

3-2020

Antitrust in the Blockchain Era

Giovanna Massarotto

UCL Centre for Blockchain Technologies

Follow this and additional works at: <https://scholarship.law.nd.edu/ndlsjet>



Part of the [Law Commons](#)

Recommended Citation

Giovanna Massarotto, *Antitrust in the Blockchain Era*, 1 Notre Dame J. on Emerging Tech. 252 (2020).

This Article is brought to you for free and open access by the Law School Journals at NDLScholarship. It has been accepted for inclusion in Notre Dame Journal on Emerging Technologies by an authorized editor of NDLScholarship. For more information, please contact lawdr@nd.edu.

ANTITRUST IN THE BLOCKCHAIN ERA

Giovanna Massarotto

INTRODUCTION	253
I. THE BLOCKCHAIN ERA	254
A. <i>The Blockchain Technology</i>	255
1. <i>From Bitcoins to Blockchain</i>	257
2. <i>The Advantages Behind Blockchain Technology</i>	257
3. <i>Incentives Underlying the Blockchain Network</i>	259
4. <i>Public and Private Blockchain</i>	260
B. <i>Blockchain and the Web</i>	261
1. <i>From the Web to a Single Universal Blockchain</i>	262
2. <i>Restoring the Web's Decentralization and Data Democracy</i>	263
II. ANTITRUST AND INNOVATION	265
A. <i>Antitrust in the Development of Information Technology</i>	265
B. <i>Antitrust Protects Innovation over Competitors – JVM v. MJVM</i>	268
C. <i>Conclusions</i>	270
III. ANTITRUST AND REGULATION IN BLOCKCHAIN MARKETS	271
A. <i>Public Blockchain and Antitrust Economic Democracy Goal</i>	271
B. <i>Regulation in the Blockchain</i>	273
1. <i>From Antitrust to Regulation</i>	274
2. <i>What Regulation for the Blockchain Network?</i>	275
C. <i>Some Considerations</i>	277
CONCLUSIONS	278

ANTITRUST IN THE BLOCKCHAIN ERA

Giovanna Massarotto*

Similar to the Internet Era, which generated new value chains based on digital marketplaces, the blockchain has the potential to be the next cutting-edge technology which will revolutionize markets. Blockchain technology built on a consensus mechanism can make intermediaries [or third parties] unnecessary and reduce the market power of today's centralized platforms. Antitrust enforcers should oversee the transformation of digital markets by means of blockchain technology to prevent anticompetitive conduct that might block the path to innovation. Using the Web as a model of reference, a public blockchain could run on universal and open protocols; with goods and services traded in a single universal blockchain. Antitrust enforcers are fundamental in keeping blockchain markets open and free. Rather than leading to the death of antitrust and regulation, blockchain will require more sophisticated versions of both.

INTRODUCTION

What struck me most in the study of blockchain technology was how this technology could be the key to efficiently regulate data flow and decentralize today's centralized platforms on the Web. A variety of blockchain platforms and technologies have been developed over the last ten years, with the bitcoin public blockchain a prime example.¹ This paper uses bitcoin blockchain to explain the phenomenon and argue how a public blockchain² can become universal and restore the Web's decentralization.

This article proceeds with an exploration of the role of antitrust and regulation in the development of a single universal blockchain platform. Similar to the Web, a public blockchain based on open source protocols can create a single universal platform on which goods and services are traded;

* Research Associate, UCL Centre for Blockchain Technologies (UCL CBT), Adjunct Professor, University of Iowa, United States of America, giovanna@massarotto.com.

¹ EUR. PARLIAMENT, BLOCKCHAIN AND THE GENERAL DATA PROTECTION REGULATION: CAN DISTRIBUTED LEDGERS BE SQUARED WITH EUROPEAN DATA PROTECTION LAW? 3 (2019), [https://www.europarl.europa.eu/RegData/etudes/STUD/2019/634445/EPRS_STU\(2019\)634445_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2019/634445/EPRS_STU(2019)634445_EN.pdf) (“[T]here is not one ‘blockchain technology’. Rather, blockchains (or Distributed Ledger Technology – ‘DLT’) are better seen as a class of technologies operating on a spectrum that present different technical and governance structures.”).

² The bitcoin blockchain is a public blockchain: blockchains can be public or private. Public blockchain is open to everybody and free, similar to the Web. See *infra* Part 2.1.4.

privacy and the safety of data better preserved than with existing regulation.³ Blockchain technology through a decentralization process may reduce market concentration and ensure open and free markets without an antitrust intervention.

Although some scholars believe that blockchain will be the death of antitrust law⁴ in that it reduces the market power of centralized platforms, an antitrust enforcement mechanism is still necessary. Antitrust enforcers are irreplaceable neutral actors in promoting an appropriate use of innovative technologies preventing companies from transforming open and free markets into monopolies. Initially, antitrust supervision and regulation might be sufficient.⁵ However, more sophisticated forms of regulation will also likely be necessary as blockchain becomes a crucial component of our economic systems.

The paper is structured into four Sections. Having introduced the main issues here, Section 2 explains blockchain technology and investigates in detail how, similar to the Web, a *public* blockchain can evolve into a universal network. Section 3 focuses on the role of antitrust in guiding the innovation process and the future blockchain era. Section 4 then draws some conclusions on the responsibility of antitrust and regulation in new markets which run on a future single public blockchain.

I. THE BLOCKCHAIN ERA

In the last thirty years, the Internet has transformed our economy impacting markets from healthcare to communication. In June 2019, 56% of the global population were Internet users⁶ mainly thanks to the low cost of

³ See, e.g., EUR. COMM'N, EU DATA PROTECTION RULES (2019), https://ec.europa.eu/commission/priorities/justice-and-fundamental-rights/data-protection/2018-reform-eu-data-protection-rules_en; *Bundeskartellamt Prohibits Facebook from Combining User Data from Different Sources*, BUNDESKARTELLAMT (Feb. 7, 2019), https://www.bundeskartellamt.de/SharedDocs/Meldung/EN/Pressemitteilungen/2019/07_02_2019_Facebook.html?nn=3591568; *FTC Charges Deceptive Privacy Practices in Googles Rollout of Its Buzz Social Network*, FED. TRADE COMM'N (Mar. 30, 2011), <https://www.ftc.gov/news-events/press-releases/2011/03/ftc-charges-deceptive-privacy-practices-googles-rollout-its-buzz>.

⁴ See, e.g., Thibault Schrepel, *Is Blockchain the Death of Antitrust Law?: The Blockchain Antitrust Paradox*, 3 GEO. L. TECH. REV. 281 (2019) (discussing blockchain affects antitrust law).

⁵ See Giovanna Massarotto, *From Standard Oil to Google: How the Role of Antitrust Law Has Changed*, 41 WORLD COMPETITION 395, 418 (2018); GIOVANNA MASSAROTTO, ANTI-TRUST SETTLEMENTS: HOW A SIMPLE AGREEMENT CAN DRIVE THE ECONOMY 75 (Wolters Kluwer, 2019) [hereinafter MASSAROTTO, ANTI-TRUST SETTLEMENTS].

⁶ STATISTA, GLOBAL DIGITAL POPULATION AS OF JULY 2019 (IN MILLIONS) (2019), <https://www.statista.com/statistics/617136/digital-population-worldwide/>.

phones and data connection.⁷ Hi-tech companies built on the Internet platform, such as Google and Facebook, have found creative ways through centralized platforms to come between the users and the Internet platform by making themselves an integral part of the process. Facebook, for example, created a platform which has enabled people to connect all over the world; the more people join the network, the more Facebook's platform becomes attractive for both users and advertisers. Similarly, Google Search provides a search engine free of charge to users, but users' search queries provide information about themselves that is extremely valuable to advertisers. The European Commission observed that in February 2017, Google Search engine held a global average monthly market share in search engines of 80.47% on desktops and 94.87% on mobile devices.⁸

Similar to the Internet Era, blockchain has the potential to change market paradigms—bringing us to the *Blockchain Era*. Blockchain is based on a consensus mechanism built on a decentralized database that potentially eliminates the need for third-party intermediaries, offering cheaper goods and services. Sir Tim Berners Lee (the founder of the World Wide Web) has predicted that the future is moving towards decentralized platforms rather than the present centralized versions.⁹

A. *The Blockchain Technology*

A common tendency is to confuse Bitcoins with blockchain. Bitcoin is a cryptocurrency and blockchain is the technology (the infrastructure) designed to store bitcoin transactions without the supervision of the banking system (or anyone for that matter). Today, the same technology can be applied to a variety of industries and situations, from cryptocurrency to social applications, consumer goods and supply chain.¹⁰ Blockchain

⁷ *Tim Berners Lee on Reshaping the Web*, FT TECH TONIC (Dec. 3, 2019) (downloaded using Podcast Player).

⁸ Directorate-General for Competition, Eur. Comm'n, Case AT.39740: GOOGLE SEARCH (SHOPPING) 35 (2017).

⁹ See Klint Finley, *Tim Berners-Lee, Inventor of the Web, Plots a Radical Overhaul of His Creation*, WIRED (Apr. 4, 2017 7:00 AM), <https://www.wired.com/2017/04/tim-berners-lee-inventor-web-plots-radical-overhaul-creation/>.

¹⁰ For example, in supply chain, blockchain networks enable companies to track and lodge the flow of goods in real time. See David Frulla & Kristi Wolff, *Blockchain Could Open Markets* 99 NAT'L FISHERMAN 8, 9 (2018). Blockchain technology is also valuable in the context of IP law where it can be used in providing creatorship, controlling and tracking the distribution of a registered IP, furnishing evidence of the first use, or registering and clearing IP rights. See, e.g., Birgit Clark, *Blockchain and IP Law: A Match made in Crypto Heaven?*, WORLD INTELLECTUAL PROPERTY ORGANIZATION (Feb. 2018), http://www.wipo.int/wipo_magazine/en/2018/01/article_0005.html; Brian Forde, *Using*

infrastructure can, for example, track an entire supply chain,¹¹ and store data of all kinds in a more efficient way than existing centralized technologies. Walmart, one of the world's largest grocery chains is experiencing blockchain technology because blockchain tracking enables to save a massive amount of time. "Research that used to take 7 days can now [through blockchain] takes as little as 2.2 seconds,"¹² reported Walmart.

In a blockchain, users can also interact and regulate their commercial relations in a more efficient way by means of *smart contracts*—contracts built into a code and enforced by a program¹³. Through smart contracts, blockchain users can agree to execute a transaction or other assets at different time points or under different conditions and to automatize the performance of such terms through a program.¹⁴ Blockchain and smart contracts can significantly improve and make the negotiation, search and verification stages, commonly performed with the assistance of third-party intermediaries, more reliable and safe.¹⁵ Companies with powerful platforms

Blockchain to Keep Public Data Public, HARV. BUS. REV. (Mar. 31, 2017), <https://hbr.org/2017/03/using-blockchain-to-keep-public-data-public>. Governments could apply blockchain technology to make their databases more secure and transparent, and to better protect the privacy of their citizens. See Brian Forde, *Using Blockchain to Keep Public Data Public*, HARV. BUS. REV. (Mar. 31, 2017), <https://hbr.org/2017/03/using-blockchain-to-keep-public-data-public>; MELANIE SWAN, BLOCKCHAIN: BLUEPRINT FOR A NEW ECONOMY 44 (Tim McGovern ed., 1st ed. 2015). Blockchain government is "the idea of using blockchain to provide services traditionally provided by nation-states in a decentralized, cheaper, more efficient, personalized manner . . . [t]he blockchain could become both the mechanism for governing in the present, and the deposit of all of a society's documents, records, and history for use in the future." *Id.*

¹¹ See, e.g., UCL Centre for Blockchain Technologies, *Distributed Ledger Technology in the Supply Chain* (2019), http://blockchain.cs.ucl.ac.uk/wp-content/uploads/2019/08/DLT-in-the-Supply-Chain_UCL-CBT.pdf.

¹² Matt Smith, *In Wake of Romaine E. coli Scare, Walmart Deploys Blockchain to Track Leafy Greens*, WALMART: NEWSROOM, <https://corporate.walmart.com/newsroom/2018/09/24/in-wake-of-romaine-e-coli-scare-walmart-deploys-blockchain-to-track-leafy-greens> (last visited Mar. 17, 2020).

¹³ See Massimo Bartoletti & Livio Pompianu, *An Empirical Analysis of Smart Contracts: Platforms, Applications, and Design Patterns* (Mar. 18, 2017), <https://arxiv.org/pdf/1703.06322.pdf>.

¹⁴ In other words, "smart contracts are self-executing contractual states stored on a blockchain." MASSAROTTO, ANTITRUST SETTLEMENTS, *supra* note 5, at 202.

¹⁵ See, e.g., Nick Szabo, *The Dawn of Trustworthy Computing*, UNENUMERATED (Dec. 11, 2014, 10:16 AM), <http://unenumerated.blogspot.com/2014/12/the-dawn-of-trustworthy-computing.html>; Nick Szabo, *Formalizing and Securing Relationships on Public Networks*, 2 FIRST MONDAY (1997), <https://journals.uic.edu/ojs/index.php/fm/article/view/548/469> ("Smart contracts combine protocols with user interfaces to formalize and secure relationships over computer networks. . . . These protocols, running on public networks such as the Internet, both challenge and enable us to formalize and secure

may become unnecessary by means of blockchain technologies unless they embrace the technology.

1. *From Bitcoins to Blockchain.* – In November 2008, an anonymous person (or group of people) under the name of Satoshi Nakamoto introduced a distributed system for electronic transactions called Bitcoin blockchain based on the consensus mechanism rather than one relying on the bank system.¹⁶ Bitcoins are a cryptocurrency created by powerful computers which require a large amount of electric power to resolve complex mathematical problems (the so-called *mining process*). Once the solution of a specific mathematical problem is solved by a participant of the blockchain (also called *miner*), the block is closed, and a new block is added. Bitcoins (hence bitcoin blocks), rather than being recorded and stored in a centralized database, are recorded in a decentralized public ledger that consists of blocks stored in a distributed database (the blockchain). This public ledger is shared among all participants of the blockchain network, which is open to everybody.¹⁷

In other words, instead of having a centralized database stored in a single location (like a server of a bank), a distributed database is stored in multiple locations linked to the network of blockchain's participants. The participants can see and verify each transaction, but once the transaction has been validated by the network and added to the blockchain, the transaction cannot be modified or deleted. The network is continuously adding new blocks, making the blockchain irreversible.

2. *The Advantages Behind Blockchain Technology.* – The blockchain is an immutable, decentralized and transparent system that promises to protect privacy and security.¹⁸ In practice, the possibility of losing information is zero, as the information is stored on a number of computers and synchronized ledger copies. Although a transaction in the bitcoin blockchain is public, the name of the involved parties remains unknown thanks to the use of a form of cryptography called Public Key Infrastructure (PKI). The idea of using public key cryptography methods for digital money systems in which spender identity is not revealed was introduced in the 1990 (long

new kinds of relationships in this new environment, just as contract law, business forms, and accounting controls have long formalized and secured business relationships in the paper-based world."); *Id.*

¹⁶ A distributed system implies that data are saved at multiple sites (nodes) of a network. See EDWIN D. REILLY, *MILESTONES IN COMPUTER SCIENCE AND INFORMATION TECHNOLOGY* 82 (Greenwood Press, 1st ed. 2003).

¹⁷ Deepak Puthal, Nisha Malik, Saraju P. Mohanty, Elias Kougiannos & Chi Yang, *The Blockchain as a Decentralized Security Framework*, 7 *IEEE CONSUMER ELECTRONICS MAG.* 18, 18-19 (2018).

¹⁸ *Id.*

before bitcoins) by the American cryptographer David Chaum.¹⁹ Chaum also presented the idea of adopting public key cryptography methods for untraceable electronic mail and digital pseudonyms.²⁰ In the world of cryptography the “public key cryptography is rightly considered to be a revolution,”²¹ Timothy C. May noted.²²

The unique element of the PKI is (also in the context of blockchain) that, although the public key is visible to everybody, this key is never attached to a real-world owner. The owner of, for example, a bitcoin receives a private key that creates a pair (one private key and a public key) by a complex mathematical algorithm.

The creation of a public key from a private key is easy—the opposite is exceptionally difficult. In summary, the public key preserves transparency because all transactions are public and known by all participants; the private key, on the other hand, ensures privacy by keeping secret the name of the actual parties in transactions. The recipient of a transaction or an order that uses the blockchain can verify the signature, thus the identity of the sender, by checking whether the private key of the sender has effectively created the public key. The public key of the recipient would not authenticate the private key of the sender, if it has not. These cryptographic keys (pairs of a public and private key) can be stored in an application called *wallet*. There is a variety of wallets available created for different uses and devices.²³

As the founder of Bitcoins noted, digital signatures based on a public and a private key could provide only part of the solution, since you would probably still need a trusted third-party to prevent the issue of double-spending.²⁴ To accomplish this without a central authority (hence without a bank), the founder of Bitcoins devised a consensus system based on the *proof-of-work* (PoW) protocol, which is used during the *mining process*

¹⁹ See, e.g., David Chaum, Amos Fiat & Moni Naor, *Untraceable Electronic Cash*, CRYPTO '88: PROCEEDINGS ON ADVANCES IN CRYPTOLOGY (1990), <https://www.chaum.com/publications/Untraceable-Electronic-Cash.pdf>.

²⁰ David Chaum, *Untraceable Electronic Mail, Return Addresses, and Digital Pseudonyms*, 24 COMM. OF THE ACM 84 (1981), <https://www.chaum.com/publications/chaum-mix.pdf>.

²¹ Timothy C. May, *Crypto Anarchy and Virtual Communities*, SATOSHI NAKAMOTO INSTITUTE (Dec. 1994), <https://nakamotoinstitute.org/virtual-communities/>.

²² Timothy C. May is considered the father of the crypto-anarchy and one of the key figures in the Cyberpunk movement that led to the development of blockchain technologies.

²³ See, for example, Bitcoin wallets. Bitcoin, *Choose your Bitcoin wallet*, <https://bitcoin.org/en/choose-your-wallet?step=1> (last visited Mar. 18, 2020).

²⁴ Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*, <https://bitcoin.org/bitcoin.pdf>.

described in 2.1.2.²⁵ The participants of the bitcoin blockchain network need to agree to a set of rules hard-coded into a protocol referred to as the *consensus mechanism* that governs the blockchain.²⁶ If all participants follow the protocol (hence the network's rules), everyone wins, and the network properly functions.

In the case of Bitcoins transactions, the PoW consensus protocol requires that once the transaction is broadcasted to the bitcoin network, participants need to resolve a complex mathematical problem before adding a new block in the chain.²⁷ Only when the majority of participants in the network agrees on the solution of the math problem²⁸ a new block is added in the blockchain. The purpose of using PoW is to slow down the message or transaction sent to all participants, giving time for honest participants to agree on a common solution.²⁹ The same logic underlying PoW is commonly used to prevent spam in emails.³⁰ In short, it is the consensus mechanism (in case of bitcoin the PoW) utilized in blockchain technology that makes the services of third parties and centralized platforms unnecessary.

The bitcoin blockchain is a decentralized database that stores bitcoin transactions, but as previously discussed, the same technology can be applied in a variety of industries and situations to record and store any kind of data, not only cryptocurrency transactions.

3. Incentives Underlying the Blockchain Network. – Now that we understand *how* the underlying technology of blockchain works, it might be helpful to explore *what* are the financial incentives for participants. The participants are also called *bookkeepers* or *validator nodes* because they maintain their own records of each block of the blockchain in which they participate. To incentivize the participants, each needs to be rewarded and

²⁵ *Id.* See also Satoshi Nakamoto, *Re: Bitcoin P2P E-cash Paper* (Nov. 13, 2008), <https://www.mail-archive.com/cryptography@metzdowd.com/msg09997.html>.

²⁶ See, e.g., Szabo, *supra* note 15.

²⁷ Nick Szabo, *Money, Blockchain, and Social Scalability*, Unenumerated (Feb. 9, 2017) <http://unenumerated.blogspot.com/2017/02/money-blockchains-and-social-scalability.html>.

²⁸ *Id.*

²⁹ See Marcella Atzori, *Blockchain Technology and Decentralized Governance: Is the State Still Necessary?* 6 J. GOVERNANCE & REG. 45, 45 (2017) ("Even if some nodes are unreliable, dishonest or malicious, the network is able to correctly verify the transactions and protect the ledger from tampering through a mathematical mechanism called *proof of work*, which makes the human intervention or controlling authority unnecessary."); *Id.*

³⁰ The proof of work system used to limit email spam is called Hashcash. What Hashcash does is to introduce cpu cost like a processing cost to engage something. In the context of emails, when you send an email the receiver must first resolve that costs a bit of cpu. For a user this is a tiny difference, but for a spammer that used to send thousands of emails per minute means a significant cost of time. Hashcash.org, <http://www.hashcash.org/> (last visited Mar. 18, 2020).

the remuneration could consist of block rewards, transaction fees or simply participation in the blockchain network. Even without a system of block rewards or transaction fees, anyone can decide to participate in a blockchain network, just as anyone can decide to be part of a group, benefiting from network effects that one could not experience as a single individual. Anyone can create and participate in a decentralized network and benefit of innovative services,³¹ and anyone can create a buyer group to acquire some specific products bypassing the intermediaries.

4. *Public and Private Blockchain.* – The bitcoin blockchain is a public blockchain. Blockchains can be public or private. While everyone can potentially participate in a public blockchain, a private blockchain clearly defines who can participate.³² The public blockchain is based on anonymity and consensus mechanisms reached, for example, through PoW or *proof of stake* (PoS).³³ In private blockchains the participants are identified, and the consensus (the approval of their acceptance) is based on voting or a multi-party consensus algorithm.³⁴

In other words, in private blockchains participants need to be invited and are only known to each other.³⁵ Instead of a consensus mechanism like the PoW, the security of the transactions relies on the facts that participants have been previously screened by the other participants to join the blockchain and that everything the blockchain does is totally private.

Blockchains (both public and private blockchains) can set rules to clearly define what activities participants have the permission to perform—*permissioned blockchains*. In permissioned public blockchain, for example, all participants have “read” access, while the “write” and the “consensus management” is reserved to those who obtained the permission by a set

³¹ Ethereum, for example, is a public blockchain that offers a variety of decentralized applications and services. See Ethereum, <https://ethereum.org/> (last visited Mar. 18, 2020).

³² Tim Kozak, *Public v. Private Blockchain*, INTELLECTSOFT (Feb. 28, 2018), <https://blockchain.intellectsoft.net/blog/public-vs-private-blockchain/>.

³³ Proof of stake means that the creator of a new block is defined in a deterministic way, for example depending of its wealth (the so-called stake). In practice, the PoS requires participants to vote on blocks of transactions that they consider valid with their money (the network tokens). They lose their tokens if, for example, they validate at the same time two different blocks of transactions. See MANAV GUPTA, *BLOCKCHAIN FOR DUMMIES*, IBM LTD. EDITION, 16 (Carrie A Burchfield et al. eds., 2018).

³⁴ See, e.g., *Blockchains & Distributed Ledger Technologies*, BLOCKCHAINHUB BERLIN, <https://blockchainhub.net/blockchains-and-distributed-ledger-technologies-in-general/>.

³⁵ Rose Jacobs, *The Good and Bad of Blockchain*, CHI. BOOTH REV. (Feb. 12, 2018), <http://review.chicagobooth.edu/finance/2018/article/good-and-bad-blockchain>.

of nodes, which is pre-selected.³⁶ In permissioned private blockchains, both participation and the capability to write is limited to those participants that a central authority has authorized.³⁷ In other words, these are closed blockchains with a hierarchical authority structure.

This article focuses only on the public (open) blockchain and its similarities with the Web, as private blockchains deserve a special discussion and will be treated separately.³⁸

B. Blockchain and the Web

In 1990, Tim Berners-Lee devised the Web as an open platform without owners where everybody³⁹ could freely interact and work on the Internet network similar to companies acting in open markets. Similar to the Web, a public blockchain can become a universal decentralized network with no-central control.

Over the last years, large technology companies found ways through centralized platforms to make themselves an integral part of the Web by offering, for example, goods and services free of charge to attract users and collect money from users' data. As a consequence, the Web has become more centralized, most of digital markets are now highly concentrated, and data represents an essential factor for companies to compete.⁴⁰ But, a public universal blockchain might be the key to restoring the Web's decentralization, to reducing the role of big technology companies, protecting data of Internet users by democratizing data platforms. The renowned computer scientist and legal scholar Nick Szabo recognizes that a public blockchain, such as bitcoin blockchain, improves *social scalability*.⁴¹ The term *social scalability* implies that an increasing number of people benefit of

³⁶ Paolo Tasca & Claudio Tessone, *A Taxonomy of Blockchain Technologies: Principles of Identification and Classification*, 4 LEDGER 1, 28 (2019).

³⁷ *Id.*

³⁸ See, e.g., MASSAROTTO, ANTITRUST SETTLEMENTS, *supra* note 5, at 201, 202.

³⁹ Tim Berners-Lee, *Frequently Asked Questions*, W3C, <http://www.w3.org/People/Berners-Lee/FAQ.html> (last visited Mar. 18, 2020).

⁴⁰ See Shannon Bond, *Google and Facebook Build a Digital Ad Duopoly*, FIN. TIMES (Mar. 14, 2017), <https://www.ft.com/content/30c81d12-08c8-11e7-97d1-5e720a26771b>; Lara O'Reilly, *The Race Is On to Challenge Google-Facebook 'Duopoly' in Digital Advertising*, WALL ST. J. (June 19, 2017 5:30 AM), <https://www.wsj.com/articles/the-race-is-on-to-challenge-google-facebook-duopoly-in-digital-advertising-1497864602>.

⁴¹ "Social scalability is the ability of an institution -- a relationship or shared endeavor, in which multiple people repeatedly participate, and featuring customs, rules, or other features which constrain or motivate participants' behaviors -- to overcome shortcomings in human minds and in the motivating or constraining aspects of said institution that limit who or how many can successfully participate." Szabo, *supra* note 27.

(participate in) human institutions.⁴² In other words, *social scalability* concerns the participation in shared human endeavors, which is the essence of a public blockchain. As previously discussed, a public blockchain (e.g. bitcoin blockchain) is based on a consensus mechanism that requires that the majority of blockchain participants agree on a common solution before adding a new block. This means that *bad participant(s)* or ‘traitors’ in the blockchain network to succeed in an attack need the consensus of fifty-one percent of the participants in the network—Szabo called this ‘*democracy in action*,’ rather than an attack.⁴³

1. *From the Web to a Single Universal Blockchain.* – In predicting the creation of a universal public blockchain, the story of the Web is compelling and helpful, as both the Web and the public blockchain are open and decentralized platforms, which scale human institutions. The Internet is the infrastructure where information and data travel by means of languages known as protocols or standards. In 1990, Sir Tim Berners-Lee set a universal language and protocol—the Web—by means of which data such as texts and pictures are transferred on the Internet infrastructure. Specifically, the Web includes the Hypertext Transfer Protocol (HTTP) and Hyper-Text Markup Language (HTML).⁴⁴

Initially, there were other languages and protocols to transfer data on the Internet platform. On August 24, 1995, for example, Microsoft launched the Microsoft Network (MSN), along with Windows 1995.⁴⁵ The MSN was a centralized network built on the Internet infrastructure, which ran on protocols and software for Microsoft applications only.⁴⁶ But, given the standardization of the Web by means of the HTTP and HTML, the MSN was converted to provide standard World Wide Web applications.

Although Microsoft tried to leverage its dominant position in personal

⁴² *Id.*

⁴³ The market itself, where “the most humble of products depended, directly and indirectly, on the work of large numbers of a wide variety of people” is a scalable human institution, Szabo noted. *Id.* (citing ADAM SMITH, *THE WEALTH OF NATIONS*, (“The woolen coat, for example, which covers the day laborer, as coarse and rough as it may appear, is the produce of the joint labor of a great multitude of workmen. . . . if we examine, I say, all these things, and consider what a variety of labor is employed about each of them, we shall be sensible that without the assistance and co-operation of many thousands, the very meanest person in a civilized country could not be provided, even according to what we may falsely imagine the easy and simple manner in which he is commonly accommodated.”))

⁴⁴ *Help and FAQ*, W3C, <https://www.w3.org/Help/>.

⁴⁵ See James Gleick, *Making Microsoft Safe for Capitalism*, N.Y. TIMES, (November 5, 1995)

<https://www.nytimes.com/1995/11/05/magazine/making-microsoft-safe-for-capitalism.html>.

⁴⁶ *Internet Service Providers*, RZERO, <http://alternatives.rzero.com/isp.html>.

computer operating systems and force its customers to install its MSN, the power of the Web platform based on free and open protocol and language prevailed. While the Web was supposed to be open and universal, Microsoft owned the MSN and Windows 1995 for which consumers had to pay.⁴⁷

The vision of the founder of the Web was “to create a way of placing and finding data on the Internet that had no central manager and no central data-base.”⁴⁸ As a result, the open and decentralized World Wide Web took off, while the closed and centralized MSN no longer exists. A public blockchain which is open, free and decentralized has the potential to evolve in a similar fashion.

Like Sir Tim Berners-Lee in 1990, someone could set a protocol in a public blockchain which has the potential of becoming a universal platform similar to the Web on the Internet where data are globally stored. It is the protocol, indeed, integrated with strong cryptography that makes blockchain technology more reliable and less vulnerable than existing centralized technologies.⁴⁹

2. *Restoring the Web's Decentralization and Data Democracy.* – As the Web became more centralized, antitrust agencies started scrutinizing a few powerful companies, such as Google and Facebook.⁵⁰ Since the early 1990s, hi-tech companies exponentially increased their market shares in the emerging data industry through the Internet and the Web platform. In 2018, Google Search reported about eighty seven percent of online searches

⁴⁷ Gleick, *supra* note 46. See also, Jim Hu, *Whatever Happened to MSN? The Second-Largest Online Service is Relegated to Relative Obscurity Behind Microsoft's Start Portal Site*, CNET (Jul. 1, 1998 2:30 PM), <https://www.cnet.com/news/whatever-happened-to-msn/>.

⁴⁸ *The Economist Review of Books: Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web by its Inventor*, THE ECONOMIST, Sept. 18, 1999, at S10.

⁴⁹ See, e.g., Szabo, *The Dawn of Trustworthy Computing*, *supra* note 15. (“Many other decentralized or peer-to-peer (P2P) technologies do not provide anything close to the security and reliability provided by a blockchain protected by full Byzantine or Nakamoto consensus and cryptographic hash chains, but deceptively style themselves as blockchains or cryptocurrency.”); *Id.*

⁵⁰ See, e.g., Press Release, European Commission IP/18/4581, Antitrust: Commission Fines Google €4.34 Billion for Illegal Practices Regarding Android Mobile Devices to Strengthen Dominance of Google's Search Engine (July 18, 2018); Press Release, European Commission IP/17/1784, Antitrust: Commission Fines Google €2.42 Billion for Abusing Dominance as Search Engine by Giving Illegal Advantage to Own Comparison Shopping Service (June 27, 2017); F.T.C., STATEMENT OF THE FEDERAL TRADE COMMISSION REGARDING GOOGLE'S SEARCH PRACTICES (2013); Bundeskartellamt, Case Summary: Facebook, Exploitative Business Terms Pursuant to section 19(1) GWB for Inadequate Data Processing (Feb. 15, 2019).

globally; Facebook reached more than two billion monthly active users.⁵¹ These numbers are expected to grow further,⁵² and the centralization of the Web raises not merely monopoly issues, but also privacy and security concerns.

Blockchain technology can lead to a decentralization process that affects a variety of services and goods, ensuring open markets and *social scalability* before antitrust intervention. Blockchains can be the key to successfully enforcing antitrust principles in today's data-driven markets as well as in present and future markets based on blockchain technologies. Through a universal public blockchain that adopts a PKI, privacy and the safety of data could be better preserved than existing regulation, such as the European General Data Protection Regulation (GDPR).⁵³ Although GDPR requires companies to get users' consent to use their data,⁵⁴ a company can without such a consent easily collect the same users' data through the Web.

In contrast to today's centralized databases, this ideal decentralized universal database would enable each person's data to be stored on multiple computers, and everyone would have equal rights to data. Nobody would be required to pay (with money or personal data) for this platform, just as nobody now pays to access the Web. However, individuals would pay for other private blockchain services and goods, or would receive these services and benefits in exchange for personal data. The control of personal data would be ensured by means of cryptographic keys.

In other words, similar to bitcoin transactions, people would be able to track and transfer their data stored in such an online chain using a set of private keys and a PKI to online-or-offline, private-or-public chains, benefiting from a variety of services and goods. Each user could use a *wallet* to

⁵¹ Simon Kemp, *Digital in 2018: World's Internet Users Pass the 4 Billion Mark*, WE ARE SOCIAL BLOG (Jan. 30, 2018), <https://wearesocial.com/blog/2018/01/global-digital-report-2018>.

⁵² Rupert Neate, *\$1tn is Just the Start: Why Tech Giants Could Double Their Market Valuations*, THE GUARDIAN (Jan. 18, 2020, 11:00 AM), <https://www.theguardian.com/technology/2020/jan/18/1-trillion-dollars-just-the-start-alphabet-google-tech-giants-double-market-valuation>.

⁵³ EU Regulation 2016/679, of the European Parliament and of the Council of 27 April 2016 on the Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Movement of Such Data, and Repealing Directive 95/46/EC (General Data Protection Regulation), 2016 O.J. (L 119) 1. A recent study by Celestin Matte, Natalia Bielova and Cristiana Santos detected that "12.3% of 1,426 sites sent a consent signal before the user makes a choice. Semi-automatically reviewing 560 sites reveals that 54% of them contain at least one violation regarding the way consent is determined, asked, or complied with." Midas Nouwens, Ilaria Liccardi, Micheal Veale, David Karger & Lalana Kagal, *Dark Patterns After the GDPR: Scraping Consent Pop-ups and Demonstrating their Influence* (Jan. 8, 2020), <https://arxiv.org/abs/2001.02479>.

⁵⁴ EU Regulation 2016/679, *supra* note 53.

store his cryptographic keys without the need to participate in the blockchain network, which would imply downloading the entire blockchain history on its own device (thus running a node of the blockchain).⁵⁵

In summary, through a universal public blockchain each person would own and control their personal data as everything is tracked and protected by means of a strong form of cryptography and distributed technology. This public universal blockchain would be immutable, decentralized, and not fragmented. Similar to the Web, such a public blockchain would represent a good basis of democracy in today's most crucial industry—the data industry—because similar to the Web no one owns a public blockchain.

II. ANTITRUST AND INNOVATION

“Without change there is no innovation, creativity, or incentive for improvement.” – William Pollard.

If we look back historically, antitrust law has made clear the importance of the innovation process in preserving market efficiency and consumer welfare. In the context of information technology, antitrust intervention has often led the path to innovation and the development of new markets. The 1956 antitrust intervention at AT&T unintentionally set the tone for the creation of the Internet.⁵⁶

Blockchain technology can revolutionize markets, leading us to the *Blockchain Era*; antitrust interventions might be again crucial in developing new markets based on such a breakthrough technology. However, an antitrust intervention is not always ideal in preserving the innovation process. In enforcing antitrust law, the protection of innovation has to prevail over that of competitors.⁵⁷

A. Antitrust in the Development of Information Technology

The AT&T antitrust consent decree of 1956 led to the development of the first and most important universal computer operating system⁵⁸ used in the creation of the Internet–Unix. Although AT&T developed the Unix

⁵⁵ See BitcoinCore, *Running a Full Node*, <https://bitcoin.org/en/full-node> (last visited Mar. 18, 2020).

⁵⁶ This was the AT&T consent decree of 1956. See *United States v. Western Elec. Co., Inc.*, 1956 Trade Cas. (CCH) 68, 246 at 71,143 (D.N.J. 1956). See also, MASSAROTTO, *ANTI-TRUST SETTLEMENTS*, *supra* note 5, at 11, 12.

⁵⁷ WILLIAM J. BAUMOL, ROBERT E. LITAN & CARL J. SCHRAMM, *GOOD CAPITALISM, BAD CAPITALISM, AND THE ECONOMICS OF GROWTH AND PROSPERITY* 82 (2007).

⁵⁸ LAURA LAMBERT, *THE INTERNET: A HISTORICAL ENCYCLOPEDIA* 138 (Hilary W. Poole et al. eds., 2005).

operating system for private use in 1969, the terms of the consent decree of 1956 prevented AT&T from selling software,⁵⁹ such as Unix. Thus, AT&T decided to freely license the Unix operating system to universities, and Unix soon became the most important universal operating system⁶⁰ due to its network effects and the underlying language of the Internet. In 1980, Berkeley University, which had created complementary software for Unix,⁶¹ collaborated with the Defense Advanced Research Projects Agency to adapt Unix for the creation of the precursor to the Internet—the ARPANET project.⁶² Unix has been developed in many different versions, such as GNU/Linux, Sun Solaris and MacOS X.⁶³ Linux is the open source operating system that powers Google, Facebook, Twitter and Amazon.⁶⁴

The terms of the consent decree of 1956 also required AT&T “to license their patents [e.g. the transistor patents] to all applicants upon the payment of appropriate royalties,”⁶⁵ in addition to provide the technical information necessary to manufacture the related equipment. This enabled nascent technologies created at Bell Laboratories (the AT&T Research and Development branch), such as the transistor, to be shared in the market and to be released from the sole control of AT&T.⁶⁶ The transistor is the primary building block of all computers (more accurately microchips, including the

⁵⁹ *United States v. American Tel. and Tel. Co.*, 552 F. Supp. 131, 137-38 (D.D.C. 1982).

⁶⁰ See Giovanna Massarotto, *Open Source Paradigm: Beyond the Solution to the Software Patentability Debate*, 15 J. MARSHALL REV. INTELL. PROP. L. 647, 664 (2016). See also LAMBERT, *supra* note 58, at 138 (The development of Berkeley Unix ‘helped pave the way for the way for the open-source movement.’).

⁶¹ Berkeley University distributed the new components for Unix as Berkeley Software Distribution (BSD).

⁶² David McGowan, *Between Logic and Experience: Error Costs and United States v. Microsoft Corp.*, 20 BERKELEY TECH. L.J. 1185, 1204 (2005). See also STEVEN WEBER, *THE SUCCESS OF OPEN SOURCE* 29 (2004); LAMBERT, *supra* note 58, at 137 (“In 1978, Berkeley UNIX was awarded a Defense Department Advanced Research Projects Agency (DARPA) contract to develop the networking capabilities of ARPA, the predecessor of the Internet, for the popular VAX computer.”).

⁶³ See *UNIX Introduction*, UNIV. OF SURREY, <http://www.ee.surrey.ac.uk/Teaching/Unix/>.

⁶⁴ LINUX FOUND., *THE FUTURE IS OPEN: FIND YOUR PATH TO OPEN COLLABORATION 2* (2013), www.linuxfoundation.org/sites/main/files/linux_foundation_brochure.pdf.

⁶⁵ *American Tel. and Tel.*, *supra* note 60, at 176 (“Under the terms of the 1956 consent decree, AT&T is required to grant to all applicants non-exclusive licenses for all existing and future Bell System patents. 1956 Consent Decree, Section X. In addition, the decree requires that, upon the payment of reasonable charges, AT&T must furnish to those with licenses for AT&T patents the technical information necessary to manufacture the equipment for which the applicant obtained the patent license.”).

⁶⁶ Anthony J. Pennings, *Why AT&T Invented and Shared the Transistor that Started the Digital Revolution* (Mar. 2, 2011), <http://apennings.com/how-it-came-to-rule-the-world/why-att-invented-and-shared-the-transistor-that-started-the-digital-revolution/>

central processing unit (CPU)) used to storage and transport data. The transistor is considered one of the more crucial big-tech innovations in the last century.⁶⁷

In the discussion on antitrust and the development of information technology,⁶⁸ the IBM antitrust case and the creation of the market of operating systems represent another interesting story. In the 1960s, IBM was the leading computer manufacturer,⁶⁹ which produced a range of computer components from the hardware to the operating system and most of software installed in IBM computers. In 1968, the DOJ required IBM to implement a software unbundling policy,⁷⁰ which prevented IBM from installing its own operating system and software. The IBM unbundling decision opened the market of operating systems and software to competition. In the 1980s, Microsoft started developing the operating system for IBM's personal computers (IBM PC)⁷¹—the rest of the story is well known.

In summary, although the end results of such antitrust interventions were unpredictable for antitrust enforcers, these interventions have guided the innovation process through the creation of new markets open to competition. This innovation process should be the primary focus of antitrust enforcers. The real competition is inherent in such a process, namely in the creation of new technologies, new types of organizations and new sources of supply—Professor Joseph Schumpeter observed.⁷² Blockchain represents the next breakthrough technology in the innovation process and, similar to the operating system markets and the creation of the Internet network, an antitrust intervention may turn out to be crucial. For example, antitrust agencies might think of imposing blockchain technology to tackle forms of monopolization and collusion in quasi-monopoly data-

⁶⁷ *Id.*; See also ERNEST BRAUN & STUART MACDONALD, *REVOLUTION IN MINIATURE, THE HISTORY AND IMPACT OF SEMICONDUCTOR ELECTRONICS RE-EXPLORED IN AN UNPDATED AND REVISED SECOND EDITION* 35 (Cambridge Un. Press, 2d ed. 1982); BAUMOL, LITAN & SCHRAMM, *supra* note 57 at 88.

⁶⁸ See, e.g., Howard A. Shelanski, *Information, Innovation, and Competition for the Internet*, 161 U. PA. L. REV. 1663 (2013); Herbert Hovenkamp, *Antitrust and Information Technologies*, 68 FLA. L. REV. 419 (2016).

⁶⁹ MARTIN CAMPBELL-KELLY, *FROM AIRLINE RESERVATIONS TO SONIC THE HEDGEHOG: A HISTORY OF THE SOFTWARE INDUSTRY* 109 (William Aspray ed. 2003).

⁷⁰ See, e.g., James Pethokoukis, *Taking a Second Look at the Idea that Antitrust Action Created the US Software Industry*, AM. ENTER. INST. (Jan. 12, 2018), <http://www.aei.org/publication/taking-a-second-look-at-the-idea-that-antitrust-action-created-the-u-s-software-industry/> (“IBM implemented a software unbundling policy due to scrutiny from the antitrust suit. This allowed a software industry to emerge.”).

⁷¹ CAMPBELL-KELLY, *supra* note 70, at 206-07.

⁷² JOSEPH ALOIS SCHUMPETER, *CAPITALISM, SOCIALISM AND DEMOCRACY* 83 (Taylor & Francis e-Library, 2003), <https://eet.pixel-online.org/files/etranslation/original/Schumpeter,%20Capitalism,%20Socialism%20and%20Democracy.pdf>.

driven markets. As previously discussed, everything is tracked in the blockchain network making it easy for antitrust enforcers to supervise company's use of data. In other situations, antitrust agencies might prevent some companies that now exert monopoly power in crucial markets from entering into certain blockchain business. In summary, blockchain can be a valuable tool to make the enforcement of antitrust principles in today data economy effective.⁷³

However, as the following discussion reveals there are situations where no antitrust intervention might be justified.

B. Antitrust Protects Innovation over Competitors – JVM v. MJVM

The legal antitrust dispute concerning Java Virtual Machine (“JVM”)⁷⁴ is interesting in the discussion on antitrust and blockchain technology for two reasons. First, similar to a public blockchain, Java technology released by Sun Microsystem (Sun) created an open and free platform—the JVM—alternative to closed and centralized platforms and operating systems (such as Microsoft Windows). Second, judges did not punish Microsoft for having developed a version of JVM—Microsoft Java Virtual Machine (MJVM)—that was intentionally incompatible with Sun products, as the Microsoft version of JVM ran faster than Java JVM.⁷⁵

In 1995, Sun released Java, a set of open source technologies⁷⁶ which included the Java programming language, Java class libraries, and Java Virtual Machine (JVM). The DOJ saw in Sun and its development of Java technologies a potential alternative to Microsoft's quasi-monopoly in the market of the computers' operating systems.⁷⁷ At the time that Sun developed Java technologies, Microsoft held about ninety-five percent of the “licensing of all Intel-compatible PC operating systems worldwide.”⁷⁸

Java technologies enabled software developers to write computer programs that could run on any operating system through a JVM,⁷⁹ a virtual translator that enabled software written in Java or other computer languages to be executed in different operating systems or directly on microprocessors like Intel. Before Java was released, all computer programs were

⁷³ MASSAROTTO, ANTITRUST SETTLEMENTS, *supra* note 5, at 204.

⁷⁴ *See* United States v. Microsoft Corp., 253 F.3d 34 (D.C. Cir. 2001).

⁷⁵ *Id.* at 75.

⁷⁶ LAMBERT, *supra* note 58, at 139.

⁷⁷ *Id.* Java was officially released in January 1995, but in December 1994 Sun posted Java on a secret Web site inviting the programming community to test it out.

⁷⁸ United States v. Microsoft Corp., 65 F. Supp. 2d 1, 6-10 (D.D.C. 1999).

⁷⁹ Java technologies can be considered middleware which enabled programmers to write applications that could run on different operating system. *See* Mark Geier, *United States v. Microsoft Corp.*, 16 BERKELEY TECH. L.J. 297, 298 (2001).

written to run only on a specific operating system or microprocessor. Microsoft Windows or Apple IOS needed specific compilers (called platforms-dependent)⁸⁰ to execute computer programs because each operating system reads and understands a specific machine language. Conversely, the JVM is a virtual machine (not a compiler designed for a single operating system) that enables operating systems to run any computer programs, significantly lowering the barriers of the operating systems market. By doing so, the JVM could have become the common platform used to perform computer programs on any machine and improve *social scalability*. Sun, in addition to collaborating with Netscape,⁸¹ started collaborating with Intel, the market leader of computer microprocessors (Intel x86 CPU). Sun and Intel aimed at optimizing the translation of the computer program codes directly to Intel microprocessors, bypassing the Microsoft operating system (Windows).⁸²

In 1996, as Java was increasing in size and threatened to overshadow Windows' quasi-monopoly, Microsoft created a fork of Java technologies as mentioned above. In particular, the Microsoft fork included MJVM that was intentionally incompatible with any Sun products.⁸³ Although the DOJ considered that Microsoft's fork of Java aimed at weakening the JVM competitive position, the Court of Appeal did not embrace the DOJ's claim. As the MJVM ran faster than "ones calling upon Windows APIs with Sun's method[,]"⁸⁴ the Court of Appeal recognized Microsoft's conduct as lawful.⁸⁵

Although *de facto* Microsoft's conduct was directly focused on limiting

⁸⁰ A compiler is a software that converts high-level programming language into a lower level language (also called machine code) that can run on a specific processor or operating system.

⁸¹ LAMBERT, *supra* note 58, at 139. Since May 1995, Java was licensed as part of Netscape Navigator. Sun offered Java for free to noncommercial users. Java *de facto* transformed computing. Java was not only a programming language but also an operating system not tied to any specific desktop. "Java was supposed to put an end to frustrating software incompatibilities, the scourge of computing in an environment full of different platforms." *Id.*

⁸² Microsoft Corp., *supra* note 74, at 77.

⁸³ LAMBERT, *supra* note 58, at 139 ("Sun's ensuing \$35-million lawsuit against Microsoft, begun in October 1997, alleged that Microsoft was using its monopoly power to stamp out innovation and to quash a small, simply written program that, combined with the Internet, threatened Windows, the heart of and profit engine for the Microsoft empire.").

⁸⁴ United States v. Microsoft Corp., 84 F. Supp. 2d 9, 105 (D.D.C. 1999).

⁸⁵ Microsoft Corp., *supra* note 74, at 75 ("Microsoft's JVM is not only incompatible with Sun's, it allows Java applications to run faster on Windows than does Sun's JVM. Microsoft's faster JVM lured Java developers into using Microsoft's developer tools, and Microsoft offered those tools deceptively . . . we reverse the District Court's imposition of liability for Microsoft's development and promotion of its JVM.").

Sun's success through the standardization process of its technologies, Microsoft developed a higher quality product than Sun for its operating systems. In summary, the message of the court was clear—antitrust protects innovation over competitors. However, as we will see in Section 4, innovation is not the only goal of antitrust law.

Similar to Java technology, blockchain represents a world of new opportunities for some companies and a threat for others who hold market power in present centralized networks. But, cases such as the dispute over JVM taught us that this does not legitimize antitrust agencies to punish by default present large corporations for using blockchain technology if the result of their conduct leads to encourage innovation and benefit consumers in the end.⁸⁶

C. Conclusions

Blockchain has the potential to be the next breakthrough technology to lead the innovation process. Innovation means “the discovery, development, and commercialization of new and improved products and processes,”⁸⁷ according to Professor Michael Carrier. Professor William Baumol, Robert Litan and Carl J. Schramm provided a broader definition, defining innovation as “the marriage of new knowledge, embodied in an invention.”⁸⁸ Blockchain technology falls perfectly into both of these definitions. Antitrust and innovation (such as the blockchain) are not separate issues. Antitrust and the innovation process pursue the same goals: increasing market efficiency and consumer welfare. Antitrust and innovation need each other to achieve such goals.

Similar to the Internet, blockchain can change markets again bringing us to a new economic era—the *Blockchain Era*—where uncharted markets need antitrust guidance to enforce rules and principles.⁸⁹ Antitrust enforcers must maintain the delicate balance between over controlling the actions of large high technology companies and keeping incentives for them to lead in the creation of new technologies. Alexander Graham Bell was the founder of AT&T (the company which maintained its monopoly on the US telephone industry until the antitrust decision of 1982)⁹⁰ and the inventor

⁸⁶ See, e.g., ROBERT H. BORK, *THE ANTITRUST PARADOX: A POLICY AT WAR WITH ITSELF* (Basic Books, 1978).

⁸⁷ MICHAEL CARRIER, *INNOVATION FOR THE 21ST CENTURY: HARNESSING THE POWER OF INTELLECTUAL PROPERTY AND ANTITRUST LAW* 19 (2009).

⁸⁸ BAUMOL, LITAN & SCHRAMM, *supra* note 57, at 5.

⁸⁹ Thomas M. Jorde & David J. Teece, *Innovation and Cooperation: Implications for Competition and Antitrust*, 4 J. ECON. PERSPECTIVES 75, 76 (1990).

⁹⁰ *United States v. Am. Tel. & Tel. Co.*, 552 F. Supp. 131, 222 (D.D.C. 1982).

of the telephone.⁹¹

III. ANTITRUST AND REGULATION IN BLOCKCHAIN MARKETS

Antitrust originated in the U.S. in 1890 to address economic disparities, becoming a tool for economic democracy;⁹² its scope is not limited to promoting innovation. Section 4 explores why markets built on public blockchains may achieve antitrust's primary goal, which is preserving democratic markets. Section 4 also shows why antitrust and other forms of government regulation are necessary to make open and democratic markets based on blockchain technology viable.

A. Public Blockchain and Antitrust Economic Democracy Goal

Antitrust law originated in 1890, as a tool of economic democracy to tackle the increasing, vast accumulation of wealth in the hands of a few powerful corporations.⁹³ Long before the Sherman Act, legislators and judges recognized the desire of entrepreneurs to profit beyond that attainable in open markets.⁹⁴ In the nineteenth century, with the development of the railroads, US companies starting producing and selling goods in a larger geographic context, raising the need for a federal law to protect open

⁹¹ *Milestones in AT&T History*, AT&T, https://www.thocp.net/companies/att/att_company.htm.

⁹² ROBERT G. ALBION ET AL., *THE GROWTH OF THE AMERICAN ECONOMY, AN INTRODUCTION TO THE ECONOMIC HISTORY OF THE UNITED STATES 16-17* (Harold F. Williamson ed., 1944).

⁹³ Giovanna Massarotto, *From Standard Oil to Google: How the Role of Antitrust Law Has Changed*, 41 *WORLD COMPETITION* 395, 418 (2018). See also Walton Hamilton & Irene Till, *Antitrust – The Reach After New Weapons*, 26 *WASH. U. L. Q.* 1, 24 (1940); THOMAS W. DUNFEE & FRANK F. GIBSON, *ANTITRUST AND TRADE REGULATION, CASES AND MATERIALS* (2d ed., 1977); *Standard Oil Co. of N.J. v. United States*, 221 U.S. 1, 50 (1911) (“[T]he main cause which led to the legislation was the thought that it was required by the economic condition of the times; that is, the vast accumulation of wealth in the hands of corporations and individuals, the enormous development of corporate organization, the facility for combination which such organizations afforded, the fact that the facility was being used, and that combinations known as trusts were being multiplied, and the widespread impression that their power had been and would be exerted to oppress individuals and injure the public generally.”).

⁹⁴ See Herbert Hovenkamp, *The Sherman Act and the Classical Theory of Competition*, 74 *IOWA L. REV.* 1019, 1029 (1989) (“Until the rise of the trusts in the 1870s and 1880s, American competition policy was located principally in two bodies of law. The first was the law of corporate charters, and the questions about when the charters implied monopoly rights or when explicit monopoly rights would be recognized. The second was the law of contracts in restraint of trade.”).

markets.⁹⁵

Standard Oil predicted the importance of oil and railroads in the new economy. Rockefeller's oil company ensured its control over the oil market through an extensive *trust* that existed between Standard Oil and the railroads.⁹⁶ In short, the initial open and free market of US oil was soon subject to Standard Oil self-regulation and supervision.

The creation and preservation of open and free markets was the primary antitrust goal; the same goal should be encouraged for blockchain technology today. Public blockchains imply decentralized, open and free networks,⁹⁷ and "the final victory of free markets."⁹⁸ As outlined above, the idea behind open and decentralized networks, such as public blockchains, is the same idea that originally formed the Web.

Over the last decade, as previously discussed, large technology companies found creative ways through centralized platforms to become necessary intermediaries between the users and the Web.⁹⁹ As Tim Berners-Lee observed, the blockchain and the Web have the chance to "connect together in lots of interesting ways,"¹⁰⁰ which may reduce the role of big tech companies, such as Google and Facebook.¹⁰¹

Blockchain can reduce the market power of centralized platforms owned by large technology companies and preserve privacy and data protection better than the existing, sophisticated regulations¹⁰² by using a vast number of computers and employing strong forms of cryptography.¹⁰³

Thus, someone might be led to question the future role of antitrust to

⁹⁵ See George J. Stigler, *The Origin of the Sherman Act*, 14 J. LEGAL STUD. 1, 2 n.7 (1985). (According to Stigler, "[t]he railroad helped to bring the Midwestern farm area into the world market.").

⁹⁶ JOHN D. CLARK, *THE FEDERAL TRUST POLICY*, 17 (1931); GIULIANO AMATO, *ANTITRUST AND THE BOUNDS OF POWER* 8 (1997).

⁹⁷ Atzori, *supra* note 29, at 45 ("The formidable innovation introduced by this technology is that the network is open and participants do not need to know or trust each other to interact . . ."). *Id.*

⁹⁸ Atzori, *supra* note 30, at 49.

⁹⁹ Tim Berners-Lee observed that the Internet can be used in "unethical ways." Tim Berners-Lee, *We Must Regulate Tech Firms to Prevent 'Weaponised' Web*, THE GUARDIAN (Mar. 12, 2018), <https://www.theguardian.com/technology/2018/mar/11/tim-berners-lee-tech-companies-regulations>.

¹⁰⁰ Jeff John Roberts, *Blockchain and the Web are Coming Together, Says Berners-Lee*, FORTUNE (Oct. 17, 2017 4:09 PM), <http://fortune.com/2017/10/17/blockchain-berners-lee/>.

¹⁰¹ *Id.*

¹⁰² See, e.g., EUROPEAN COMMISSION, *EU DATA PROTECTION RULES* (2019), https://ec.europa.eu/commission/priorities/justice-and-fundamental-rights/data-protection/2018-reform-eu-data-protection-rules_en; Nouwens, Liccardi, Veale, Karger & Kagal, *supra* note 53.

¹⁰³ See *supra* pp. 257, 258, 264.

tackle monopolizing conduct and regulate data. Although the main goal of antitrust law could be achieved through open and decentralized networks, such as public blockchains, antitrust enforcers still need to play a fundamental role as gatekeepers of the economic democracy in markets. As the Supreme Court recognized, the Sherman Act is the “Magna Carta of free enterprise”¹⁰⁴ which needs to be enforced to be effective.

The railroads and the Internet network created potential open platforms and infrastructures, which required an antitrust intervention to guarantee equal access to all market participants and prevent possible abusive practices.¹⁰⁵ In order for open platforms to function, antitrust agencies are irreplaceable neutral bodies to oversee that no one engages in anticompetitive conduct to profit beyond that attainable in open and free markets. *Standard Oil*,¹⁰⁶ *AT&T*¹⁰⁷ and more recently U.S. and EU *Microsoft*¹⁰⁸ have shown that the temptation for companies that have the most to lose in a totally open market to engage in illegal anticompetitive behavior is often compelling.¹⁰⁹

Antitrust agencies are responsible to ensure that there is a level playing field to compete in the evolution of existing technologies or the creation of new ones. Through the support of antitrust law, the largest companies can continue in the development of competitive technologies, creating alternative platforms or advancing the existing ones in open democratic (socially scalable) markets. As a football match needs both rules and referees, markets need rules and neutral bodies to oversee the compliance of those rules. Otherwise it is hard to tell who wins the competition or to even have a competition at all.

B. Regulation in the Blockchain

Initially, markets based on the blockchain technology might not need a complex set of rules—an antitrust supervision and regulation might be sufficient. Greater forms of oversight might be desirable if such markets become increasingly high-traffic areas and a crucial component of our

¹⁰⁴ *United States v. Topco Associates, Inc.*, 405 U.S. 596, 610 (1972).

¹⁰⁵ *Standard Oil Co. of N.J. v. United States*, 221 U.S. 1, 53 (1911); *American Tel. and Tel.*, *supra* note 60, at 138.

¹⁰⁶ *Standard Oil*, *supra* note 105, at 50.

¹⁰⁷ *American Tel. and Tel.*, *supra* note 59, at 178 n.196.

¹⁰⁸ *United States v. Microsoft Corp.*, 231 F. Supp. 2d 144 (D.C. Cir. 2002), final judgment, No. 98-1232 (D.C. Cir. Nov. 12, 2002); Case T-201/04, *Microsoft v. Comm'n*, 2007 E.C.R. II-3619.

¹⁰⁹ As Professors William J. Baumol, Robert E. Litan and Carl J. Schramm observed: “[t]he temptation to live for the status quo is especially strong if the large firms that dominate a market are successful in thwarting competition.” BAUMOL, LITAN, & SCHRAMM, *supra* note 57 at 84.

economic system.¹¹⁰

In a perfect world, self-regulation would be ideal.¹¹¹ But as the financial crisis of 2008 revealed, specific forms of regulation are often necessary when antitrust alone is insufficient to regulate high-traffic industries.¹¹²

As one looks back on the Internet regulatory framework, it is true that the “Internet is the least regulated part of the telecommunications world today[,]”¹¹³ and it is also true that the fundamental compatibility rule is enforced.¹¹⁴ Although it is the least regulated, the Internet is still public in nature and governed by public rules enforced by public bodies.¹¹⁵ The following section explores some regulatory issues related to blockchain.

1. From Antitrust to Regulation. – Antitrust law originated in the United States as the first arm of government regulation¹¹⁶ on the booming oil market to limit the risks linked to the monopoly power of Standard Oil. Data represent the ‘new oil’ and instead of being traded in physical platforms (like the railroad) are being traded in online digital platforms based on the Internet. As a consequence, data have attracted even more and varied businesses, creating new, digital, online platforms. Such platforms based on the Internet network became increasingly high-traffic marketplaces and a crucial part of today’s economy, thereby requiring sophisticated regulations.¹¹⁷

Similar to the Internet through the Web, as above outlined, we might consider having a single universal blockchain that includes a variety of different markets. Blockchain markets built on a single universal blockchain infrastructure might become a fundamental component of our economy and require government intervention to regulate competition and possible legal issues.

Markets require trust in order to attract business. The blockchain is not an exception to this fundamental economic principle. As learned from the past, self-regulation has often failed to maintain trust in markets from the

¹¹⁰ Massarotto, *supra* note 93, at 416.

¹¹¹ According to Alfred E. Kahn, “the most creative thing a regulator can do is remove his or her body from the market entryway.” Alfred E. Kahn, *Applying Economics to an Imperfect World*, 2 AEI J. ON GOV'T & SOC'Y 17 (1978).

¹¹² Massarotto, *supra* note 93, at 416.

¹¹³ NICHOLAS ECONOMIDES, *THE INTERNET AND NETWORK ECONOMICS, THE INTERNET AND DIGITAL ECONOMICS: PRINCIPLES, METHODS, AND APPLICATIONS* 239, 241 (Eric Brousseau & Nicolas Curién eds., 2007), https://assets.cambridge.org/97805218/55914/front-matter/9780521855914_frontmatter.pdf.

¹¹⁴ Professor Economides observed that “[o]n the Internet, compatibility is the rule, pricing is independent of distance or direction of origination.” *Id.*

¹¹⁵ *Id.*

¹¹⁶ Herbert J. Hovenkamp, *Progressive Antitrust*, 2018 U. ILL. L. REV. 71 (2018) (“[A]ntitrust policy is an extended arm of regulation.”).

¹¹⁷ See, e.g., EUROPEAN COMMISSION, *supra* note 102.

Great Depression to the cryptocurrency crash of 2018.¹¹⁸ Antitrust and effective forms of regulation are necessary to build—*trust*.¹¹⁹

2. *What Regulation for the Blockchain Network?*—The blockchain technology is in its infancy and the creation of a universal public blockchain is merely an idea. At this moment, it might be difficult to elaborate specific forms of regulation for new markets that we cannot even envisage, but the Internet and the Web can certainly be used as a useful model of reference both to anticipate and to regulate a future single blockchain network. Similar to the Internet, government agencies might start theorizing rules to guarantee the compatibility in a public blockchain platform and prevent an uncontrolled centralization and private supervisory powers. Sir Tim Berners-Lee suggested the adoption of a Magna Carta or Bill of Rights for the Web to prevent Internet fragmentation into private networks and get everybody on the open and universal Web platform.¹²⁰ Should we theorize a Magna Carta for the Blockchain to protect users' rights related, for example, to their data? Perhaps, similar to the Web, we might start from setting some universal open standards to guaranty inter-operability of data¹²¹ and a *socially scalable* platform. The World Wide Web Consortium (W3C) set the open standards principles for the Web—open and free standards for a World Wide Blockchain might be defined in a similar fashion.

The blockchain network, as well as the Internet platform, would certainly raise some specific legal and ethical issues, which cannot yet be envisaged. Thus, let us start from what we already know about the Web and the Internet regulations to anticipate and prevent some negative consequences that might also affect the creation of a single blockchain. Regulators are encouraged to envisage rules to protect ethical principles in blockchains¹²²—for example, rules to prevent access by minors or people that might be interested in using a blockchain to commit crimes. This regulation may also cover the uncontrolled exchange or storage of sensitive

¹¹⁸ From Jan. 6 to Feb. 6 2018, for example, the price of bitcoin fell by about 65 percent. See Ben Popken, *Bitcoin Loses More Than Half Its Value Amid Crypto Crash*, NBC NEWS (Feb. 2, 2018, 4:43 PM), <https://www.nbcnews.com/tech/internet/bitcoin-loses-more-half-its-value-amid-crypto-crash-n844056>.

¹¹⁹ See Paul J. Zak, *The Neuroscience of Trust*, HARV. BUS. REV. (2017), <https://hbr.org/2017/01/the-neuroscience-of-trust>.

¹²⁰ Tim Berners-Lee, *A Magna Carta for the Web*, TED (Mar. 2014), https://www.ted.com/talks/tim_berniers_lee_a_magna_carta_for_the_web?language=en (last visited Mar. 18, 2020).

¹²¹ *W3C Mission*, WORLD WIDE WEB CONSORTIUM, <https://www.w3.org/Consortium/mission#openstand> (last visited Mar. 18, 2020).

¹²² Tim Berners-Lee observed that the Internet can be used in “unethical ways.” Berners-Lee, *supra* note 99.

information,¹²³ or generally illegal and speculative activities. For example, the FBI expressed their concerns about the criminal exploitation of Bitcoins as the parties of bitcoin transactions are unknown.¹²⁴ As with any tool, blockchain is not immune to abuses.

Similar to the Internet, a public universal blockchain might need rules to guarantee non-discrimination among market players. A regulator may choose to adopt a net-neutrality regulation to prevent a paid prioritized blockchain in a single universal blockchain.¹²⁵ In Europe and in part of the United States, net-neutrality or open internet regulation¹²⁶ have allowed corporations of all sizes to act without the interference of the big Internet providers companies, creating a '*neutral*' environment where every company can benefit from the same Internet speed and indiscriminately grow.¹²⁷

Learning from the Internet, a paid prioritization blockchain network could generate a dual speed blockchain which would require one to pay for the benefits of a high speed blockchain or use a slower speed one for free.¹²⁸ This duality might be prevented through the creation of developing technologies. The *lightning network*, for example, has the potential to make blockchain transactions faster and less expensive. It is based on a *payment channel* that is simple and fast in a decentralized manner.¹²⁹ Parties pay a

¹²³ See, e.g., FEDERAL TRADE COMM'N, ADVERTISING AND MARKETING ON THE INTERNET: RULES OF THE ROAD (2000), <https://www.ftc.gov/system/files/documents/plain-language/bus28-advertising-and-marketing-internet-rules-road2018.pdf> ("These rules and guidelines protect businesses and consumers - and help maintain the credibility of the Internet as an advertising medium.").

¹²⁴ Kim Zetter, *FBI Fears Bitcoin's Popularity with Criminals*, WIRED (May 9, 2012, 10:51 PM), <https://www.wired.com/2012/05/fbi-fears-bitcoin/>; Matthew Sparkes, *The Coming Digital Anarchy*, TELEGRAPH (June 9, 2014, 2:26 PM), <http://www.telegraph.co.uk/technology/news/10881213/The-coming-digital-anarchy.html>; Gaurav Savanur, *Ethics of Blockchain*, MEDIUM (June 12, 2018), <https://medium.com/coin-monks/ethics-of-blockchain-f66f24a4e9d9>.

¹²⁵ See Falk Schoning, *What Blockchain can Learn from the Net Neutrality Debate: Antitrust and Regulatory Aspects of "Paid Prioritization" for a Nascent Technology*, HOGAN LOVELLS: FOCUS ON REGULATION (Nov. 7, 2017), <https://www.hoganlovells.com/en/blogs/focus-on-regulation/what-blockchain-can-learn-from-the-net-neutrality-debate>. Similar rules might also be applied to blockchain where a paid prioritization blockchain network can generate a dual speed blockchain.

¹²⁶ *Open Internet*, EUR. COMM'N, (last visited Mar. 18, 2020), <https://ec.europa.eu/digital-single-market/en/open-internet-net-neutrality>.

¹²⁷ See, e.g., Nicholas Economides & Joacim Tåg, *Network Neutrality on the Internet: A Two-Sided Market Analysis*, 24 INFO. ECON. & POLICY 91 (2012).

¹²⁸ Schoning, *supra* note 125.

¹²⁹ Lightning Network enables users to perform numerous transactions outside of the main blockchain and record them next as a single transaction. See Joseph Poon &

fee only once and can transact back and forth without paying fees to *miners*.¹³⁰ With each transaction, parties sign a balance sheet confirming the new balance and when their transactions are completed, the parties pay to close the channel.¹³¹

The *lightning network* is a technology less developed than blockchain. However, it demonstrates along with the same blockchain ingenuity, how the creation and development of new technologies can provide more organic solutions which can be more ideal than regulation in certain circumstances.

C. Some Considerations

If we look back historically, regulation and guidelines are fundamental components in the prevention of forms of inequality, illegal activities, and the abuse of market power in free and open markets. Presently, there are basically no regulations to guide the growth and ensure an environment of trust among blockchain providers and users. Antitrust surveillance is the first step in preventing monopolies and forms of collusion among network participants in addition to overseeing markets until regulations are in place.¹³²

Regulators and antitrust enforcers have a huge responsibility in the development of blockchain markets that we cannot fully envisage presently, although we know it very possibly might include the creation of a universal public blockchain. By its nature, the competitive market process looks for innovative and unanticipated solutions. As outlined above, antitrust, regulation, and innovation are not separate issues.¹³³ The path of innovation largely depends on the action of both regulators and antitrust agencies, the

Thaddeus Dryja, *The Bitcoin Lightning Network: Scalable Off-Chain Instant Payments* (Jan. 14, 2016), <http://lightning.network/lightning-network-paper.pdf> ("A decentralized system is proposed whereby transactions are sent over a network of micropayment channels (a.k.a. payment channels or transaction channels) whose transfer of value occurs off-blockchain.").

¹³⁰ *Id.* ("Sending many payments inside a given micropayment channel enables one to send large amounts of funds to another party in a decentralized manner. These channels are not a separate trusted network on top of bitcoin. They are real bitcoin transactions.").

¹³¹ *What is Bitcoin's Lightning Network?* COINDESK (last updated Mar. 21, 2018), <https://www.coindesk.com/learn/bitcoin-101/what-is-the-lightning-network>.

¹³² See, e.g., MARTIN TASCHDJIAN, FROM OPEN NETWORKS TO OPEN MARKETS: HOW PUBLIC POLICY AFFECTS INFRASTRUCTURE INVESTMENT DECISIONS 33 (2000), http://www.pirp.harvard.edu/pubs_pdf/taschdj/taschdj-p00-5.pdf.

¹³³ Matthew Lane, *The History of Innovation in Antitrust Law*, PROJECT DISCO (June 12, 2018), <http://www.project-disco.org/competition/061218the-history-of-innovation-in-antitrust-law/#.WyJuwxm-m2w>.

results of which are unpredictable.

The creation of a single universal blockchain where new markets run is feasible if such a blockchain can be kept free and open while subject to the supervision of regulatory bodies. History told us that individual market participants cannot be trusted to operate in the public interest in a total *laissez-faire* market. Markets rely on the trust of users. Market speculation, uncontrolled centralization and private supervisory powers can all promote a lack of trust rather than trust.

CONCLUSIONS

In the context of antitrust, the likely shifting from closed-centralized platforms to open-decentralized networks, based on blockchain technology, is as compelling, critical, and revolutionary as the Internet has been over the past decades. Today antitrust agencies are concerned with a few powerful hi-tech companies which control most digital markets through their centralized platforms and databases.¹³⁴ This economic scenario is likely to change soon, not by means of an antitrust intervention, but rather by decentralized networks based on blockchain technology.

Antitrust enforcers then need to preserve both economic democracy and innovation to benefit consumers and the economy overall. Antitrust law should encourage competition to increase consumer welfare by improving, for example, social scalability and stimulate the growth of markets—no matter what the harm to a competitor, if the result of such conduct benefits consumers. Antitrust enforcers must endorse and oversee the process of the decentralization phenomena on behalf of free open markets and economic democracy. They will also be crucial in maintaining the delicate balance between over controlling the actions of large players and keeping them incentivized to lead the creation of new technologies.

Regulators are ideally placed to encourage user trust by preventing the misuse of blockchain and similar cutting edge technologies when these platforms take off, becoming critical and complex high-traffic markets.¹³⁵ The

¹³⁴ See Shannon Bond, *Google and Facebook Build a Digital Ad Duopoly*, FINANCIAL TIMES (Mar. 14, 2017), <https://www.ft.com/content/30c81d12-08c8-11e7-97d1-5e720a26771b>; Lara O'Reilly, *The Race Is On to Challenge Google-Facebook 'Duopoly' in Digital Advertising*, WALL ST. J. (June 19, 2017, 5:30 AM), <https://www.wsj.com/articles/the-race-is-on-to-challenge-google-facebook-duopoly-in-digital-advertising-1497864602>.

¹³⁵ See, e.g., ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, BLOCKCHAIN TECHNOLOGY AND COMPETITION POLICY - ISSUES PAPER BY THE SECRETARIAT 3 (2018), [https://one.oecd.org/document/DAF/COMP/WD\(2018\)47/en/pdf](https://one.oecd.org/document/DAF/COMP/WD(2018)47/en/pdf) (“[T]he adoption of blockchain poses some regulatory challenges for governments. These will need to co-operate to . . . develop the technology in a competitive environment, subject to rules that preserve fundamental values such as safety and integrity.”).

Internet benefits from a “sophisticated governance ecosystem, the whole world of blockchain and digital currencies is the Wild West”¹³⁶ and could only benefit from guidelines.

Similar to the Internet through the Web, markets can encourage the development of a public universal blockchain. Such a blockchain would need consensus and trust to become a universal open technology—not controlled but not *uncontrolled*.¹³⁷ Rather than leading to the death of antitrust and regulation, blockchain will require more sophisticated versions of both.

¹³⁶ Don Tapscott & Rik Kirkland, *How Blockchains Could Change the World*, MCKINSEY & CO.: OUR INSIGHTS (May 2016), <https://www.mckinsey.com/industries/high-tech/our-insights/how-blockchains-could-change-the-world>.

¹³⁷ Massarotto, *supra* note 93, at 418.