formal registration.[230] Uniswap's legal compliance, decentralization and structural design, as well as its proactive engagement

221 Xia Pengcheng et al., *Trade or Trick? Detecting and Characterizing Scam Tokens on Uniswap Decentralized Exchange*, 5 PROC. A.C.M. MEASUREMENT & ANALYSIS OF COMPUTING SYS. 1 (2021).

222 Securities and Exchange Comm'n v. Terraform Labs Pte. Ltd., 684 F. Supp. 3d 170 (S.D.N.Y. 2023).

223 Securities and Exchange Comm'n v. Bankman-Fried, 2023 WL 345198 (S.D.N.Y. 2022).

224 Richard Fair, *Uniswap's Reprieve Reveals the Uncertainty of DeFi Regulation*, THE CLS BLUE SKY BLOG (Apr. 28, 2025), https://clsbluesky.law.columbia.edu/2025/04/28/uniswaps-reprieve-reveals-the-uncertainty-of-defi-regulation/ [https://perma.cc/P3LW-ENNW].

225 *Wells Submission on Behalf of Uniswap Labs*, *supra* note 211, at 7.

226 *Id.* at 27.

227 *Id.* at 12 (describing the *Howey* test); Fair, *supra* note 224.

228 SEC v. LBRY, 639 F.Supp.3d 211 (D.N.H. 2022).

229 Order, SEC v. Ripple Labs, No. 1:20-cv-10832 (S.D.N.Y. July 13, 2023).

230 *Id.*; SEC v. LBRY, *supra* note 228.

with the SEC in defense,[231] help it gain a foothold in the operation and minimize the risk for enforcement actions.

The Uniswap case reflects on the one hand, the limitations of applying the traditional framework of securities law to a true DeFi software and, on the other, the increasingly common occurrences of TradFi regulatory agencies extending their oversight and enforcement power to DEXs. The on-chain financial market driven entirely by self-executing smart contracts on the blockchain network has revolutionized the medium for transactions. Unlike common practices in TradFi, entities or individuals do not necessarily need to be registered as a financial institution to offer a platform for financial products and services in the DeFi space, as they can position themselves as a software provider or technology company to provide a valid platform for on-chain finance. This has challenged the application of securities law to DeFi entities,[232] questioning its aptness in the remaking of finance through technology and exposing the grey areas in the existing legal framework that are exploited to be absolved from regulatory actions and oversight. The Uniswap example suggests the need to revamp the prevailing regulatory framework before its application to a 'true' DeFi system, if traditional regulatory authorities like the SEC are to extend their purview more effectively to the DeFi space.

While Uniswap serves as an exemplar of an on-chain market that is very close to true DeFi, regulation is still primarily achieved by the involvement of TradFi institutions. We are and will continue seeing an increasingly intertwining relationship between DeFi companies and TradFi regulatory agencies. There remains an unresolved question of whether the in-built smart contract dispute resolution system is mature and convincing enough to self-regulate and serve as an arbitrator – a role that is usually performed by judicial institutions – when things go wrong. The heavy involvement of the SEC also suggests that traditional regulatory institutions are extending their supervisory power to the DeFi space, in an attempt to monitor the legitimacy of the entities involved as a neutral third party. This will relate to our arguments on embedded regulation in Part V.

D. Tornado Cash

Tornado Cash functions as an open-source, non-custodial and fully decentralized crypto mixer that runs on Ethereum smart contract networks.[233] Once users select an amount they would like to transfer and connect their wallets to Tornado Cash, it generates a security key

231 Fair, *supra* note 224.

232 *Id.*

233 *Understanding Tornado Cash, Its Sanctions Implications, and Key Compliance Questions*, CHAINALYSIS (Aug. 30, 2022), https://www.chainalysis.com/blog/tornado-cash-sanctions-challenges/#ofac-designation [https://perma.cc/43SL-2FLW].

specifically for that deposit to enable a transaction.[234] When the transaction is executed, Tornado Cash will send the deposit to a shared pool – a process known as 'crypto tumbling' or 'crypto mixing', allowing the receiver to withdraw crypto without revealing the direct linkage between the two wallet addresses.[235] This design blends the potentially identifiable or 'tainted' cryptocurrencies to obfuscate the origins and destinations of the funds, through which greater privacy can be achieved compared with other transparent public blockchains.[236]

In August 2022, following the accusation that Tornado Cash was 'used to launder more than $7 billion worth of virtual currency since its creation in 2019',[237] including for a North Korean-based hacking group to launder their cybercrime proceeds, the U.S. Department of the Treasury's Office of Foreign Assets Control (OFAC) blacklisted and sanctioned it through adding the addresses associated with Tornado Cash to its Specially Designated Nationals and Blocked Person (SDN) list.[238] Two founders of Tornado Cash, Roman Storm and Roman Semenov, were charged with conspiracy to commit money laundering through operating Tornado Cash services.[239] Storm was arrested for trial while Semenov has remained a fugitive.[240] Similarly in the Netherlands, the district court of Oost-Brabant sentenced a Tornado Cash-related 31-year-old Russian to imprisonment of 5 years and 4 months owing to his founding and governing role in the crypto mixer.[241] In 2024, the U.S. Federal Court of Appeals for the Fifth Circuit[242] ruled that the OFAC overstepped its authority to sanction Tornado Cash, which, as autonomous software, was not 'property' under prevailing federal law, and therefore not sanctionable.[243] The OFAC eventually lifted

234 *Term Tornado Cash: How It Works & Applicable Sanctions*, UNIT 21 (2025), https://www.unit21.ai/fraud-aml-dictionary/tornado-cash [https://perma.cc/JFR7-7JV2].

235 *Id.*

236 *Crypto Mixers and AML Compliance*, CHAINALYSIS (Aug. 23, 2022), https://www.chainalysis.com/blog/crypto-mixers/ [https://perma.cc/GG74-LCQ4]

237 Press Release, *U.S. Treasury Sanctions Notorious Virtual Currency Mixer Tornado Cash*, I.R.S. (Aug. 8, 2022), https://home.treasury.gov/news/press-releases/jy0916 [https://perma.cc/6H68-9HMN].

238 Van Loon v. Dep't of Treasury, 122 F.4th 549, 553 (5th Cir. 2024).

239 Press Release, *Tornado Cash Founders Charged with Money Laundering And Sanctions Violations*, U.S. ATT'Y OFF. (Aug. 23, 2023), https://www.justice.gov/usao-sdny/pr/tornado-cash-founders-charged-money-laundering-and-sanctions-violations [https://perma.cc/K7E3-R9F7].

240 *Id.*

241 Rechtbank Oost-Brabant, *Developer of Tornado Cash Gets Jail Sentence for Laundering Billions of Dollars in Cryptocurrency*, DE RECHTSPRAAK (May 14, 2024), https://www.rechtspraak.nl/Organisatie-en-contact/Organisatie/Rechtbanken/Rechtbank-Oost-Brabant/Nieuws/Paginas/Developer-of-Tornado-Cash-gets-jail-sentence-for-laundering-billions-of-dollars-in-cryptocurrency.aspx [https://perma.cc/MN8H-XB8Z]

242 *Van Loon*, 122 F.4th at 553 (5th Cir. 2024).

243 *Van Loon*, 122 F.4th at 570**.** *See also* Gal Arad Cohen & Ilya Keselman, *Understanding Tornado Cash*, LEXOLOGY (Dec. 19, 2024), https://www.lexology.com/library/detail.aspx?g=03222e65-4a05-49a5-884e-faec0ce46072 [https://perma.cc/4P2M-6VM6].

sanctions on Tornado Cash in 2025, reversing one of the most contestable enforcement decisions made during the Biden administration.[244]

This unique and trailblazing case of sanctioning a decentralized system begs the question of how truly decentralized systems that fall outside of existing legal frameworks should be regulated and, as in this case where the developers of Tornado Cash burnt their admin keys to relinquish their control over the Ethereum blockchain,[245] rendering it censorship resistant, unstoppable and almost impossible to remove,[246] how criminal behaviors committed via the exploitation of these sorts of systems could be addressed.

The cryptographic solution to enhance transaction privacy through a self-executing coin mixer, despite designed with good intention, is eventually abused by motivated individuals for criminal activities, leading to misuse of DeFi on blockchain and the call for stringent AML and KYC obligations as in TradFi to reduce the potential for DeFi exploitation. This is the challenge of true DeFi: how can one address the issues that are necessary to make it work in practice? If Tornado Cash provides a paradigmatic example of DeFi gone bad, Uniswap and Bitcoin highlight the potential for positive results, given careful design. That is the subject of Part V.

GOVERNING DECENTRALIZED FINANCE: BUILDING CASTLES IN THE SKY AND THE NECESSITY OF LEGAL ORDERING

Our study aims to understand and appreciate the challenges of constructing appropriate governance frameworks for ordering nascent financial ecosystems, in particular DeFi, primarily from the perspective of those actively building it. The focus on novelty and decentralization as inherent features brings us back to considering the merits of DeFi as an autonomous legal order, as its strongest proponents would have us do. The distinction of this legal order appears to stem from its ambition to detach itself from the state's yoke – its architecture of institutions, supervisors, and regulators that impede the liberty and ability of individual actors to conduct financial transactions directly.

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244 Michael J. Bresnick & Christopher L. Boone, *A Legal Whirlwind Settles: Treasury Lifts Sanctions on Tornado Cash*, VENABLE LLP (Apr. 8, 2025), https://www.venable.com/insights/publications/2025/04/a-legal-whirlwind-settles-treasury-lifts-sanctions [https://perma.cc/K6JP-LR94].

245 Max Parasol, *Tornado Cash 2.0: The Race to Build Safe and Legal Coin Mixers*, MAGAZINE BY COINTELEGRAPH (June 6, 2023), https://cointelegraph.com/magazine/tornado-cash-2-0-the-race-to-build-safe-and-legal-coin-mixers/ [https://perma.cc/973W-YRYA].

246 Anders Brownworth et al., *Regulating Decentralized Systems: Evidence from Sanctions on Tornado Cash*, FED. RSRV. BANK N.Y. STAFF REPS. (Aug. 2024), https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr1112.pdf [https://perma.cc/A4DB-DGYH].

Yet, our findings from the interviews as well as the evolution of the market to date highlight the fact that the attainment of such paradigmatic shifts must be secured with appropriate administration and governance to protect participants' rights and manage negative impacts. This is currently lacking within the practice and constitution of DeFi. At some point, the theoretical must merge with practical realities. This manifests in several important ways.

Centralized Finance in Disguise

Our findings suggest that the implementation and daily operation of DeFi typically involve at least some centralized elements, such as the concentration of power by governance token holders, crypto exchanges that work like market makers, wallet custodians, intervention from the courts and state enforcement bodies, or the recent supervisory oversight from jurisdictions. Even for a well-coded smart contract that enables automatic transactions and dispute resolution, it still requires a centralized party, be it a project team or an individual, to design and start it. These features stand at odds with the purist's vision of DeFi, one that is truly decentralized and disintermediated. Bitcoin is perhaps unique in – after its initial genesis – becoming a decentralized system, not unlike the ideal of the film *Building Castles in the Sky*.

Our findings that few others – with perhaps the exception of Uniswap and Tornado Cash (drawing of course from the original reference in *Building Castles in the Sky* itself) – are in fact decentralized resonate with the view shared by Aramonte et al: DeFi involves a 'decentralization illusion', where some form of centralized governance in substance and procedure will always be needed to effect strategic and operational decisions among a community of actors, no matter how dispersed or decentralized they are.[247] This idea was reflected by Zetzsche, Arner, and Buckley highlighting the necessity of a centralized actor to assure the functioning of the infrastructure in order to support decentralized systems.[248]

Our participants are aware of this paradox and believe that centralized governance in DeFi systems will remain. What was striking, however, was that most of them suggested that the community should stick with it and forgo the idea of achieving true decentralization in real-life application. To quote: the question we should ask, therefore, is 'how much, or to what extent centralization will take hold within DeFi' rather than 'how centralization could be eliminated from the ecosystem'. The centralized features in DeFi suggests that it is far from being free from the influences of traditional

247 Aramonte, Huang & Schrimpf, *supra* note 10.

248 Zetzsche, Arner & Buckley, *supra* note 4.

regulators, which will reshape the governance of DAOs and impel them to navigate an appropriate operating structure that can adapt to the complex regulatory and institutional environments.[249] True decentralization is a theoretical proposition that is difficult to achieve. Thus, perhaps the regulatory exceptions for it will remain lightly used, and, therefore, in fact, the functional argument applies in most cases.

The Dilemma of Accountability

Accountability is another controversial aspect in DeFi that is likely to remain unresolved. It is a question of who we should go after when things go wrong – the same logic as we intend to make the culprits liable for their victims' harm, be it sending them to jail or requiring them to compensate for the losses. In theory, DeFi works without any human element involved, potentially meaning that no natural person could be held responsible for some losses that may occur. However, our mindset largely contradicts this philosophy and still wishes to look for a party that can be responsible for failures in DeFi or simply someone that people can blame, an approach that has a long history in tort law.[250] It is useless to go after malfunctioning smart contracts. If we go after the person, the developers of the failed project, on the other hand, it leads to the existential question of DeFi – does the term 'decentralized' still hold true if someone needs to be accountable for what the smart contracts do wrong? This is where the tension lies. After all, accountability can only apply to human beings but not to machines, at least in the absence of independent, sentient artificial intelligence (AI).

As experimentation with DeFi continues, the community has been exploring the possibility of constructing a dispute resolution mechanism within DeFi, trying to minimize as much state intervention as possible when problems occur while also incorporating an effective accountability mechanism as a stand-in for arbitration through coding. They have the capacity to write their own rules or even re-create the state within the ecosystem, but all effort has hitherto ended up with repercussions that require a responsible agent to step in. As evidenced in the failure of FTX and the Terra/Luna project, individuals who suffered a loss in crypto intuitively pointed an accusing finger at the founders and celebrity promoters.[251] In the JPEX case, two victims in Hong Kong even filed a civil

249 Collao, *supra* note 19.

250 *See e.g.* TONY HONORÉ, RESPONSIBILITY AND FAULT (Hart Pub. 1999).

251 Alex Hern, *US Lawsuit Launched Against FTX Founder and Celebrity Backers* (Nov. 16, 2022), THE GUARDIAN, https://www.theguardian.com/business/2022/nov/16/us-lawsuit-launched-against-ftx-founder-and-celebrity-backers [https://perma.cc/7ECM-QFWN]. *See also* Martina Barash, *Shaquille O'Neal to Pay $1.8 Million in FTX Class Settlement* (June 10, 2025), BLOOMBERG LAW, https://news.bloomberglaw.com/litigation/shaquille-oneal-to-pay-1-8-million-in-class-accord-over-ftx [https://perma.cc/C2UU-F8AT]; Joe Tidy, *Cryptocrash: 'I Was Arrested For Knocking on Luna Boss's*

lawsuit against the Dubai-based crypto exchange to recoup their losses and won the case with court judgement in their favor.[252] Crypto lenders such as Celsius Network[253] and BlockFi[254] also filed for bankruptcy in court when they defaulted, asking the state institution to take over the problem and be responsible for any issues on their behalf. In the context where the person responsible is unclear, or theoretically should not exist, the effort to minimize human elements within DeFi has ironically resulted in greater state intervention, with the state supervising and redirecting things as a neutral and responsible agent.

The frequent involvement of the state in dispute resolution and the absence of an internal monitoring and investor protection mechanism within the DAO suggest the need for a gatekeeper to strengthen the oversight of its operation. This gives rise to a new form of intermediary – cryptogatekeepers – that can fill the governance void and enhance accountability in DeFi through appropriate information disclosure in cryptoenterprises.[255] This, however, goes back to the question of who should be accountable for a self-executing smart contract that is free from the control of the developers, as in the case of Tornado Cash.

'Same Risks, Same Rules' or 'New Risks, New Rules'?

The existing regulatory framework for TradFi may aptly apply to the corresponding risks that are also observed in the decentralized context, denoting the 'same risk, same rule' principle. For instance, the FATF extends the regulatory scope of the 'travel rule'[256] from the context of wire transfer to the crypto sector, requiring service providers to obtain, record, and submit information associated with the crypto transfers for AML/CFT check. The registration and licensing regime in the securities and futures markets is also introduced to crypto lenders and trading platforms.[257] This may strengthen the supervision of the newly emerged sector but does so in an old and familiar way.

Door' (May 24, 2022), BBC NEWS, https://www.bbc.com/news/technology-61552030 [https://perma.cc/KCL4-ES9P].

252 *FTX Hong Kong Victim Wins Lawsuit, Bank Criticizes Stablecoin*, BINANCE SQUARE (Nov. 1, 2024), https://www.binance.com/en/square/post/15632877943538 [https://perma.cc/3NB9-4WVT].

253 Op. & Ord., In Re Celsius Network LLC, No. 1:23-cv-10755-ALC (S.D.N.Y. 2025) (Doc. 21).

254 Memorandum Decision, In Re BlockFi Inc., No.:22-19361 (MBK) (D.N.J. 2023) (Doc. 1420).

255 Vanessa Villanueva Collao, *Cryptogatekeeper as a Response to Conflicts of Interest in Decentralized Finance*, 23 NW. J. TECH. & INTELL. PROP. (forthcoming 2026).

256 FIN. ACTION TASK FORCE, VIRTUAL ASSETS AND VIRTUAL ASSET SERVICE PROVIDERS 82 (2021), https://www.fatf-gafi.org/content/dam/fatf-gafi/guidance/Updated-Guidance-VA-VASP.pdf.coredownload.inline.pdf [https://perma.cc/U23N-L7SM].

257 *See generally* Regulation (EU) 2023/1114, *supra* note 91, at 40; *Proposed Regulatory Measures for Digital Payment Token Services*, *supra* note 88, at 294; *Discussion Paper on Crypto-Assets and Stablecoins*, *supra note 89,* at 19-21.

DeFi emerges as a novel technology that serves a similar economic function as TradFi, but with innovation in its processes, governance structures, and decentralized functions. This could result in risk being concentrated in different places and with different actors compared to that entailed within TradFi, thus making the argument that it cannot or should not be dealt with simply by applying the same old rules. New risks can require bespoke guardrails that are specifically tailored for DeFi, dealing with potential issues such as operational malfunctions, crypto staking, insolvency, resolution, and restructuring for crypto actors.[258] These new approaches, coupled with the existing regulatory oversight from TradFi, would create a more comprehensive and fit-for-purpose framework for DeFi to realize its core objective of decentralization.

The decentralization paradox, the question of accountability, and the questionable novelty of DeFi are considerable matters for DeFi protagonists to grapple with both conceptually and practically. But before they consider how they could, there is merit in considering whether they should hold on to the ideal of DeFi as a distinct, self-sustaining legal order.

We suggest that there is a compromise that can be reached which would still help to achieve the aims of DeFi without the extremism of complete detachment. The compromise has two related parts: first, the recognition that DeFi can be a legal order that operates within and across other legal systems and, second, that the development of symbiotic relationships with these legal systems can help it to achieve its aims by providing it with resources and capacity in areas where it is weak, such as the administration of justice.

Let us take the first matter, the recognition that DeFi can be a legal order that operates within and across other legal systems. The construction of legal orders and their governance is always dependent upon the active participation of responsible agents[259] or legal subjects.[260] While smart contracts might provide more efficient and effective ways of facilitating financial transactions, this is a functional argument and benefit. Without the clear identification or nomination of responsible actors or subjects, there is a governance vacuum that must be filled. This is where DeFi purists fall short. The idea of such a system is much more appealing than its current reality. This, however, is not insurmountable. As persons, both legal and natural, we inhabit spaces and are members of legal orders that we both constitute and are subject to. A critical legal pluralism invites us to imagine

258 Arner et al., *The Financialization of Crypto: Lessons from FTX and the Crypto Winter of 2022-2023*, *supra* note 13.

259 LON FULLER, MORALITY OF LAW 162 (Yale Uni. Press 2nd ed. 1964).

260 Martha Kleinhans & Roderick Macdonald, *What Is A Critical Legal Pluralism?*, 12 CAN. J.L. & SOC'Y 25, 38-39 (1997).

and acknowledge legal subjects as both 'law inventing' and 'law abiding'.[261] As legal subjects we create and constantly recreate legal orders to facilitate the operation and governance of a plethora of practices, communities, and interests, all while relying upon the mechanisms, systems, and knowledge gained by our affiliation and participation in other legal orders. *Lex mercatoria*,[262] *lex sportiva*,[263] canon law,[264] or even international arbitration[265] all exist as legal systems constructed by their participants all while still collaborating with the state and its institutions to enhance their operation and governance. This may be for the facilitation of commercial contracts, resolving the decisions of sports governance institutions, such as FIFA or the IAAF, giving legal effect to the sacrament of marriage, or facilitating the enforcement of arbitral awards.

This symbiotic relationship between and among legal orders is worthy of further attention. Indeed, relying upon or partnering with state-based institutions can provide DeFi with the support that it needs to achieve its goals. It may not match the purists' method, but it can help to achieve their goals.

This also relates to the central idea of embedded regulation and supervision, as framed by Zetzsche, Arner, and Buckley:[266] the functional realities of finance (as highlighted by both Frost et al as well as by Arner et. al. and others) means that finance – of whatever form – works best with certain regulatory, legal, and institutional support, a point made also by Milhaupt and Pistor[267] and the entire body of LLSV / law and finance literature.[268] Thus, in reality, DeFi designers – if the objective is largely independent functionality – must nonetheless address these core functional needs: monetary stability, financial stability, market efficiency, consumer / investor protection, market integrity, and sustainable development. Otherwise, their systems are almost certain to fail.

This idea suggests the need for both guidance and standards in terms of how to achieve this in the context of system design as well as the benefits of having an external monitor such as a regulator to ensure the proper functioning of systems and infrastructure. The Bermuda Monetary

261 *Id*

262 Ralf Michaels, *The True Lex Mercatoria: Law Beyond the State*, 14 IND. J. GLOB. LEGAL STUD. 447 (2007).

263 Antoine Duval, *Transnational Sports Law: The Living Lex Sportiva*, *in* THE OXFORD HANDBOOK TRANSNATIONAL (Peter L. Zumbansen ed., 2021).

264 William W. Bassett, *Canon Law and the Common Law*, 29 HASTINGS L.J.1383, 1386 (1978).

265 Emmanuel Gaillard, *L'Ordre Juridique Arbitral: Réalité, Utilité, Et Spécificité* [The Arbitral Legal Order: Reality, Usefulness, and Specificity], 55 MCGILL L.J. 891 (2010).

266 Zetzsche, Arner & Buckley, *supra* note 4.

267 *See generally* CURTIS J. MILHAUPT & KATHARINA PISTOR, *LAW* AND CAPITALISM: WHAT CORPORATE CRISES REVEAL ABOUT LEGAL SYSTEMS AND ECONOMIC DEVELOPMENT AROUND THE WORLD (Uni. of Chic. Press 2008).

268 Rafael La Porta et al., *Law and Finance*, 106 J. POL. ECON. 1113 (1998).

Authority is a pioneer in experimenting the Embedded Supervision initiative with a few crypto firms that operate within the jurisdiction, encompassing compliance, assurance and data integrity in the decentralized infrastructure with real-time visibility to regulators.[269] Positive feedback of this pilot would provide valuable insights to other policymakers and potentially facilitate a wider adoption of this idea, which the EU, among others, is currently investigating.[270]

CONCLUSION

DeFi, like most kinds of innovation, can hold great potential through its efficiencies and capacity to expand financial inclusion. Innovation, however, almost by definition, suggests that there can be risks and unintended consequences. DeFi is no exception to this, and it has in fact shown how far and how badly it can impact financial market participants who are relatively far removed from seemingly contained transactions. To date, DeFi proponents have yet to show workable methods for the self-regulation of P2P transactions, methods for resolving loss or harm to transacting parties, or the administration of justice for consequences beyond the transacting parties. This suggests that the presence and intervention of TradFi supervisors may be necessary until these solutions are found to maintain consumer and market participant protection, market integrity, and financial stability. Regulators around the world appear to have adopted this position, with the functional approach to regulation being preferred – that is, similar activities posing similar risks should be subject to similar supervision. Emphasis here is placed on the activity as opposed to how the activity is conducted.

Adopting this approach in the short term is not a defeat for DeFi protagonists as it does not preclude changes to regulatory approach in the future. It just means that there is more work to be done to ensure that DeFi does not have unintended consequences in the way that it has in the past. This means that DeFi will have to develop its own internal norms, both substantive and procedural, to respond to the needs of convenience and autonomy for its participants, while reassuring the regulators and supervisors of the legal orders and jurisdictions with which it interacts and in which it operates. Until then, DeFi proponents can and should rely on state actors for their enforcement and administration of justice capabilities,

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269 Press Release, *Bermuda Monetary Authority Advances Landmark Embedded Supervision Initiative To Architect Real-Time Regulatory Oversight for DeFi*, B.M.A. (Nov. 6, 2025), https://www.bma.bm/viewPDF/documents/2025-11-06-15-36-53-Press-Release—-Bermuda-Monetary-Authority-Advances-Landmark-Embedded-Supervision-Initiative-to-Architect-Real-Time-Regulatory-Oversight-for-DeFi.pdf [https://perma.cc/HC3Z-BG9T].

270 *See, e.g., Embedded Supervision of Decentralised Finance: Final Report*, EUR. COMM'N (Feb. 2025), https://euagenda.eu/publications/embedded-supervision-of-decentralized-finance [https://perma.cc/9NUB-TF3R].

knowing that it is a safer path towards the innovation and change that they seek to make.