

## Blockchain: A Journey to.....Where?

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### Bitcoin—Birth of Blockchain<sup>1</sup>

On October 31, 2008, Satoshi Nakamoto made an announcement on the Cryptography Mailing List at metzdowd.com that “I’ve been working on a new electronic cash system that’s fully peer-to-peer, with no trusted third party” and posted a white paper on [www.bitcoin.org](http://www.bitcoin.org).<sup>2</sup> The same author mined the genesis block of 50 Bitcoins on January 3, 2009<sup>3</sup> and released the Bitcoin software as an open source code on January 9, 2009.<sup>4</sup> All

these took place rather unceremoniously. So started an obsession with blockchain.

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The blockchain technology that underpins Bitcoin solved the problem that had long vexed the digital currency world—the “double spend” problem. A digital currency is represented in a digital file, which can be duplicated or falsified. How can we prevent an owner of a unit of digital currency from spending the same unit more than once without validation by a trusted third party?<sup>5</sup> The Bitcoin blockchain solved that problem by having network participants validate each Bitcoin transaction and thus having the network reach consensus.<sup>6</sup> The Bitcoin platform thus started a “trustless” ledger system.

In less than a decade, the world has witnessed an increasing fascination with blockchain in many corners of society from the academia to corporate boardrooms to government offices and, occasionally but most importantly, to cartoons in newspapers.<sup>7</sup> Despite government crackdowns in some countries, we are still seeing a conveyor belt

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<sup>1</sup> This is largely based on the script of a key note address given at the Accounting Meeting of the 33<sup>rd</sup> Annual General Meeting of the International Swaps and Derivatives Association on April 24, 2018.

<sup>2</sup> “What is ‘Bitcoin’” ([www.investopedia.com/term/b/bitcoin.asp](http://www.investopedia.com/term/b/bitcoin.asp)).

<sup>3</sup> Block 0—Bitcoin Block Explorer (<http://blockexplorer.com/block/0000000019d6689c085ae165831e934ff763a>)  
<sup>4</sup> <https://sourceforge.net/projects/bitcoin/files/>.

<sup>5</sup> Mark Ryan, “Digital Cash,” School of Computer Science, University of Birmingham Retrieved 2018-4-22.

<sup>6</sup> Bitcoin and the Double Spending Problem, (<https://blogs.cornell.edu/info4220/2013/03/29/bitcoin-and-the-double-spending-problem/>).

<sup>7</sup> <https://www.google.com/search?q=blockchain+cartoons&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwju167y963aAhWkT1MKHfuHAR4QsAQIlg&biw=1538&bih=925>.

production of blockchain platforms and tokens. A number of countries and some states in the United States have adopted new laws to lure blockchain business.<sup>8</sup>

An endless number of potential use cases have been proposed.<sup>9</sup> A vast number of platforms have been launched, and a handful of them have been operating with some success. In some countries, laboratory experiments have been carried out in controlled environments under the supervision of national regulators.<sup>10</sup> At the same time, a large number of bad actors have shown up on the scene to prompt regulators to step in. We can just go to [deadcoins.com](http://deadcoins.com) to view a long list of scam ICOs (and simply defunct platforms).

As a new technology, blockchain has its share of die-hard advocates, vehement antagonists and a lot more in between with a combination of enthusiasm and skepticism in varying degrees.

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## Blockchain as Ledger

Blockchain is a ledger; it records transaction and other data. For example, the Bitcoin blockchain is a chain of blocks with each block containing transaction data (up to 1 MB of data) linked to a prior block with cryptographic hash and to be linked to a subsequent block with cryptographic hash.

A ledger is a book or computer file for recording assets and transactions. In a modern economy, a ledger is normally maintained by a central authority. In general, it is efficient to rely on a central authority to conduct business and other activities. A central authority could establish the rule of the game and enforce it, thereby creating knowledge structure. This minimizes duplication and establishes clear order and hierarchy, and can resolve disputes.

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<sup>8</sup> <https://www.nasdaq.com/article/blockchain-regulation-in-europe-and-potential-hurdles-cm854360>; <https://uk.reuters.com/...belarus.../belarus-adopts-crypto-currency-law-to-woo-foreign-investors-idUKKBN1EG0XO>. Dec 22, 2017; [https://www.nvbar.org/wp-content/.../NevadaLawyer\\_Aug2017\\_Blockchain-1.pdf](https://www.nvbar.org/wp-content/.../NevadaLawyer_Aug2017_Blockchain-1.pdf).

<sup>9</sup> <https://www.ibm.com/blockchain/use-cases/>; <https://www.nasdaq.com/article/4-innovative-use-cases-for-blockchain-cm901636>; <https://gomedici.com/30-non-financial-use-cases-of-blockchain-technology-infographic/>; <http://www.businessinsider.com/blockchain-technology-applications-use-cases-2017-9>; <https://www.forbes.com/forbes/welcome/?toURL=https://www.forbes.com/sites/bernardmarr/2018/01/22/35-amazing-real-world-examples-of-how-blockchain-is-changing-our-world/&refURL=&referrer=>; <https://academic.oup.com/jamia/article/24/6/1211/4108087>; <https://www2.deloitte.com/insights/us/en/focus/tech-trends/2018/blockchain-integration-smart-contracts.html>.

<sup>10</sup> [https://medium.com/@avtar\\_15406/nivaura-executes-worlds-first-automated-cryptocurrency-denominated-bond-6394c33f2f63](https://medium.com/@avtar_15406/nivaura-executes-worlds-first-automated-cryptocurrency-denominated-bond-6394c33f2f63).

Let's consider the history of securities. In early days, the seller and the buyer of a security had to negotiate the terms of a sale, and the buyer had to do due diligence on the terms of the security, the power of the purported seller to sell it and so on. The lack of liquidity in the capital markets held back the economic growth. As a solution, the markets developed mechanisms to enhance liquidity. A paper certificate was introduced to irrevocably treat the owner of a certificate as the owner of a related security. The other mechanism is a register maintained by the issuer to record the owners of securities.

Capital markets soon found these mechanisms too cumbersome to increase the efficiency and velocity of transactions, leading to the birth of intermediaries like banks and brokers. An intermediary effects and records a customer's transaction on its ledger; hence, there is no need for the transfer of a physical certificate or a change to the issuer's register. We now have a layer of intermediaries between the issuer and the owners (from a central securities depository down to a retail broker), completely delinking the two for the sake of efficiency in the trading market.<sup>11</sup>

Efficiency comes at a cost, and such cost has begun to accumulate, as the power given to a central authority is susceptible to exploitation such as misconduct and rent seeking. Further, the central authority has become a single point of failure, as a mistake by the central authority or an attack on it can have a cascading effect on the financial system; market participants cannot prevent the collapse or disruption of a central ledger system. The central authority takes control away from the market participants who have given full trust to it. The question is whether the society can create a system where the market participants retain control without sacrificing efficiency.

Blockchain is designed to create a ledger system without a central authority; it distributes all transaction data across all participating nodes in the network and those participants verify such data by way of consensus. Combined with cryptography, this enables blockchain to securely record value transfer. Distributed ledgers can cure problems arising from central ledgers.

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## Blockchain's Evolution

The blockchain technology has constantly been improved and refined since its debut. It started with a rather simple setup to record Bitcoin transactions. The Bitcoin blockchain has a very limited scripting language that is not sufficient for writing complex software codes. Its validation mechanism, a proof-of-work, is a democratic way to reach

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<sup>11</sup> Philipp Paech, *Securities Intermediation and the Blockchain—An Inevitable Choice between Liquidity and Legal Certainty*, London School of Economics and Political Science, June 2016.

consensus, but it has proven to be very expensive as it consumes an astonishing amount of electricity, and has become concentrated in a small number of mining groups and companies that can pool a significant amount of computing power. Although it is a ground-breaking technology, it needed to be improved to become a technology for wider application.

A wide-spread application of the technology arguably started with the introduction of Ethereum. Ethereum is an open-source technology that provides a protocol for building decentralized applications with the Turing-complete scripting language. Developers and entrepreneurs build distributed applications for their own network on the Ethereum protocol. As the then-19-year-old co-creator of Ethereum, Vitalik Buterin summed up his vision, “A blockchain is a magic computer that anyone can upload programs to and leave the programs to self-execute, where the current and all previous states of every program are always publicly visible, and which carries a very strong cryptoeconomically secured guarantee that programs running on the chain will continue to execute in exactly the way that the blockchain protocol specifies.”<sup>12</sup>

We need to take a short detour here to talk about a smart contract, since it is essential to blockchain as envisioned by Buterin.

In 1996, a computer scientist, Nick Szabo, coined the term by stating that a “smart contract is a set of promises, including protocols within which the parties perform on the other promises. The protocols are usually implemented with programs on a computer network, or in other forms of digital electronics, thus these contracts are ‘smarter’ than their paper-based ancestors.”<sup>13</sup> It was not technologically possible to implement a smart contract concept until blockchain came onto the scene. The parties must use an identical series of computer codes deployed on the network, which will execute the pre-agreed function based on a set of facts shared on the network, and neither party can subsequently modify the codes or stop the execution of the function by the codes. Prior to blockchain, neither party was ensured that the other party would use the same codes or would not later modify them, or that the program would be enforced based on the same set of facts. Blockchain provides transparency, immutability and distributed access, all necessary for a successful implementation of a smart contract.

A smart contract is in essence a computer program that regulates and automates the relationship between the parties by executing the terms of a contract without direct human involvement. That could lead to more efficient contractual relationship with a reduced possibility of error, delay or dispute. A smart contract digitizes trust through certainty of execution, thereby removing intermediaries and associated social costs.

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<sup>12</sup> Vitalik Buterin, *Vision Part 1: The Value of Blockchain Technology*.

<sup>13</sup> [https://www.revolvy.com/main/index.php?s=Smart%20contracts&item\\_type=topic](https://www.revolvy.com/main/index.php?s=Smart%20contracts&item_type=topic).

Through the implementation of a smart contract, blockchain can create an economy unconstrained by geography, or by political or legal institutions. In this crypto-economy, blockchain, rather than trusted third parties, sets its own rules and regulates relationship and behavior. It could ultimately render trusted third parties, including governments, obsolete.

To visionaries, blockchain is expected to have broad transformative application across many sectors of the economy and contribute to multifactor productive growth. It will also lower transaction costs through costless verification without the need for costly intermediation, which will improve the efficiency of markets. In short, blockchain will lower production and transaction costs. Thus, society should recognize the competitive efficiencies of blockchain, and, because of network effects and switching costs, its adoption should be on a steep upward-sloping curve.<sup>14</sup>

The question is why we have not seen a tipping point for mass adoption.

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## Blocking Blockchain—Technology and Economics

Blockchain has exhibited a number of issues that hamper a practical adoption on a large scale. Deployment of blockchain has proven to be expensive in terms of the initial outlay to build the system. These days, most blockchain platforms are built on Ethereum, using smart contracts meeting the ERC 20 standard. Ethereum is an open-source technology, but it is not necessarily cheap to build your own platform on the Ethereum protocol. As a starter, the operation of a smart contract requires a payment of a “gas fee,” which could be significant depending on the complexity of a contract.

Let’s say I want to build a platform for peer-to-peer transfers of precious metal like gold and silver bars using ERC 20 smart contracts. I have to write a bunch of smart contracts encoded on Ethereum to create my own platform and make it operational. Writing smart contracts is a serious, time-consuming and thus expensive undertaking.

In writing smart contract codes, I need to be very careful to consider all possibilities that could result in losses to users. Let’s say Alice agrees to buy one silver bar (1,000 ounces of silver) for \$15,000 from Bob. The smart contract should be something like “if Alice

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<sup>14</sup> Sinclair Davidson, Primavera De Filippi and Jason Potts, Blockchains and the Economic Institution of Capitalism, *Journal of Institutional Economics* (published online on January 18, 2018); Sinclair Davidson, Primavera De Filippi and Jason Potts, *Disrupting Governance: The New Institutional Economics of Distributed Ledger Technology* (July 22, 2016 at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2811995](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2811995)); Sinclair Davidson, Primavera De Filippi and Jason Potts, *Economics of the Blockchain* (March 8, 2016) at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2744751](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2744751).

pays \$15,000 to Bob, then Bob transfers one silver bar to Alice”. But Alice and Bob almost certainly don’t know each other and thus don’t trust each other. So Alice will not agree to pay \$15,000 unless she is certain that she will receive one silver bar from Bob. Therefore, the contract should include some conditional construct like “if Bob transfers one silver bar to an escrow account to lock it up, then Alice pays \$15,000.” There are more contingencies I must address.

I need to think about whether there is any hole, bug or other problem in my codes. For example, Bob may agree to sell the same silver bar to Charlie. Once the silver transfer to the escrow account is validated, then both smart contracts will automatically send \$15,000 each to Bob, because the smart contract is written to trigger the cash payment upon the transfer of Bob’s silver bar to the escrow account. I have to prevent problems like this, which arise from transaction-ordering dependency or time-stamp dependency inherent in the deterministic nature of smart contracts.

If my codes are not air-tight, bad actors may disrupt my blockchain. The DAO smart contract was written by a seasoned coder, but its code had an inherent defect ultimately leading to a classic case of re-entrancy vulnerability or recursive attack.<sup>15</sup> The DAO was a decentralized autonomous organization sponsored by Stock.it UG that would have operated like a virtual venture capital fund. The attacker stole about \$60 million worth of Ether tokens, leading to the premature death of The DAO. Other issues may arise in code writing.<sup>16</sup>

More fundamentally, my blockchain is not self-contained in the sense that it must interact with the outside world—the bank accounts and silver bar custody accounts of Alice and Bob. This can create an issue that is external to my blockchain and is therefore beyond its control. If there is an operational problem with any external account or ledger, then my blockchain will encounter a performance issue. Or, a hacker may get into my blockchain through an external account.

The interaction with an outside world will raise a host of issues. A platform that is going to store patient medical data and make data available to interested participants like healthcare service providers and insurers cannot verify that the data of a particular patient are accurate. A blockchain does not cure mistakes in data originating from the outside world; garbage in, garbage out. If an insurance company pays or refuses to pay based on incorrect data on the blockchain, will the blockchain or its administrator or sponsor be responsible? Can any of them disclose away its liability?

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<sup>15</sup> <http://hackingdistributed.com/2016/06/18/analysis-of-the-dao-exploit/>.

<sup>16</sup> Maher Alharby and Aad van Moorsel, Blockchain-based Smart Contracts: A Systematic Mapping Study, October 17, 2017.

Smart contracts frequently condition execution on the occurrence of an external event. A smart contract executing an interest rate swap will calculate and pay an amount under the swap if the external information source, called an oracle, sends to the smart contract the relevant level of a specified floating rate at a specified time. If the external information source is disrupted, then the smart contract will not execute as intended.

I may still encounter a variety of performance and governance issues beyond my control. I have no control over a CryptoKitties congestion problem, which would take up so much space on Ethereum as to slow down the operation of my platform almost to a complete stop. CryptoKitties is a blockchain-based virtual game that allows players to breed, buy and sell virtual cats. It was so popular toward the end of 2017, it generated an all-time high traffic that led to a severe congestion on the Ethereum network.<sup>17</sup>

A majority of the users of my platform may decide to hard fork my blockchain. Hard fork takes place when a new software program is deployed on a blockchain or the existing software program is modified and the new or modified program is inconsistent with the existing program. In that case, the blockchain will split into the old and new versions that run concurrently. We have seen the split of Bitcoin into Bitcoin and Bitcoin Cash, and the split of Ethereum into Ethereum and Ethereum Classic. Hard fork at a minimum causes a confusion to users and in the worst possible scenario might result in multiple people recorded as the owners of the same asset. I can retain control over my blockchain to prevent hard fork, but then that is somewhat antithetical.<sup>18</sup>

And, I need to have a plan for the time when a malicious actor gets hold of a quantum computing software in the near future, which will very likely break encryption on my blockchain and cause massive economic losses to the users.<sup>19</sup>

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## Blocking Blockchain—Resistance and Lack of Understanding

Entrepreneur-driven technological competition is often met with political response. While centralized ledgers may not always be able to compete on cost, they can still compete through political force by, say, campaigning for regulation to artificially drive up the cost of decentralized technology, including by rendering it illegal. There is some

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<sup>17</sup> <https://qz.com/1145833/cryptokitties-is-causing-ethereum-network-congestion/>.

<sup>18</sup> <https://cryptocurrencyfacts.com/understanding-hard-forks-cryptocurrency/>.

<sup>19</sup> <https://www.financemagnates.com/cryptocurrency/news/quantum-computing-threat-blockchain-security-study-says/>.

speculation about why a number of countries have banned or may ban cryptocurrencies like Bitcoin for reasons other than to protect retail investors.<sup>20</sup>

We are creatures of habit. It is difficult to significantly change the way we conduct our economic and social activities, particularly if a new technology is disruptive, rather than incremental. Blockchain is a difficult concept to explain. Consider, again, a blockchain platform for medical data. Many people have wondered whether data stored on a blockchain are secure when such data are distributed to all network participants. Most don't understand that data will be secure as they are encrypted. Even those who understand cryptographic encryption are concerned about unauthorized access to data by hacking or by a simple mistake of a participant with permission to access. But we implicitly trust doctors, hospitals and insurance companies that hold our medical data. Do they safeguard our data better than blockchain?

Resistance to a new technology is not limited to individuals. Business and other organizations are reluctant to embrace disruptive changes, even if the changes are going to produce social benefits. The London Metal Exchange introduced an electronic tracking system for metals stored in warehouses in 2016<sup>21</sup> only after a well-publicized fraud by a Chinese warehouse in Qingdao that issued multiple paper certificates representing the same batch of aluminum.<sup>22</sup> In many countries, including the United States, negotiable paper certificates are still used as the only title documents for many commodities; only the ownership of a handful of commodities is recorded and transferred by way of electronic receipt.<sup>23</sup> Sometimes, incumbents counter with some marginal improvements in an attempt to preserve their market position.<sup>24</sup>

Business and other organizations need to overcome their organizational culture and internal resistance. Storing financial and other data in digital form has resulted in cost saving. Storing data on a blockchain could result in a further saving and it may be shared with all relevant parties, including regulators, in a more cost efficient manner. This, however, will certainly disrupt the way business has been conducted and may marginalize or eliminate some organizations or employees. Resistance to a change is a natural reaction.

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<sup>20</sup> <https://www.express.co.uk/finance/city/920062/Bitcoin-news-will-cryptocurrencies-be-made-illegal-2018-Crypto-news>.

<sup>21</sup> <https://www.reuters.com/article/us-metals-lmeweek/lme-aims-for-chinese-warehouse-breakthrough-with-electronic-receipt-system-idUSKBN12V0ZS>.

<sup>22</sup> <https://www.google.com/search?q=qingdao+certificate&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwiH6s3e1rLaAhWLzLMKHUmiCfoQsAQIOg&biw=1484&bih=925>; <http://www.portstrategy.com/news101/administration/finance-and-investment/an-end-to-paper>.

<sup>23</sup> <http://www.southwestfarmpress.com/electronic-warehouse-receipts>.

<sup>24</sup> <https://qz.com/1217017/a-40-year-old-banking-co-op-is-overhauling-payments-without-using-blockchain/>; <http://treasurytoday.com/2017/07/ripple-vs-swift-payment-r-evolution-ttpv>.



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## Blocking Blockchain—Regulatory Landscape

The current regulatory landscape may play a significant role in determining where the path forward will be.

I will start with a situation where the current regulatory system may be a speed bump on the road to a promised land. As blockchain is essentially a decentralized ledger system, an obvious use case is for the execution, clearing and settlement of securities and other financial transactions. Properly designed and operated, a securities trading blockchain platform could expedite the process of trade execution, clearing and settlement and reduce the possibility of error, mistake and dispute.

However, the regulatory framework for the securities market has been developed and refined over a long period of time to achieve well-defined objectives. It has been modified from time to time on an incremental basis as new technology is introduced into the market. If the blockchain technology is applied in the securities market, then the current regulatory framework may become inconsistent with the new transaction paradigm using blockchain. The regulatory system may need to be reworked, but that will be a massive undertaking, and the regulators may be reluctant to do so, since they may not be certain whether they can anticipate all issues from a new transaction paradigm.<sup>25</sup> Because the current regulatory system is complicated and technical and is tailored for the intermediary-based system, it is likely that in highly regulated segments of the financial industry the technology may be adopted in an incremental manner, rather than fundamentally changing the way the financial markets function.

Now, I will talk about a Wild, Wild West with no sheriff in sight. In the case of a transaction conducted in a traditional manner, a national regulator can easily find one or more persons to enforce its rules against. For instance, in enforcing the AML rules in the case of the money transfer by a bank for customers, a regulator requires the bank to establish policies and procedures designed to comply with the AML rules. If the bank fails to implement them to prevent illegal activities, the regulator will sanction it.

In a truly decentralized blockchain platform, a regulator may not easily find any person as a point of enforcement. For example, the SEC stated that an online trading platform for security tokens would have to register as a national securities exchange or broker-dealer (or alternative trading system) with the SEC. But a number of decentralized trading platforms have appeared without any clearly identifiable sponsor or administrator. Software programmers launch those platforms simply by releasing programs on the internet. There is nobody who administers or operates those platforms.

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<sup>25</sup> FINRA, Distributed Ledger Technology: Implications of Blockchain for the Securities Industry (January 2017 at [https://www.finra.org/sites/default/files/FINRA\\_Blockchain\\_Report.pdf](https://www.finra.org/sites/default/files/FINRA_Blockchain_Report.pdf)).

They are just match-making services without providing trade execution or settlement or custody. Generally, they are not easy to use and liquidity is not deep. Nonetheless, trading does happen through them, but no national regulators can regulate them, except by shutting them down, in which case the same programs can be released again to create identical platforms in different domain names. It is simply unclear how to regulate fully decentralized platforms.

I will move on to a case where we know we are regulated but we don't know whom we need to deal with. Many countries still struggle to decide whether a digital currency is a method of payment, asset or something else. Let's think about Tether, which is a pure cryptocurrency and is supposed to be fully backed by U.S. dollars on a one-to-one basis. Since the full amount of U.S. dollars is supposedly custodied at a bank, should Tether be treated just like a bank deposit or even like the U.S. dollar itself? Or is it some other type of asset, even if its value does not fluctuate at all? The question becomes fuzzier as to Bitcoin, Ether or Ripple.

Now, let's look at the big picture. The larger picture is a bit hazier.<sup>26</sup> Some countries have adopted or are in the process of adopting laws or rules specifically dealing with blockchains and tokens (including cryptocurrencies). Other countries, including the United States, are generally applying the existing legal framework to blockchains. This is creating a fractured blockchain global market. For example, a commodity-backed token may be a commodity, security, ownership certificate or just a commercial contract depending on the laws of each country where such token is bought or sold or where the platform is located or managed. In addition, the platform sponsor may have to deal with anti-money laundering, privacy, cyber security, consumer protection and other rules in all relevant countries, which rules are very likely different, conflicting or even inconsistent among one another.

The immediate consequence of this fractured, regulatory environment is that a typical blockchain platform sponsor simply chooses a handful of jurisdictions which will yield the most financial benefits to the sponsor. Other countries are left with developing their own platforms that pass muster their own regulatory requirements.

This is not unique to the blockchain world. However, the problem is compounded in the case of blockchain, because we have to deal with not simply a fractured global regulatory system, but a system with a number of local uncertainties. Regulatory systems often result in sub-optimal choices in conducting business activities and distortion in resource allocations. This problem is exacerbated in the case of blockchain, as legal systems are filled with uncertainty and unpredictability.

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<sup>26</sup> <http://www.businessinsider.com/blockchain-cryptocurrency-regulations-us-global-2017-10>.

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## Where to?

I have talked about just a few current roadblocks on the path of blockchain application. All these point to some significant switching costs.

The question is: where are we heading to?

Is blockchain just like cloud computing that has not turned out to be a solution to all our problems? Some observed that “[n]o other blockchain-based software initiative [other than Bitcoin] seems to be at any real risk of hockey-sticking into general recognition, much less general usage.”<sup>27</sup>

It is hard to predict what path the blockchain technology will follow. We first need to remind ourselves that this technology is less than 10 years old. It will need some time to mature, and we need to support many experiments and pilot programs. This is a very young technology which needs to be tested in real-life situations.

I will conclude with my own anecdotal experience. In the mid-1990s, when Amazon.com had just started selling books online, I met a person who told me that people would buy everything online in the future. I was polite enough not to tell him, “not in my lifetime.” I was so wrong. Having seen what blockchain technology can accomplish, I believe that it has a very bright future.

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<sup>27</sup> <https://www.forbes.com/sites/jasonbloomberg/2017/05/31/eight-reasons-to-be-skeptical-about-blockchain/#434901fc5eb1>.