# Merging Developing and Developed Worlds: The Blockchain Revolution's Impact on Collective Global Growth

**Jeffrey R. Martindale**
*University of Delaware*

The purpose of this research is to investigate the productive ways in which blockchain technology can impact the world in both private and public sectors. This paper begins with a short description of how blockchains were initially conceptualized and how they work, which the author expresses in a more universally understandable manner for non-experts in the fields of coding and computer science. Then the larger implications of world changes in both developing and developed countries through myriad blockchain technology application possibilities in corporate industries and public agencies are explored in detail. Specifically, Internet accessibility is not as limited to wealthier people and countries as it was at the turn of the century, so, while only developed states seemingly experienced overwhelming benefits from the initial Internet revolution, sectors of all countries from an array of differing developmental levels currently maintain the ability to collectively benefit, grow, and thrive during the blockchain revolution. Finally, this paper concludes with a warning to corporations and governments alike and a petition that public and private entities learn from the mistakes of those who did not initially see the Internet for the world-altering disruptive force it proved to be. Blockchain technology has the potential to make an enormous portion of traditional corporate practices and services obsolete, as well as potentially challenge the worldwide legitimacy of governments' central authority through its use of distributed ledgers and online expanse.

## Introduction

A blockchain, in the most basic terms possible, is a non-centralized encrypted digital ledger that allows transactions to occur between parties in a manner that is currently safe from outside hacking. The transactions established through blockchain technology are publicly and chronologically disseminated to all servers on the blockchain network. If a specific server on the network were hacked to show transactions different from those shown on the remaining unaltered servers after a specific period of time, the transactions recorded on the unaffected servers become legitimized and built upon, thus rendering the compromised transactions illegitimate and disregarded. As such, barring a hack of a majority of the network servers within a short period of time, which is nearly impossible, altering transactions after acceptance among all vested parties is unlikely (Nakamoto, 2008). This process will be thoroughly explained in the following section.

The advent of blockchain technology came in 2008 when the secretive person or group known only as Satoshi Nakamoto developed

Jeffrey Martindale is a first-year Masters student in Public Administration at the School Public Policy and Administration, University of Delaware. His research interests include International Development, Community Development, Finance, Technology and Gender Equality

methods to create the Bitcoin blockchain. With this new technological development came opportunities for numerous economic sectors and public organizations to become more efficient and effective. Specifically, many aspects of traditional transactions and record keeping are outdated compared to the possibilities offered by blockchains and are likely to be replaced by blockchain technology in the next several years. While this process will surely be a disruptive occurrence across nearly all public and private industries, resulting in massive job cuts and an eradication of several current financial and documentation processes, citizens in both developing and developed countries will benefit extensively from the world's embrace of blockchain technology. Furthermore, if blockchain technology is emphasized and utilized mutually and immediately by governments and private corporations in both the developing and developed worlds, the technological gap between the financial markets and public sectors of the two worlds can be collectively addressed and reduced for the further betterment of all global citizens.

Before the economic, political, and social implications of global blockchain distribution are further addressed, the fundamentals of blockchain technology must be investigated and understood. Currently, most of the information regarding blockchains is known only by those that understand the computational properties of the technology and its coding processes. Through greater collective comprehension of how blockchain technology works, policymakers and corporations can respectively regulate and integrate this technology before it completely surpasses the understanding of legislators and executives, leaving gaps between regulatory and technological advancements as well as traditional and blockchain-utilizing business practices.

## Blockchain Technology Overview

In 2008, the secretive individual or group known as Satoshi Nakamoto disseminated an article conceptualizing blockchain technology. In the article—"Bitcoin: A Peer-to-Peer Electronic Cash System"—Nakamoto asserted that, since the Internet's inception, Internet commerce required banks or other financial entities to act as third parties during transactions to process electronic payments. To Nakamoto, this process worked satisfactorily given the state of electronic transactions in the late 2000s, yet suffered "...from the inherent weaknesses of the trust based model," and, as such, "completely non-reversible transactions [were] not really possible, since financial institutions cannot avoid mediating disputes" (Nakamoto, 2008, p. 1). Mediation costs, along with other fees from financial institutions, raise the price of electronic transactions, while the possibility of payment reversal through mediation, lack of funds, or other transaction hindrances force banks to require extensive amounts of private information from customers to ensure credibility and trust (Nakamoto, 2008, p. 1).

Instead of continuing to use an antiquated transaction process, Nakamoto called for "an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party" and in a manner that is "computationally impractical to reverse" (Nakamoto, 2008, p. 1). This system, now known as a blockchain, involves a peer-to-peer (P2P) network wherein numerous nodes—network users tapped into the system—receive information regarding all transactions broadcasted over the network and collect the transactional information into a block of data—a compilation of all the transactional history within the network over a certain period of time (Nakamoto, 2008, pp. 2-3). The nodes then work to solve extensive cryptographic (coding) "puzzles," or computational assignments, to have their block of data become the next block "mined" for the chain. In other words, the network requires a specific number of zeroes in the next block's header, which always ends in "SHA-256^2," to become the validated block upon which the chain continues. Once a node figures out the correct number of zeroes for the block's header (i.e., generates a "proof-of-work" (PoW)), that node's version of the block is able to become the version accepted across the entire network. After all the other nodes on the network confirm that the transactions within the block are valid, the block finalized by the node providing PoW is legitimized and becomes the next block on the chain (Christidis & Devetsikiotis, 2016, p. 2294; Nakamoto, 2008, p. 3).

Finally, the creator of a block (i.e., the node that generates PoW to finalize the block holding data added since the preceding block was completed) is awarded a pre-determined amount of Bitcoin—the first and most renowned cryptocurrency (digital/virtual currency)—for their efforts, thus incentivizing nodes to continue attempting to have their blocks mined (Nakamoto, 2008, p. 4). Other blockchain platforms have since been created as well, each with their own unique cryptocurrency payout for mining, such as the Ethereum platform and its cryptocurrency Ether ("Ethereum: Blockchain App Platform," 2017).

Through providing PoW and having nodes accept and build upon previous blocks, the opportunities for hackers to retroactively alter amounts transacted diminish, since each node in a system maintains an individual copy of all previous blocks (and thusly all previous transactions). In other words, each block of data chronologically orders the transactions recorded between the block's inception and completion, while the dissemination of every block to all network servers helps ensure that the transactions recorded are legitimate. Altering prior transactions would require the modification of a majority of nodes' block histories, which is virtually impossible, especially as a blockchain gains interest and more nodes enter the system (Nakamoto, 2008, pp. 1-2). It is for this reason that blockchain technology is also referred to as distributed ledger technology—non-trusting nodes record each transaction simultaneously across the globe, thusly ensuring proper documentation of transactions mutually by an array of strangers (Kshetri, 2017, p. 1710).

Transactions within a block also ensure privacy and security within a trustless P2P structure. A transaction between two parties on a blockchain operates as such: party A digitally signs a transaction using a "private key," known only to the user, that decreases her/his amount of one asset and increases her/his amount of another asset by the amount agreed upon with party B. Party A's transaction sets up for the allotted amount of the asset being traded to go to party B's "public key," which is similar to a user name or other online address. Once party B also signs away the amount of an asset being traded using her/his private key, while crediting party A's account using her/his public key, the transaction is finalized, documented, and ultimately distributed across the network in an irreversible manner (Christidis & Devetsikiotis, 2016, p. 2295).

A final innovative transactional aspect of blockchains that this paper will discuss is smart contracts, which are "self-executing scripts that reside on the blockchain... that allow for the automation of multi-step processes" (Christidis & Devetsikiotis, 2016, p. 2292). For example, if a blockchain user needs asset Y, but only has asset X, she/he can craft a smart contract asking for three units of asset Y for five units of asset X. The user relinquishes her/his five units of X to the smart contract and the smart contract announces the offer to other network users. Should another user accept the terms of this transaction, she/he gives three units of Y to the smart contract and is immediately rewarded with five units of X, while the initial user gains the desired three units of Y and the smart contract ends. If, after a predetermined amount of time, no other users agree to the terms of the smart contract, the smart contract ends and the user's five units of X are returned. Essentially, a smart contract acts as an automated and reliable extension of a network user, which, in turn, reduces the user's time and energy spent trying to find and acquire an asset. A practical example of this concept is a taxi company or ride-sharing service utilizing a blockchain: a smart contract is crafted offering a ride of a certain distance for a certain price (i.e., a bid), a network user agrees to the terms and hires the driver who created the smart contract, and the driver transports the passenger and the smart contract ends or is reposted.

## Implications of a Blockchain Revolution

As of 2016, forty-eight percent of all global citizens (approximately 3.385 billion people) had some level of Internet access through either fixed-broadband or mobile-broadband subscriptions, up from only eight percent (about five hundred million people) in 2001—an increase of nearly seven hundred percent over fifteen years. 70.6 percent of all individuals aged fifteen to twenty-four around the world also had access to the Internet in 2016 ("ICT Facts and Figures 2017," 2017, pp. 1-3; "Statistics," 2017). Additionally, the total global number of business pages on Facebook alone reached fifty million in 2015, while Facebook users made an estimated 2.5 billion comments monthly on these pages (Chaykowski, 2015). As a result of the large growth in overall Internet users and applications during the twenty-first century, and especially of the enormous proportion of young people utilizing Internet services, the need to globally recognize and embrace the technological revolution that the Internet continues to present is apparent.

Specifically, blockchain technology has the potential to reshape the manner in which all public and private entities interact with one another and with customers and constituents. Greater blockchain accessibility for people living in countries of all levels of development may also come to fruition in the near future, as Internet accessibility is projected to be more equitable than ever before. Although the rate at which people gain Internet accessibility in the future is not likely to keep up with the approximate seven hundred percent increase in global Internet users between 2001 and 2016, it is arguably likely that the majority of all global citizens will have access to some form of usable Internet at some point in 2018 or 2019. Furthermore, current global efforts aimed at improving access in under-connected regions are expected to expedite global broadband connectivity (*The State of Broadband 2017*, 2017).

Through this new Internet revolution presented by blockchain technology, interactions between individuals and organizations from across the globe can become more instantaneous, documentable, and permanent. Additionally, as the proportion of young people utilizing the Internet, many of whom maintain adequate understanding of current Internet technologies, increases and as these young people become the majority of the global populace, the need to keep up with technological advancements will be necessary for companies and governments to survive the new Internet revolution. Strategists working on Wall Street assert that those born in the "Baby Boomer" generation (between the mid-1940s and mid-1960s) helped drive the stock market "rally" of the 1980s and 1990s, while "Millenials"—those born between the early to mid-1980s and the mid-2000s—are more apt to develop a blockchain/cryptocurrency-based economy due to their capability to understand new technologies and identify digital business opportunities (Cheng, 2017). It is for this reason that, as of November 2017, "...about 30 percent of those in the 18-to-34 age range would rather own $1,000 worth of Bitcoin than $1,000 of government bonds or stocks" (Russo, 2017).

## Potential Opportunities and Challenges of Global Blockchain Utilization

Currently, governmental agencies and consumer service corporations rely on constituents and customers adhering to a strict centralized authority structure wherein a perceived need for government and company approval and/or assistance is required for a transaction or other activity to occur. Any action undertaken by an individual or organization outside of the strict regulations set by governments or corporations is often deemed illegal or against corporate policy. Blockchain technology, on the other hand, is not in-and-of-itself illegal to utilize, yet the lack of current regulation regarding and understanding of blockchains make this technology a potential threat to policymakers and business executives.

More precisely, blockchains utilize a decentralized network of cooperating nodes from around the world to allow reliable trustless transactions to occur, whereas traditional banking and financial institutions act as centralized authorities to facilitate customer transactions between one another. As such, corporations within the financial sector hinder their opportunities for growth in the long-term by fighting against the shift in transactional processes presented by the blockchain revolution. By preparing for and embracing blockchain technology prior to its potential global takeover, financial institutions will gain the ability to maintain relevance post-blockchain expansion and possibly thrive.

For instance, a bank utilizing blockchain technology could theoretically reduce or eliminate its intermediary services between customers and businesses. While this would reduce the amount that banks could charge in fees for transactions (since blockchain transactions are instantaneous and decentralized), the savings such a feat offers banking institutions are numerous. Blockchains offer ways to improve "back-end processing efficiency" and a "potential to reduce operational costs" (Guo & Liang, 2016, p. 2). As discussed earlier, a large issue within the banking industry involves post-transaction disputes and subsequent mediatory measures (Nakamoto, 2008, p. 1). Banking on a blockchain basis significantly reduces the likelihood of fraudulent disputes since all transactions require both parties to sign on to the terms of an agreement with a public and private key, meaning all parties knowingly sign on to and validate transactions, and all transactions are immediately processed and irreversible. Additionally, since blockchain users' keys are encrypted on the network, there is limited ability for hackers to steal an individual's key for unauthorized transactions. While some authors theorize that the advent of quantum computing - another revolutionary technological prospect that is far outside the scope of this paper—in the near future will allow hackers to bypass cryptographic security, current technology is fundamentally unable to hack and alter transactions on the blockchain (Cermeño, 2016, p. 19). So even if a party finds a transaction unfavorable in hindsight, the transaction is legitimately processed and documented, thusly diminishing any viable claim of fraud or other devious activity.

Banks in developing countries with large populations, such as China, often struggle to adequately judge customers' personal credit standings due to the sheer numbers of people and transactions occurring within the country. Additionally, financial industries in China and similar countries frequently maintain inadequate data sharing protocols between businesses or with the government. For Chinese banks, a majority of the data used to assess credit standings comes from checking account activity, loans, or other direct monetary actions between the banks and their customers (Guo & Liang, 2016, pp. 1-3). While this may make up a significant proportion of the needed data to accurately assess an individual's credit situation in many cases, many customers' financial transactions that should influence credit assessment may not be as readily recognizable to banks in other instances. Blockchain technology provides a remedy for such hindrances in the assessment of credit worthiness. Simply by the design of distributed ledgers, data of all past transactions and activity are embedded within the blockchain and shared across all nodes in a system (Guo & Liang, 2016, pp. 1-3). As such, data regarding customers' economic activity across numerous financial institutions can be shared, if agreed upon by consumers and different agencies, to better address individuals' credit standing for improved loan and financing opportunities. Also, as previously mentioned, due to the cryptographic nature of blockchain, this data can be encrypted when shared with government agencies to protect consumers' privacy.

In addition to the potential cost-savings associated with preventable dispute mediations, the distributed ledger concept decreases the necessity for bookkeeping within financial institutions, or any company using blockchain technology, since every past transaction relating to a business is recorded and saved in a manner that is safe from manipulation (Guo & Liang, 2016, p. 6). Consequently, nearly all industries gain the ability to save money on bookkeeping and other associated accounting costs through blockchain utilization.

Furthermore, regulations regarding high-volume payment clearing activities, such as the sale and purchase of securities—primarily stocks and bonds—vary from country to country, while brokerages and security exchanges typically have up to three days to process distributions of assets (Guo & Liang, 2016, p. 6). The United States' Securities and Exchange Commission (SEC) adopted an amendment in March of 2017 to "shorten by one business day the standard settlement cycle [of three business days] for most broker-dealer securities transactions" to "enhance efficiency... and ensure a coordinated and expeditious transition by market participants to a shortened standard settlement cycle" ("SEC Adopts T+2," 2017). While advocates of a shortened settlement cycle praised the switch to a two business day timeline for likely "reduc[ing] credit and market risk, including the risk of a trading counterparty defaulting," many investors still believe that this shortened amount of time for settlement processing is lengthy for Internet-age financing where "modern technology lets investors make trades in a matter of milliseconds" (Lynch, 2017). Since transactions are validated and processed immediately on a blockchain, both businesses and investors gain options for speedy and reliable asset attainment through a blockchain settlement system. Utilizing blockchains could bolster the economic health of companies by improving investment cash flows and reducing information technology and operations costs (which currently total hundreds of billions of dollars annually), while providing investors increased incentive to continually place money into securities markets (Bajpai, 2017).

While expedited investment in private and public securities is surely beneficial to the economic stability of corporations and governments alike, the investment improvements offered through blockchains do not end with the exchange of securities. Crowdfunding efforts consist of business startups asking the public, typically via the Internet, to donate small amounts of capital in order to fund new business ventures. Within a blockchain network, giving money to startups through crowdfunding endeavors is much safer for investors and forces greater accountability on startups, while still allowing these businesses to gain the funds necessary to engage in their new ventures. On a blockchain platform utilizing smart contracts, startups can petition that people fund their ventures, but funds can only be taken if the pre-determined monetary goal is reached. If the goal is not reached, the funds are returned ("The great chain," 2015). This potentially reduces investors' concerns about fraud and wasted funds for startups in developed and developing countries, which could bolster innovative technological advancement through more consistent funding for startups and encourage businesspeople in developing countries to engage in more global fundraising efforts.

While some skeptics argue that crowdfunding efforts may inherently retain fraud concerns in the form of startups misusing funds after achieving fundraising goals, there are theorized variations of crowdfunding techniques to alleviate investor fears. One such technique—equity crowdfunding—features an exchange of money from investors for a defined share of the startup, like a stock share from a publicly traded company. In theory, attaining equity in a startup would give an investor a greater sense of security when giving money to fundraising efforts—the investor retains a similar amount of wealth, but in the form of equity (Zhu & Zhou, 2016, pp. 2-3). In conjunction with a "...voting system for crowdfunders, which enables [investors] to be involved in the corporate governance" of a startup (i.e., money cannot be spent or decisions cannot be made without shareholder consent), new crowdfunding techniques could provide practical fraud safeguards (Zhu & Zhou, 2016, pp. 1-2).

This concept of crowdfunding applies to the not-for-profit realm of the public sector as well. If a smart contract is created for a non-profit organization to raise funds for needed supplies to achieve the organization's mission, the ambiguity regarding where raised funds are being used dissipates, allowing more not-for-profit entities to truly shape a better world. Additionally, distributed ledgers put transactional information on display and disseminate it publicly. By recording which funds are being used for which purposes, non-profits using blockchains give donors a level of accountability that is rarely seen today (Conway, 2017). It is even possible to track the precise money donated to the exact operation funded or supply purchased by a not-for-profit organization. Through this improvement pertaining to fundraising and expenditures, non-profits, especially throughout the developing world, can finally gain desperately needed capital and supplies to help those who need it most, while maintaining the trust and support of an array of donors. The potential of non-profit funding in the "global south"—the developing world in the southern hemisphere—via blockchains was aptly captured by Nir Kshetri, a professor at the University of North Carolina-Greensboro's Bryan School of Business and Economics: donors can "buy electricity for a South African School using Bitcoin. A blockchain-enabled smart meter makes it possible to send money directly to the meter... Donors can [then] track electricity being consumed by the school and calculate the power [of] their donations" (Kshetri, 2017, p. 1711). The prospects of direct result-based blockchain funding do not stop with electricity; various other necessities such as women's sanitary products, food, water purifiers, and medicine can also be purchased for communities throughout the developing world and then analyzed online to determine the impact such donations made.

## Conclusion

The lives of billions of people now consist of a duality of online and in-person personas and interactions, while a growing population raised in the Internet-era is becoming more and more entangled with the online realm of the world. However, a divide still exists between many of those born prior to and after the first Internet revolution. While this divide currently only hinders some individuals' understanding of complex phenomena related to the pre- or post-Internet age, this divide will likely expand upon the mass acceptance of blockchain technology.

Similar to the ways the first Internet revolution eradicated or temporarily disrupted numerous long-standing industry staples, such as cable television, video stores, and print journalism, this new Internet revolution—the blockchain revolution—has the potential to make currently accepted business practices, investment patterns, and governmental processes obsolete. Blockchain technology challenges many fundamental business tactics, such as the implementation of transaction fees for customers sending or receiving money through a bank, while also offering operational cost alleviations for recordkeeping, security improvements, and so on. These multi-industry opportunities could quickly redefine the manner in which consumers interact with businesses and each other. Safeguards against fraud also yield the potential for greater global investor confidence and investment opportunities, either in the form of small startups or large publicly-trade corporations. In the last few years alone, blockchain technology investment throughout the private sector has rapidly expanded due to the increasing number of companies seeking to capitalize on the many financial opportunities presented by blockchains. The most notable companies currently investing in blockchain business integration options include: Microsoft, IBM, JPMorgan Chase, Toyota, Nasdaq, Overstock.com, and even the Long Island Iced Tea Corporation (which rebranded itself as the Long Blockchain Corporation in December 2017) (Cheng, 2017; Ervin, 2018; Fink, 2017).

However, as with numerous other technological advancements, governments have demonstrated a casual interest, at best, in investing in blockchain technologies and planning for the possibility of its widespread adoption. With the exception of the United Kingdom, China, and a small number of other states scattered across the world that are actively involved in the development of blockchains and facilitating innovative entrepreneurship opportunities for blockchain-utilizing startups, most governments have disregarded the notion that a new Internet revolution is underway (Quentson, 2016; *Regulatory Sandboxes*, 2015, pp. 2-13). Opportunities to improve numerous aspects of government in both the developing and developed worlds exist through distributed ledger technology application: land registry documentation, motor vehicle registrations, arrest records, citizenship statuses, and even laws could be digitized for blockchains. The socioeconomic growth prospects of such digitization of government records are immense. By freeing up enormous amounts of capital currently being expended for registration and documentation, funds could be distributed elsewhere within the government or to not-for-profit organizations. In conjunction with improved scrutiny of international aid from donors and other states, utilizing blockchain technology for basic government activities offers developing countries the ability to bypass current financial shortcomings and truly focus on bettering the lives of citizens. Similarly, developed countries using blockchains can generate methods to further improve government effectiveness and efficiency, while also freeing up capital to invest in development internally or abroad, providing greater benefits to citizens, or making additional payments on debts.

Whereas the first Internet revolution initially only truly benefited those with extensive wealth, most of whom lived in developed countries, this will not be the case during the blockchain revolution. Having a computer was a requirement for Internet access in the 1990s and most of the 2000s, and buying a computer was an extremely expensive endeavor; today, nearly half the world has access to the Internet in the form of fixed- or mobile-broadband and gaining access is much less costly than at the turn of the century. Specifically, global mobile-broadband subscriptions increased by about twenty percent between 2012 and 2017—subscriptions in developing countries grew by over fifty percent over the same period—mainly due to the increased affordability of mobile-broadband compared to fixed-broadband (worldwide mobile-broadband prices as a percentage of gross national income per capita dropped by about fifty percent between 2013 and 2016) ("ICT Facts and Figures 2017," 2017, pp. 4-5). As such, the opportunities for citizens of developed and developing countries to use and benefit from blockchain technology are much greater than they were at any time in the past.

In light of this, corporations and governments would be well-advised to plan for the long-term implications of the advent of blockchain—such as diminished state authority and loss of jobs to technology. Furthermore, blockchain technology can provide a welcome opportunity for fast-paced technological advancement in developing countries, which would otherwise lag further behind the developed world than ever before.

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