The Illusion of Freedom: Reassessing Decentralisation in Blockchain Technology

Olivia Mayne

Abstract

Blockchain technology is more than a public, digital ledger, it is a disruptive force that challenges governments, economies, and legal systems globally. This paper explores the dual nature of blockchain as a symbol of individual freedom and a tool of control. Blockchain technology represents a transformative yet contradicting innovation, often referred to as a pathway to decentralisation and freedom, yet increasingly associated with systems of control. This paper reassesses blockchain not just as a foundation for cryptocurrencies, but as a broader technological system with social, environmental, and regulatory implications. It explores how blockchain's decentralised design challenges traditional power structures while simultaneously enabling new forms of concentration through mining pools, corporate influence, and state surveillance. The analysis contrasts blockchain's potential for transparency, financial inclusion, and empowerment, particularly through innovations such as smart contracts, with its risks of exploitation and inequality. It also examines the environmental toll of crypto-mining, the tension between immutability and data protection under frameworks like the GDPR, and the vulnerabilities of smart contracts. Using examples such as the EU's Markets in Crypto-Assets Regulation (MiCAR) and global responses to crypto-based activities, this paper argues that effective governance must strike a balance between innovation, accountability, and social justice.

1 Introduction

Before delving into the complexities of blockchain's decentralising potential, it's important to establish the basic concepts that underpin its disruptive nature. This section defines the idea of disruptive innovation, includes key terminology that will be used throughout the paper and situates blockchain within the broader political and regulatory debates that it continues to provoke.

1.1 Defining Disruptive Technology

Clayton Christensen initially coined the term disruptive technology, or disruptive innovation, in Harvard Business Review. He defined it as 'an innovation that significantly alters established industries and markets, creating new sectors and business models.'[418] Blockchain technology has idiosyncratic qualities that fulfil this definition through facilitating transparent transactions, which have transformed financial industries and created new markets, in the form of cryptocurrency, tokenised assets and decentralised finance, thus reshaping how value is exchanged and managed globally.

1.2 Distinguishing Blockchain from Crypto Assets and Bitcoin

[418] Repsol, 'Disruptive Technologies' (Repsol, 2025) <https://www.repsol.com/en/energy-and-the-future/technology-and-innovation/disruptive-technologies/index.cshtml#:~:text=What%20are%20disruptive%20technologies%3F,products%20and%20services%20are%20consumed> accessed 15 December 2024.

A common misconception within public discourse is the merging of blockchain technology with cryptocurrencies such as Bitcoin. While interconnected, they are not synonymous. Blockchain is an underlying technology, as described above, which crypto assets build upon by using cryptographic mechanisms to represent and transfer value. Bitcoin, the most prominent example, merely illustrates one financial use of blockchain technology. Cryptocurrencies rely on a process called mining, which involves high-powered computers solving complex mathematical puzzles to validate and record transactions on a blockchain, earning the miner cryptocurrency as a reward. Mining is covered in greater detail in Section 4.

While this paper acknowledges cryptocurrencies as a major driver of blockchain adoption, its analysis focuses on the broader implications of blockchain as a technological foundation with social, environmental and legal significance beyond the realm of crypto assets.

1.3 Blockchain as a Litmus Test for Governments

Antonopoulos, Bitcoin advocate, has repeatedly used this analogy that blockchains and 'cryptocurrencies act as a litmus test.'[419] The test's results reveal whether a government values individual freedom and human rights, or whether a government fears these principles. Upon failing this test, governments will attempt to ban cryptocurrencies, which exposes a "lack of trust in their own citizens to have control about their own money."[420] This distrust often stems from a broader fear of losing control over the state's economic system, as cryptocurrencies undermine traditional monetary policies and central banking structures. For example, in countries where governments heavily regulate their legal tender, cryptocurrencies can provide a lifeline to citizens and offer a stable alternative. This essay will explore the tension between the regulation of blockchain technology, its transformative potential, and its ability to empower marginalised communities.

2 Technical Foundations of Blockchain

2.1 Blockchain as a Public Ledger

As defined in a 2018 National Seminar glossary, blockchain is 'a general ledger, keeping track of all the transactions that happen in the network,'.[421] This public ledger ensures accountability and transparency, as every transaction is recorded in an immutable, unalterable database, while mimicking centralised systems by allowing pseudonymous transactions through the use of public and private keys.[422] These idiosyncratic qualities could potentially challenge the status of centralised institutions, as blockchain provides a level of trust that is unparalleled in

[419] Andreas Antonopoulos, 'Hodling, Buidling, Spedning: Andreas Antonopoulos About Anonymity, Privacy, and Sentiment Changes in Cryptocurrencies' (*Medium*, 17 October 2018) <https://medium.com/riat-institute-for-future-cryptoeconomics/hodling-buidling-spedning-andreas-antonopoulos-about-anonymity-privacy-and-sentiment-changes-in-3baa22c96f5e> accessed 8 December 2024.

[420] Torsten Hoffman, 'Cryptopia: Bitcoin, Blockchains and the Future of the Internet' (Netflix, 10 Decmber 2020) <https://www.netflix.com/title/81508426> accessed 29 December 2024.

[421] United States Sentencing Commission, Emerging Technologies: Glossary of Terms for Cryptocurrency and Blockchain (2018) <https://www.ussc.gov/sites/default/files/pdf/training/annual-national-training-seminar/2018-materials/emerging-tech_glossary-crypto.pdf> accessed 20 November 2024.

[422] Blockchain.com, 'What Are Public and Private Keys and How Do They Work?' (*Blockchain.com*, September 2024) <https://support.blockchain.com/hc/en-us/articles/4417082520724-What-are-public-and-private-keys-and-how-do-they-work> accessed 12 December 2024.

traditional systems, ensuring that, once data is recorded, it cannot be erased without consensus from the network.

2.2 Strengths and Weaknesses of Immutability

While a strength in terms of preventing fraud, immutability can become problematic in cases of errors or malicious entries, as it limits the ability to reverse transactions once they are confirmed. The Decentralized Autonomous Organization (DAO) attack shows immutability's flaw, as 'an anonymous hacker stole over $50M USD worth of Ethers.'[423] Immutability restricts corrective measures, so the funds could not be reversed on the blockchain. However, it is important to note that the Ethereum community conducted a controversial 'hard fork to return the stolen funds'[6], effectively demonstrating that decentralisation, in practice, may not be as robust as it is in theory. It is clear, in this case, that blockchain's challenges to centralised institutions are not absolute and can be overridden, when necessary.

2.3 Immutability Creating Compliance Challenges

Blockchain's idiosyncratic quality of immutability also poses compliance challenges with regulations such as the General Data Protection Rights (GDPR) in Europe, which provides Article 17, the right to be forgotten and the deletion of personal data.[424] As previously discussed, blockchain is designed to maintain transparency, which directly conflicts with GDPR. It should be emphasised that 'privacy is a human right, and it should not be jeopardized in the pursuit of technological development,'[425] as immutability is dangerous for vulnerable groups, including refugees or political dissidents, whose data security can be a matter of life and death. It is clearly necessary to limit blockchain's potential through regulations like GDPR, as its immutability puts vulnerable citizens at a greater risk of harm.

3 Decentralisation: Pros vs Cons

The most attractive quality of blockchain is its potential to challenge centralised institutions, as blockchain technology enables distributed trust and decentralised platforms.[426] But how much of a strength is decentralisation? Can it grant an unchecked freedom that empowers individuals to the point of enabling harm? The case of *Ulbricht*[427] is a clear example of a decentralised platform leading to malicious activity. In this case, blockchain technology was exploited to create a criminal marketplace that facilitated drug trafficking, theft, and other illicit activities. The lack of clear regulations around blockchain threatens the very freedom that decentralisation promises by facilitating abuse, which disregards the positive aspects of a decentralised system.

However, decentralisation also offers benefits that directly counter some of these risks, particularly in its ability to enhance transparency and reduce fraud. A leading example is IBM's Food Trust, a blockchain-based supply chain system that tracks food products from origin to

[423] Mehar M, Shier C, Giambattista A, Gong E, Fletcher G, Sanayhie R, Kim HM, Laskowski M, 'Understanding a Revolutionary and Flawed Grand Experiment in Blockchain: The DAO Attack' (2017) 21(1) *Journal of Cases on Information Technology* 19-32.

[424] NPLP, 'Blockchain vs Data Protection' (INPLP, 2025) <https://inplp.com/latest-news/article/blockchain-vs-data-protection/> accessed 3 January 2025.

[425] Shoaib, Bisma, 'The Immutable Blockchain Confronts the Unstoppable GDPR' (2023) 14 Seattle Journal of Technology, Environmental, & Innovation Law 1.

[426] Yan Chen and Cristiano Bellavitis, 'Blockchain Disruption and Decentralized Finance: The Rise of Decentralized Business Models' (2020) 13 Journal of Business Venturing Insights <https://doi.org/10.1016/j.jbvi.2019.e00151> accessed 12 December 2024.

[427] United States v Ulbricht 858 F.3d 71 (2d Cir 2017).

shelf[428]. Each stage of production, transport, and sale is recorded on a decentralised ledger accessible to all verified participants. This creates a permanent and tamper-proof record of origin, making it virtually impossible for any single actor to falsify data or conceal contamination. By distributing verification across multiple nodes rather than relying on one central authority, IBM's system prevents fraudulent relabelling and helps identify compromised batches within seconds. This demonstrates how decentralisation can be harnessed to protect consumers, strengthen accountability, and build trust. When properly regulated, blockchain's transparency can be an asset rather than a liability.

The extent of decentralisation within the blockchain system remains a contentious issue. Mining pools, namely Foundry USA and Antpool dominate the field[429], receiving transaction fees and rewards for mining on behalf of their users. As leaders in the industry, they attract a larger customer base, which raises questions about whether this concentration of power makes blockchain appear more centralised. This evidences that blockchain isn't significantly challenging the status of centralised institutions, as databases show that specific mining pool companies have taken control of the industry, therefore concentrating the power that blockchain was initially designed to decentralise.

Elon Musk's capitalisation on the blockchain market can also serve as an example of how blockchain technology can be manipulated for financial gain, as he often reinforced centralised power structures, rather than promoting decentralisation. In a lawsuit, investors claimed that Musk's conduct constituted a 'deliberate course of carnival barking, market manipulation and insider trading,' [430] enabling him to defraud investors. His actions have led to significant price fluctuations in cryptocurrencies, which clearly highlights the impact that prominent figures can have on decentralised financial systems. Musk was recently appointed co-head of the Department of Government Efficiency (DOGE), which is a new advisory group that aims to reduce regulatory excess, particularly within the cryptocurrency sector. While some perceive Musk's involvement as a shift toward deregulation, others believe Musk will disproportionately benefit affluent individuals and large corporations, at the expense of the broader public, one critic even stated that Musk's appointment to the role is 'the ultimate corporate corruption.' [431]

Balancing these competing viewpoints requires legal intervention that preserves decentralisation's advantages without encouraging its liabilities. Regulatory measures such as mandatory transparency standards, accountability requirements for mining pools, and anti-manipulation rules for market actors could strengthen the integrity of decentralised systems while maintaining their core principle of autonomy. Policies like the EU's Markets in Crypto-Assets Regulation (see section 6) demonstrate how law can recognise blockchain's potential while introducing safeguards against abuse. A regulatory model that is focused on preventing fraud, ensuring data integrity, and promoting fair access, could transform decentralisation from

[428] IBM Newsroom, 'The Food on Your Holiday Table May Have Been Verified by Blockchain' (IBM, 23 December 2019) <https://newsroom.ibm.com/2019-12-23-The-Food-on-Your-Holiday-Table-May-Have-Been-Verified-by-Blockchain> accessed 19 October 2025

[429] Hashrate Distribution by Pool' (*Hashrate Index*, 2025) <https://hashrateindex.com/hashrate/pools> accessed 1 January 2025.

[430] Jonathan Stempel, 'Elon Musk Is Accused of Insider Trading by Investors in Dogecoin Lawsuit' (Reuters, 1 June 2023) <https://www.reuters.com/legal/elon-musk-is-accused-insider-trading-by-investors-dogecoin-lawsuit-2023-06-01/> accessed 9 December 2024.

[431] Daniel Trotta and Eric Beech, 'Trump Says Elon Musk, Vivek Ramaswamy Will Lead Department of Government Efficiency' (Reuters, 13 November 2024) <https://www.reuters.com/world/us/trump-says-elon-musk-vivek-ramaswamy-will-lead-department-government-efficiency-2024-11-13/> accessed 15 December 2024.

a disruptive risk into a regulated innovation. Ultimately, effective governance will legitimise decentralisation and therefore turn distributed trust into accountable trust.

4 Environmental and Social Impacts

While blockchain's architecture offers transparency and innovation, its environmental consequences, particularly through crypto asset mining, are profound. "Each bitcoin transaction generates carbon emissions roughly equivalent to driving a gasoline-powered car between 1,600 and 2,600 kilometres,"[432] these 'significant air pollution emissions,'[433] attribute to around '4.2 million premature deaths worldwide per year.'[434] Mining takes places in countries where healthcare systems are overburdened, so the added stress of pollution-related diseases are disproportionately affecting the most vulnerable members of society (e.g., children, the elderly, and low-income families). This global health crisis emphasises the urgent need for global cooperation and regulations to mitigate the environmental toll of cryptocurrency mining.

One solution is to incentivise mining hubs to rely on clean energy sources (e.g., "mining operations powered by renewable energy, such as solar or wind, could drastically reduce emissions"[8]). This would directly reduce the carbon footprint of cryptocurrency mining, and the resulting improvement in air quality in mining regions would benefit human health. Moreover, with proper tax frameworks, blockchain can address environmental and social impacts effectively. Strategies like tiered taxation, based on energy consumption and fiscal tools, can encourage behavioural changes among blockchain developers or persuade Proof of Work miners to adopt measures that significantly reduce energy consumption.[435]

Ethereum's recent transition from Proof of Work (PoW) to Proof of Stake (PoS) exemplifies how adopting greener technologies can dramatically lower energy usage while maintaining blockchain functionality[436]. This transition has 'achieved a stunning 99.992% reduction in energy consumption, setting a new standard for sustainable blockchain technology.'[437] In contrast to mining, PoS involves participants locking up cryptocurrency as collateral in order to become validators within the network. This process removes the need for energy-intensive computational work that is typically associated with mining, where complex mathematical calculations are required. This shift, from mining to staking, highlights that there is room for the benefits of blockchain to extend to poorer communities, without exacerbating environmental or social challenges.

---

[432] Nuri Onat and Murat Kucukvar, 'The Large Environmental Consequences of Bitcoin Mining' (*LSE Business Review,* 8 November 2024) <https://blogs.lse.ac.uk/businessreview/2024/11/08/the-large-environmental-consequences-of-bitcoin-mining/#:~:text=The%20findings%20reveal%20that%20approximately,metric%20tons%20of%20CO%E2%82%82%20annually> accessed 12 Dec 2024.

[433] Shali Tayebi and Heresh Amini, 'The Flip Side of the Coin: Exploring the Environmental and Health Impacts of Proof-of-Work Cryptocurrency Mining' (2024) 252 Environmental Research Part 1.

[434] World Health Organization, 'Air Pollution' (*WHO*, 24 October 2024) <https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health> accessed 31 December 2024.

[435] Jon Truby, 'Decarbonizing Bitcoin: Law and Policy Choices for Reducing the Energy Consumption of Blockchain Technologies and Digital Currencies' (2018) 44 *Energy Research & Social Science* 399.

[436] Mayukh Mukhopadhyay, 'Ethereum's Green Leap to PoS: From PoW – Will Bitcoin Ever Follow?' (*Medium*, 13 July 2024) <https://mayukhdifferent.medium.com/ethereums-green-leap-to-pos-from-pow-will-bitcoin-ever-follow-a3a172338333> accessed 4 December 2024.

[437] Jordan Cole, 'Staking in Crypto: How PoS Reduces Energy Consumption' (*BlockApps*, 21 October 2022) <https://blockapps.net/blog/staking-in-crypto-how-pos-reduces-energy-consumption/> accessed 12 December 2024.

Despite its potential to empower citizens, the environmental impact of mining operations minimises the progress governments have achieved in advancing effective environmental legislation. While regulation through taxation could mitigate some of these issues, it also raises concerns about the irrevocable environmental consequences of blockchain. Howson's paper concludes that a 'global coordinated ban'[438] may be the most effective policy approach, a sobering assertion to reflect the irreparable damage caused by blockchain.

5 Smart Contracts

Blockchain also introduces the innovation of smart contracts (SCs). Unlike traditional contracts, SCs are self-executing agreements where contract terms are written into code, eliminating the need for a third party. For marginalised communities, SCs could provide access to services like loans or insurance, which are often inaccessible due to the need for traditional intermediaries. For example, in a leasing scenario, a smart contract can automatically unlock a vehicle once payment is confirmed, eliminating the need for manual intervention.[439] Several jurisdictions have enacted specific statutes dedicated to smart contracts, providing a legal framework for their use; Italy stands as a pioneer in legally equating smart contracts to traditional contracts.[440] Under the Italian Civil Code, a smart contract can now be legally equated to a traditional contract, provided that the contract adheres to general legal requirements particularly consent, object, and cause, all of which are necessary to form a valid contract.

In contrast, as illustrated by the hack of Crema Finance, the unregulated use of smart contracts can expose vulnerabilities, which may lead to fraudulent activities and financial losses. Crema Finance functioned upon a smart contract basis, which was manipulated by a hacker, who exploited a vulnerability in Crema's protocols and stole approximately $8.8 million.[441] This weakness of SCs demonstrates a critical need for regulation to ensure their security and functionality. As noted by CertiK co-founder Ronghui Gu, such incidents highlight 'the constantly shifting frontier of crypto security,'[23] but this could potentially undermine blockchain's promise of trust and efficiency

In an academic paper, Raskin[442] states that 'smart contracts exist in preexisting legal structures,' and that 'courts need not upend extant jurisprudence to accommodate smart contracts,' this suggests that global regulation would not be so difficult to enforce. Yet, this opinion faces backlash, as another academic paper questions whether SCs represent progress or a regression in the balance between justice and efficiency.[443] This discourse raises concerns about the future of blockchain and its authority, as the absence of clear regulation

[438] Peter Howson and Alex de Vries, 'Preying on the Poor? Opportunities and Challenges for Tackling the Social and Environmental Threats of Cryptocurrencies for Vulnerable and Low-Income Communities' (2022) 84 Energy Research & Social Science.

[439] Andreas Furrer, 'The Embedding of Smart Contracts into Swiss Private Law' (trans. from German) (1 March 2018) Anwaltsrevue 103-115 <https://www.mme.ch/en/magazine/publications/the-embedding-of-smart-contracts-into-swiss-private-law.> accessed 30 December 2024.

[440] Italy, Law No. 12/2019, Article 8-ter, para 2.

[441] CertiK, 'Crema Finance Exploit' (*CertiK,* 4 July 2022) <https://www.certik.com/resources/blog/4XzSJEeWC2bRppR9CeBckw-crema-finance-exploit?> accessed 30 December 2024.

[442] Max Raskin, 'The Law and Legality of Smart Contracts' (22 September 2016) 1 Georgetown Law Technology Review 304 (2017).

[443] Kilian Bosson, *Smart Contracts and Swiss Obligation Law: The Conclusion "On the Chain" of the Contract* (Faculty of Law, University of Neuchâtel 2019).

could hinder its ability to realise its full potential. The lack of effective global regulatory frameworks could setback blockchain technology from its intended goal of decentralisation.

6 Regulatory Frameworks

6.1 The Markets in Crypto-Assets Regulation (MiCAR)

MiCAR represents a significant step towards establishing a regulatory framework for blockchain technology, as it aims to create a unified regulatory environment across EU member states.[444] While blockchain provides the underlying infrastructure that enables crypto assets to exist, MiCAR's focus lies in governing how those assets (stablecoins, tokens, and crypto lending products) are issued, traded, and safeguarded across EU member states. An example of this is the regulation of stablecoins and asset-referenced tokens under MiCAR could provide a safer means for individuals to transact and store value, which in turn could enhance financial inclusion globally,[445] beyond traditional banking systems.

Although the regulation aims to protect consumers, the strict focus on regulatory compliance could lead to a scenario where blockchain becomes a barrier to entry, ultimately monopolising power amongst the wealthiest stakeholders and dismissing the democratisation that blockchain technology intends to promote. Therefore, to enhance MiCAR's effectiveness, regulators could consider a more nuanced approach that allows for interest payments under specific conditions[446]. For example, tiered permissions based on the type of stablecoin (asset vs e-money tokens) could be introduced. Interest-bearing stablecoins could be allowed where issuers meet capital requirements and conduct regular audits. By incorporating flexibility into the framework, MiCAR could encourage the growth of crypto lending, while still safeguarding financial stability.

6.2 The Exploitation of Blockchain

It is crucial to consider how regulatory frameworks might negatively impact blockchain. Instead of merely limiting its potential, such frameworks could be deliberately weaponised by authorities with malicious intent. Blockchain's appeal lies in its immutability and transparency, but these very features can just as easily be used by states to fuel surveillance capitalism. As previously discussed, regulations often permit the collection and reporting of private data, namely through schemes including KYC (Know Your Customer) and AMS (Anti-Money Laundering Standards), with claims of protecting citizens, yet still exposing private data. Still, as Zuboff notes, the 'unilateral claiming of private human experience'[29] can also be used as 'free raw material for translation into behavioral data.'[447]

Blockchain's transparent nature makes it easily monitored and scrutinised, potentially opening 'a new paradigm of surveillance capitalism,'[30]. Echoing previous discussions of the global adoption of smart contracts; the automation of these contracts, combined with surveillance

---

[444] European Securities and Markets Authority, Markets in Crypto-Assets Regulation (MiCAR) (*ESMA*, 2024) <https://www.esma.europa.eu/esmas-activities/digital-finance-and-innovation/markets-crypto-assets-regulation-mica> accessed 20 December 2024.

[445] Chainalysis, MiCA's Stablecoin Regime: Challenges Part 1 (Chainalysis, 28 November 2022) < https://www.chainalysis.com/blog/mica-stablecoin-regime-challenges-part-1/ > accessed 1 December 2024.

[446] Freshfields, 'MiCAR Perimeter Issues: Tokenized Deposits and Payment Services' (*Freshfields*, 2 January 2025) < https://technologyquotient.freshfields.com/post/102js80/micar-perimeter-issues-tokenized-deposits-and-payment-services > accessed 2 January 2025.

[447] Shoshana Zuboff, 'Harvard Professor Says Surveillance Capitalism Is Undermining Democracy' (Harvard University, 28 March 2019) https://news.harvard.edu/gazette/story/2019/03/harvard-professor-says-surveillance-capitalism-is-undermining-democracy/ accessed 15 December 2024.

capitalism, could allow states to exert significant control. It is further argued that 'states enjoy an undeniably superior position in their ability to control citizen behavior by making access to public goods and services conditional.'[448] This suggests that regulations could demand compliance with government rules as a prerequisite for accessing blockchain services, escalating the harmful effects of centralisation on vulnerable communities. For instance, smart contracts could be programmed to deny access to welfare benefits, healthcare, or even financial systems unless individuals meet state-imposed criteria.

Another example of the exploitation of blockchain is the technology's legalisation in Russia to evade sanctions.[449] This strategic decision has enabled companies in Russia to bypass traditional financial systems, effectively evading the accountability enforced by international restrictions under Western sanctions. While Ukraine's use of blockchain-based donations has been transparent in supporting the safeguarding of civilians[450], Russia's use of cryptocurrency has been to prolong a conflict that exacerbates human suffering. This distinction highlights how regulation can limit blockchain's decentralising potential, instead reinforcing dictatorial state control over financial systems, while using blockchain for unethical and malicious activities that harm the innocent.

7 Accessibility and Social Justice

Finally, the statement that 'blockchain could empower citizens,' fails to consider the significant barriers that exclude the most vulnerable populations. The technical complexities of the technology, including the need to understand its language and mechanisms, act as a barrier for those without access to adequate education or the expensive hardware required for running the technology. Unless significant regulatory efforts are made to provide access through education, such as a mandatory secondary school course on blockchain[451], this technology will remain a tool for the privileged, rather than a means of empowerment for the world's most vulnerable populations.

8 Conclusions

In conclusion, blockchain is a disruptive technology whose idiosyncrasies empower citizens in a social context, by "combatting disinformation through blockchain's supply-chain record for facts,"[452] and in economic contexts, as "anyone with an internet connection can participate in the global economy."[453] However, blockchain's potential is highly influenced by regulation,

---

[448] Firat Cengiz, 'Blockchain Governance and Governance via Blockchain: Decentralized Utopia or Centralized Dystopia?' (2023) 6(4) *Policy Design and Practice* 446 <https://doi.org/10.1080/25741292.2023.2247203> accessed 19 December 2024.

[449] Chainalysis, 'Russia's Cryptocurrency-Legislated Sanctions Evasion' (*Chainalysis Team*, 7 December 2022) < https://www.chainalysis.com/blog/russias-cryptocurrency-legislated-sanctions-evasion/ > accessed 11 December 2024.

[450] Spencer Feingold, 'The Role of Cryptocurrency in the Ukraine War: How Crypto Is Helping to Fund the Fight Against Russia' (*World Economic Forum*, 21 March 2023) <https://www.weforum.org/stories/2023/03/the-role-cryptocurrency-crypto-huge-in-ukraine-war-russia/> accessed 30 December 2024.

[451] Blockchains.com, 'Education Initiative' (*Blockchains.com*, 2025) <https://www.blockchains.com/education-initiative/> accessed 3 Jan 2025.

[452] Kathryn Harrison and Amelia Leopold, 'How Blockchain Can Help Combat Disinformation' (*Harvard Business Review,* 19 July 2021) <https://hbr.org/2021/07/how-blockchain-can-help-combat-disinformation> accessed 12 December 2024.

[453] BingX, 'The Social Impact of Cryptocurrencies: What Does It Affect?' (*Medium*, 14 October 2022) <https://bingxofficial.medium.com/the-social-impact-of-cryptocurrencies-what-does-it-affect-3cbe12457cf2> accessed 30 December 2024.

which depends on whether authorities perceive the technology as a threat or an innovation. While the immutable nature of blockchain ensures accountability, it can also be weaponised through regulation, as seen in surveillance capitalism and by figures like Elon Musk seeking to capitalise on the market. For blockchain to remain a positive force for social justice, regulation must seek an equilibrium in ensuring blockchain achieves decentralisation and empowers citizens, while containing its impact to prevent misuse.