

THE ROLE OF BLOCKCHAIN IN THE COVID-19 PANDEMIC

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Abstract

Blockchain technology can play a fundamental role in the COVID-19 crisis, as it opened a new door to ground-breaking technologies with potential to impact every industry from finance, manufacturing, and educational institutions to global supply chain to the health sector. Today, many health scientists and technology experts believe that reliable big data can be obtained using the blockchain technology to fight against the COVID-19 pandemic. As blockchain has the ability to store large data without a single point of failure while providing verifiability, traceability, accountability, and transparency with its decentralized nature, it provides a permanent audit trail for reliable health data for the COVID-19 pandemic. By helping researchers, supply chain providers in health care, insurance companies, governments, and drug companies, the negative impact of COVID-19 pandemic on health and economics can be lessened. This study investigates how the blockchain technology can mitigate the destructive impact of COVID-19.

Keywords: COVID-19, pandemic, blockchain, health, technology

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Introduction

The negative impact of the COVID-19 pandemic on the global economy is beyond anyone's imagination. According to the United Nations, this pandemic is expected to reduce global economic output by \$8.5 trillion over the next two years, eradicating nearly all the gains in the last four years and pushing more than 34 million people into extreme poverty (UN Report, 13.05.2020). The World Economic Forum (WEF) predicted that foreign trade and global supply chains might soon collapse (WEF, 2020). To attenuate the destruction, the blockchain technology can be adopted as it is reliable, secure, transparent, private, and decentralized.

According to Ziyong Fan, Head of Digital Trade at WEF, "blockchain technology has the ability to help the global supply chain mechanism to work efficiently in times such as COVID-19 pandemic" (Huilet, 6.4.2020). By using this technology, companies in Western Europe would save nearly 450 billion US dollars in logistical costs by controlling and distributing their data safely and timely.

The blockchain technology has certain disadvantages such as use in illicit activities, low transactions per second, significant technology costs, and being hackable. However, these disadvantages can be worked upon, and the technology can be adopted with advantages to be used in different sectors and fields such as health.

Two of the world's biggest technology companies, IBM and Microsoft, have invested in the blockchain technology via the technology company, *Azure*, to introduce the blockchain platform.

However, it is incumbent to define blockchain and its use. Why is this so important? How can blockchain help us fight Covid-19? This study answers these questions and proposes solutions. In section two of this study, blockchain is defined and its historical background is discussed. Section three highlights why the blockchain technology should be used to remediate Covid-19. Section four analyzes the current challenges and future directions and proposes solutions by focusing on some projects either underway or planned in the near future to control the virus from spreading. Finally, section five provides the conclusion with some policy options to highlight policymakers' decisions.

What is Blockchain?

Brief Historical Background of Blockchain

Blockchain was first outlined in 1991 by Stuart Haber and W. Scott Stornetta. In 2008, it was modelled by Satoshi Nakamoto in his article *Bitcoin: A Peer to Peer Electronic Cash System*. Nakamoto explained the basic technology (blockchain) behind cryptocurrencies, especially in the production of Bitcoin, which opened the door to ground-breaking technologies with the potential to impact every industry. Figure 1 summarizes the historical timeline of the blockchain technology

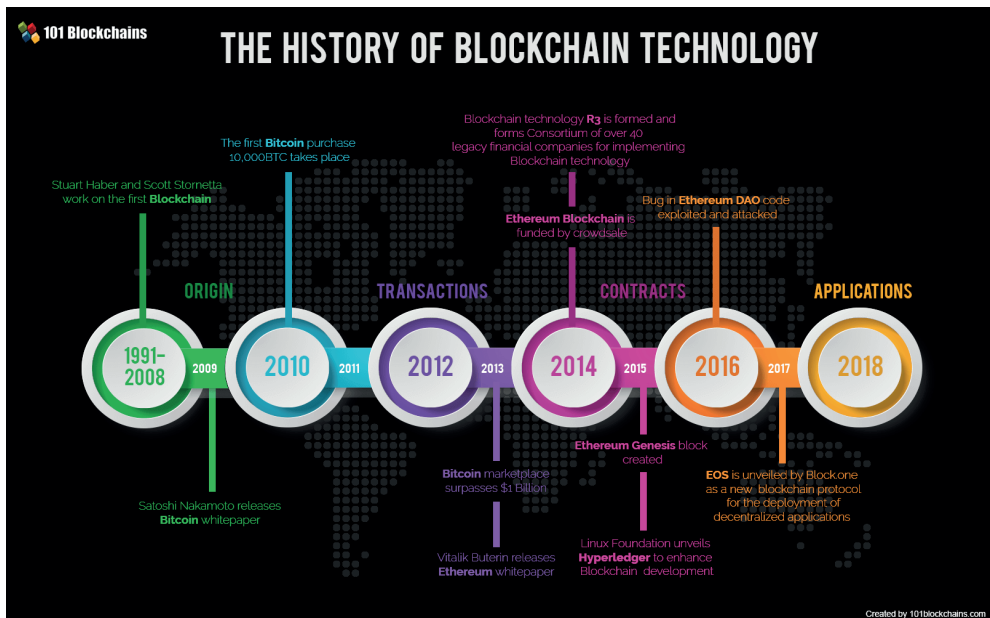


Figure 1. Historical Timeline of Blockchain Technology

Source: The History of Blockchain Technology: Must Know Timeline, by Swati Goyal on March 16 2020, <https://101blockchains.com/history-of-blockchain-timeline/>

In *A Very Brief History of Blockchain Technology Everyone Should Read*, Bernard Marr (2020) states that even today, many people believe that blockchain and bitcoin are the same. However, they are not the same since 2014, as Blockchain can be used in many different operations in addition to producing bitcoin.

In the last 10 years, the following main innovations were noted in the blockchain technology:

- The first digital currency, *bitcoin*, which has a current market share of nearly 20 billion dollars, was popular between 2003 and 2009.

- *Blockchain* began being used for purposes other than producing bitcoin, such as in financial sector, between 2009 and 2013.
- *Smart contracts* were incorporated in a second generation blockchain system called Ethereum, which enabled the activation of financial instruments, between 2013 and 2015.
- *Proof of stake*, i.e., blockchain is secured by “proof of work” and was popular between 2015 and 2018.
- *Blockchain scaling* to accelerate the process of producing data without sacrificing security was used after 2018 (Gupta, 2017).

Although the Internet is a great innovation for collaboration and communication, it unfortunately undermines privacy. Nevertheless, by keeping user information anonymous, the blockchain technology facilitates peer-to-peer transactions without any intermediary and validates a permanent public record of all transactions (Tapscott and Tapscott, 2015). This suggests that blockchain is the technology of the future and needs to be supported by technology firms and the public (Ünsal and Kocaoğlu, 2018).

Today, in addition to bitcoin, the blockchain platforms include Ethereum, Hyperledger Ripple Tendemit, and Corda (Usta and Doğantekin, 2017), with a cumulative market capitalization of cryptocurrencies of 237.1 billion USD in 2019, up from 128.78 billion USD in 2018 (Strauss and Gitaude, 2020).

How Blockchain Works

The blockchain is “a chain of blocks,” i.e., digital information (the “block”) stored in a public database (the “chain”). When a block stores new data, it is added to the blockchain, becoming available for public viewing. Thus, blockchain, as the name suggests, consists of multiple blocks strung together, allowing digital information to be recorded and distributed but not edited. Figure 2 indicates how blockchain operates:

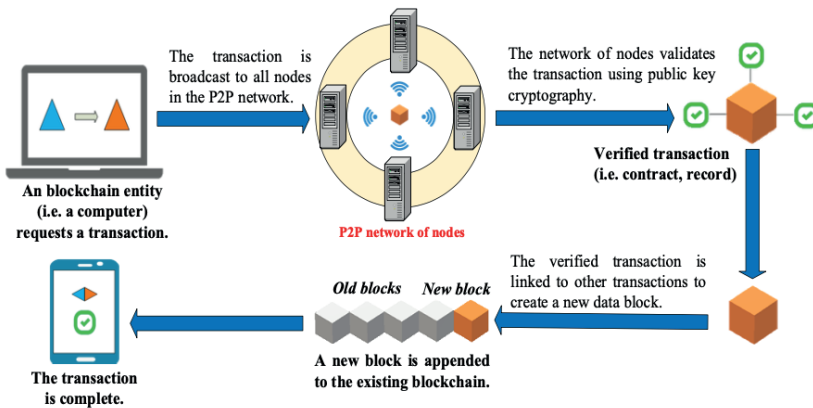


Figure 2. Blockchain Operations

Source: Nguyen et al. 2020. Blockchain and AI-based Solutions to Combat Coronavirus (COVID-19)-like Epidemics: A Survey

In working terms, “Blockchain is a peer-to-peer distributed ledger that is secure and used to record transactions across many computers. The ledger’s contents can only be updated by adding another block linked to the previous block. It can also be envisioned as a peer-to-peer network running in addition to the internet.” William Moupayar’da (2016) explains that in a blockchain, transactions are stored in “blocks,” with each newly generated block referring to the one before it with a unique identifying number called a “hash.” These blocks constitute a chain and, hence, are named “blockchain.” This chain continues indefinitely” (p.3).

In simple terms, “blockchain is a platform where people are allowed to carry out transactions of all sorts without the need for a central or trusted arbitrator” and without any transaction cost (Goyal, 2018, p.2). Figure 3 illustrates how blockchain works.

What is a Blockchain

and how does it work?

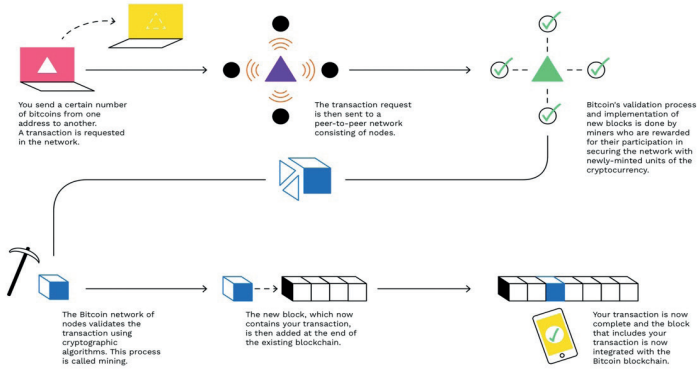


Figure 3. How Blockchain works

Source: How does blockchain work in 7 steps — A clear and simple explanation. 2008, <https://blog.goodaudience.com/blockchain-for-beginners-what-is-blockchain-519db8c6677a>

According to Tepscoott and Tepscoott (2017), “blockchain, also called a distributed ledger, the technology enabling cryptocurrencies such as bitcoin and Ethereum, has brought about a new era of openness, decentralization, and global inclusion” (p.4). Unlike the Internet, blockchains are distributed and not centralized; open and not hidden; inclusive and not exclusive; immutable and not alterable; and secure. Blockchain gives us unprecedented capabilities to create and trade value in society (Realizing the Potential of Blockchain, WEF).

Khan (2020) states that “blockchain is not about just doing things in a different way, but it completely changes the way things are done, in essence re-creating models for finance, trade, logistics, education, healthcare, and more” (p.2). This means that the blockchain technology is more than just bitcoin; as a foundational technology, it can strengthen every industry.

Summers (2016) asked, “Is the blockchain technology going to be fundamental? I think the answer is overwhelmingly likely to be *yes*. Is bitcoin going to be a valuable store of value, the same way as people use gold? I don’t know, but I think that certainly the answer is *no* doesn’t seem like the right position to take” (p.7).

Blockchain’s Practical Applications

In 2019, Deloitte surveyed 1,000 companies across seven countries about integrating blockchain into their business operations. Accordingly, 40 percent of the companies had a

strong investment in 2019, and were willing to invest US\$5 million or more in new blockchain initiatives in 2020. At the same time, 53 percent indicated that the blockchain technology had become a critical priority for their organizations in 2019. Moreover, 83 percent saw a compelling rationale for using blockchain, as the overall attitude toward blockchain strengthened meaningfully (Deloitte, 2019; Sam et. al., 2020)¹. The survey also indicated general improvements in companies' attitude toward blockchain, and currently, this technology is applied to a wide variety of fields:

Financial Services, as users find blockchain cheaper, more transparent, and more effective in business transactions, settlement of financial assets, prediction markets, and economic transactions.

Healthcare Management, as it is possible to encode and store personal records on the blockchain with a private key granting access only to specific individuals for public healthcare management, longitudinal healthcare records, automated health claims adjudication, online patient access, sharing patients' medical data, user-oriented medical research, drug counterfeiting, clinical trial, and precision medicine.

Global Supply Chain Management, as sensors give companies end-to-end visibility of their supply chain by providing data on the location and condition of the supplies when transported around the globe. The blockchain technology is expected to increase transparency and accountability in supply chain networks, thus enabling more flexible value chains.

Smart Contracts, as blockchain not only waives the need for third parties but also ensures that all ledger participants know the contract details and that contractual terms implement automatically once conditions are met.

Blockchain Identity, as blockchain protects identity by encrypting it and securing it from spammers and illicit marketing schemes.

The Energy Sector, as blockchain may reduce costs and enable new business models to manage complexity, data security, and ownership along grids, engaging prosumers in the energy market acting as enablers for energy creation.

1 *Stablecoin Economy: Ultimate Guide to Secure Digital Finance* is an educational book written and published by Alyze Sam, Adam Alonzi, and Koosha Azim.2020, Koosha Azim Publishing

Governance, as blockchain-enabled applications might change how local governments operate by disintermediating transactions and record-keeping. The accountability, automation, and safety that blockchain offers for handling public records could eventually obstruct corruption and make government services more efficient (Casino et al., 2019).

Why Blockchain Should Be Used to Remediate COVID-19

Since the outbreak of Covid-19, the world is confronted with an existential global health crisis. As the knowledge of COVID-19 evolves, evidence suggests that it will be less deadly than initially thought (with mortality rate of approximately 2–3 percent) but more contagious (4.810.000 cases in 70 countries, with over 320,000 deaths as of May 19, 2020) (<https://www.worldometers.info/coronavirus/>). Nevertheless, the economic, social, political, and technological impact of COVID-19 is probably be greater than that of the severe acute respiratory syndrome (SARS) in 2003. However, its impact depends on how we use the available technology to fight it (Wei et al., 2020).

If we explore the potential applications of **Blockchain**, we could be better equipped to fight the coronavirus crisis by enabling early detection of outbreaks, protecting user privacy, and ensuring a reliable medical supply chain (Stalmans, 2020; Nguyen et al., 2020). Here are some blockchain-based solutions for fighting COVID-19:

- **Outbreak tracking:** Blockchain can provide achievable solutions for tracking coronavirus: (1) by distributing database ledgers that can receive multiple updates and store data on blocks linked together in a trusted and immutable manner and (2) by recording immutably patient symptoms of infection and deviations. If governments and healthcare organizations use blockchain, they can monitor potential patients at every stage with high reliability and accuracy and track patient moments, provide real-time data about affected areas, and direct fighting efforts (Novikov et al., 2018).
- **User privacy protection:** In South Korea and China, governments have exploited personal data to fight coronavirus, including using surveillance-camera footage, credit card purchase history, and smartphone location data. Blockchain was used to record patient symptoms, locations, and historic health conditions with high privacy. This can be achieved by blockchain's trust and decentralization. This can contain the spread of the virus and the pandemic can be suppressed without using the measures that invade privacy (Dimitroy, 2019).

- **Medical supply chain:** Blockchain has proved an extremely useful tool in *good supply chains* such as drugs, gloves, gowns, face masks, and in *trading supply chains* such as services. In the COVID-19 crisis, maintaining a continuous supply of medicines and food has become a real challenge. The blockchain technology can help supply chain companies achieve a swift flow of supply by tracking the origin/destination flow in a trusted and reliable manner (Macios, 2020). Recently, *Alipay*, along with the government and healthcare organizations in China, launched a blockchain-based platform that allows users to track the demand and supply chains of medical supplies quickly to help patients without delay (Nguyen et al., 2020; Juma et al., 2019)
- **Safe day-to-day operations:** The current situation requires health experts, governments, and health organizations to respond quickly and find solutions. At this stage, blockchain can enable day-to-day digital activities to reduce the risk of virus contraction without delay. In particular, during user-to-user and cross-border operations, blockchain can provide the latest and most accurate information (Nguyen et al., 2020).
- **Donation tracking:** The potential of blockchain in donation tracking has been empirically supported. In the COVID-19 crisis, donation is an important way to support the existence of and healthcare services available to infected individuals and healthcare services for infected victims. Blockchain can feasibly and reliably track donation activities to ensure that donated goods and money are transferred to the targeted victims. The donation process can be traced through blockchain, which issues signatures and certificates to mark each donation update, i.e., location, time, donation volumes, and list of targeted receivers (Nguyen et al., 2020; Sarker, 2019).

Challenges and Future Direction

During the COVID-19 pandemic, several blockchain projects have been developed:

- The Haslog Blockchain solution to control the spread of COVID-19
- The Hyperchain Blockchain, which has a donation-tracking platform for supporting governments and healthcare organizations
- VeChain, a Blockchain-based platform, to monitor vaccine production in China
- The PHBC Project, a monitoring blockchain for the continual and anonymous verification of communities and workplaces that are free from coronavirus COVID-19 as well as other high-risk viruses (Nguyen et al., 2020)

These platforms are expected to continuously improve.

Although Blockchain is a highly useful tool, which is here to stay, its shortcomings must be revisited and redressed:

- ***How to regulate the healthcare sector*** if blockchain technology becomes more readily accessible, and how to deal with the challenge of no party being held accountable (Cacioli, 2020)? For example, in the blockchain network, it is important to consider what law might apply to transactions and what appropriate risk management should be implemented (Reddy, 2018). In legal issues about content, personal information running on blockchain platforms, such as problems with copyright infringement and defamation, must be considered by authorities and regulators.

- ***Lack of a unified database***, including infected cases, affected areas, and medical supply status, is critical. Despite many data sets obtained from WHO and at the national level, from social media to individuals, we need a unified data set to track and fight COVID-19 (Cohen et al., 2020).

- ***Regarding protection of patient privacy***, although the blockchain technology is one of the best ways to maintain patient privacy, the government must impose privacy laws on users' tracking mobile applications to ensure the public's safety and security. Conflicts and privacy infringements to collect data or track symptoms need to be resolved (Li et al., 2017).

- ***With regard to security weaknesses***, although blockchain is widely regarded as a secure monitoring platform to track COVID-19, individuals can illicitly enter the blockchain software to control/obstruct seriously breaching security. The modification of medical transactions or patient data information will raise privacy concerns, which should be given high priority (Nguyen et al., 2020; Liu et.al., 2018).

Conclusion

To effectively combat the COVID-19 pandemic, we must develop effective vaccines using blockchain platforms and communicate with each other effectively. Blockchain platforms should be optimized to reduce network latency and improve security, making Blockchain an ideal choice (Gordon and Catalini, 2018).

To mitigate the impact of COVID-19, it is important to use digital technology in the long and short run. Many Chinese hospitals are collaborating with blockchain companies and pharmacies to deliver patients' medications to their doorsteps. Through blockchain, hospitals could ensure timely delivery of medication with accurate tracking (Amper, 2020).The

successful application of Blockchain and other digital technologies to tackle COVID-19 in 2020 will probably increase public and governmental acceptance of such technologies for other areas of healthcare, including chronic diseases. In 2018, as Liu et.al stated, “a crisis provides an opportunity,” and the COVID-19 crisis may be an opportunity for digital technology, especially blockchain, to save lives.

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