

# **The Impact of Blockchain on Emerging Economies**

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*The development of blockchain technology - an open distributed ledger of entries that records transactions in a permanent way without requiring third-party authentication (Marr, 2018) - and the subsequent appearance of the cryptocurrency Bitcoin in 2010 ignited a wave of investor enthusiasm and extraordinary projections for its use and impact, especially in the emerging economies. This article reviews the early expectations for blockchain in emerging economies, examines its progress in the first decade of its use, identifies implementation obstacles unique to emerging economies, and projects its most likely impact in the next decade.*

*The Covid-19 pandemic of 2020 is likely to affect the expansion of blockchain and cryptocurrencies throughout the world, including emerging economies. Some expect that blockchain will encompass sovereign currencies, with experiments in the future by China and Sweden (Canesin, 2020).*

*Keywords: Cryptocurrency, bitcoin, world economy, Covid-19, blockchain, open ledger, emerging economy, currency, finance, trade security, cash economy, costs, infrastructure.*

## **INTRODUCTION**

Bitcoin, the first and most successful cryptocurrency, captured the attention of investors and speculators around the globe, zooming from virtually no value in January, 2010 to almost \$13.803 by end of October 21, 2020. The foundation of the new currency is the electronic ledger system known as blockchain that maintains a permanent, tamper-proof record of a transaction without the need of a central authority while being equally accessible to the parties on each side of a transaction. While the future of bitcoin remains uncertain due to regulatory problems in many countries, the underlying blockchain technology is hailed as a panacea for business inefficiencies and social inequities, perhaps the vehicle to transform the economies of poor countries around the globe. The following discussion examines the claims for the technology, especially as it relates to emerging economies and the likelihood that blockchain implementation will have the hoped-for results of its proponents.

## **DISCUSSION**

### **Background**

Cryptocurrency triggered investor speculation around the world, eventually resulting in more than 2800 digital currencies with a market cap of more than \$200 billion ("All Cryptocurrencies," 2019). Bitcoin accounts for more than 60% of the total value but is unlikely to replace traditional state-sponsored currency

or long-established payment systems (DeVries, 2016), its impact being far greater due to its underlying foundation of blockchain technology.

Blockchain, a decentralized, distributed open ledger with redundant, tamper-proof entries, was quickly extended into other applications (Christidis and Devetsikiotis, 2016; Zhao, Fan, & Yan, 2016) including banking (Kraft, 2016), finance (Hyvarainen, Risius, and Friis, 2017), supply chain management (Kim and Laskowski, 2018), and copyright protection (Savelyev, 2018). The technology attracted computer scientists, business leaders, and academics, resulting in 925 published academic papers by March 25, 2019 (Xu, Chen, and Kou, 2019).

Advocates of the technology expect that emerging economies will especially benefit from blockchain's implementation. Potential uses include:

- **Water shortage.** One researcher suggested that a system of water credits and trading based on blockchain will improve water sustainability in emerging countries (Poberezhna, 2018).
- **Food safety.** In addition to water sustainability, existing blockchain technology has been adopted for traceability, information security, and manufacturing in the agri-food value chain, a critical component of emerging countries' economies (Zhao, G., et al.).
- **Finance.** Peruvian economist Hernando de Soto, claims that the poor do not lack capital, but the ability to monetize it, resulting in \$20 trillion of dead capital, the total value of the houses, small business assets, and other property that lacks formal documentation to prove ownership (de Soto, 2003). The use of an independent, immutable blockchain ledger will allow individuals to exchange assets directly without the need of possibly corrupt third-party intermediaries such as banks, big businesses, or governments (Casey, 2016). Also, use of blockchain technology protects against the failure of centralized institutions, common in emerging markets experiencing hyperinflation or broken financial institutions (Guo, 2019).
- **Trade security.** Transactions occurring through a blockchain are tamperproof and evidence of movement and ownership, a necessity in a world of trade restrictions and criminally sourced products. With less ability of third parties to subvert agreed-upon processes – reduced potential for fraud and corruption – emerging countries will benefit (Gupta, V. and Knight, R., 2017)

### **Unrealistic Expectations and Claims**

Early advocates of the technology were especially optimistic about the benefits of blockchain implementation. Computer scientists and Silicon Valley tech professionals asserted that the new technology was the breakthrough that would lead the digital revolution, concluding with the replacement of centuries-old physical systems of authentication, documentation, verification, and reporting by faster, cheaper, immutable, and transparent digital processes.

Few human activities or economies would be overlooked by the transformation, according to one proponent (Choudbury, 2018) who asserted that blockchain was “the next General Purpose Technology (GPT) like the wheel, steam engine, electricity, semiconductors and the internet” that would spread rapidly through the world. Economists and technologists forecast that its implementation will enable emerging economies to “leapfrog” more developed economies similar to Japan's competitive advantages following WWII (Gupta & Knight, 2017).

Wall Street, always on the lookout for the next Apple or Google, eagerly participated in funding the new technology, opening the purse strings for those companies associated with blockchain, no matter how tenuous the link. U.S. blockchain startups have been the biggest recipients of venture capital since 2014, drawing more than \$4.1 billion in 2018 alone (Sharif, 2019). Many like Brian Singer, Partner in the William Blair & Company global investment bank, justified their enthusiasm on moral grounds, claiming that blockchain has the ability to bring the poor out of poverty, echoing de Soto's earlier hope (Forbes, 2015).

Not everyone bought into the hype, and their skepticism seems justified:

- Two Harvard Business School professors claimed that the technology is not disruptive, but foundational, necessitating decades to seep into the economic and social infrastructure (Iansiti & Lakhani, 2017).

- Bruce Schneier, a security technologist and fellow at Harvard Law School and New America Foundation's Open Technology Institute, opined that blockchain solutions are frequently much worse than the systems they replace (Schneier, 2019).
- A Bundesbank/Deutsche Boerse trial determined that using blockchain to transfer and settle securities and cash was more costly and required more time than the banks' traditional methods. Jens Weidmann, President of Bundesbank, noted that similar trials produced the same results and stated that "a real breakthrough in [the] applications missing so far" (Look, 2019)

As a consequence of blockchain's record to date, blockchain entrepreneur and advocate Toshendra Sharma was realistic when he said, "Blockchain is a promising technology, and despite being a decade old, it has still not picked up the pace that it should have" ("Blockchain brings social benefits," n.d.)

### *Obstacles to Implementation*

Blockchain proponents, in their enthusiasm for the new technology, overlooked and under-estimated the difficulties of transforming an emerging economy. The obstacles include

- **Cash economies.** An estimated 2.5 billion people, the majority living in Africa, Asia, Latin America, and the Middle East and earning less than \$5 per day, do not use banks or financial institutions to save or borrow money, relying on cash and barter to acquire the products and services they need (Chaia, Goland, & Schiff, 2010). Ninety-four percent of transactions in these emerging markets occur with physical cash due to the mistrust of people in banks and government (Down, 2018). Transitioning the unbanked to a digital world, while a market opportunity, is a difficult cultural change.
- **Lack of Infrastructure.** Poor record-keeping is endemic in poor countries with a subsistence economy, especially in the documentation of individual identities and land ownership. Much of the citizens in an emerging economy are financially illiterate, subject to confusing laws and regulations, and lack access to a reliable power and communication networks ("4 Ways Blockchain," 2019)
- **Corruption.** Emerging economies are especially vulnerable to widespread corruption with bloated bureaucracies, excessive or indecipherable rules and regulations, and leaders actively seeking baksheesh (bribes). Economist Soto, noted for his decades-long effort to improve the poor's access to the formal economy, explains that many citizens resist modern information systems because "they [the poor] don't trust who they are giving it [personal information] to" (Casey, 2016).
- **Cultural.** A 2018 study reviewing technology acceptance, specifically blockchain adoption in the logistics and supply chain field, in India and the USA found that cultural differences create obstacles to adoption despite similar technical training in the two countries (Queiroz and Wamba, 2018.)
- **Likely job losses.** The inefficiency accompanying traditional business practices in an emerging economy provides employment to large numbers of people who might otherwise be unemployed. Blockchain is likely to eliminate many of a country's existing jobs, idling thousands of government and industry jobs. Blythe Masters, CEO of Digital Asset Holdings, speaking at the 2017 Blockchain Summit, estimated that "30%-60% of jobs could be rendered redundant by the technology (del Castillo, 2017)
- **Competitive Solutions.** M-Pesa, a proprietary mobile payment system created in 2007 (Monks, 2017), dominates the market in Kenya and Tanzania without a blockchain solution. In addition, a new form of distributed ledger eliminating blockchain's need for external verification (IOTA) may be a better blockchain without its inefficiencies (Krishnakumar, 2017). As far as blockchain's competitive superiority, Erik Brynjolfsson of MIT notes that while blockchain is an intellectually interesting technology, but questions if it can solve problems better than "good old, public-key cryptography plus a traditional database or ledger" ("Will Blockchain Transform, 2019).

- **Excessive costs.** Researchers Choi and Luo found the lack and unreliability in the fashion supply chains of emerging countries would benefit from blockchain implementation, but was likely to reduce profitability. They propose that government sponsorship will be required in addition to favorable tax treatment to overcome the cost additions (Choi, T. and Luo, S., 2019).

### Existing Applications

While the impact of blockchain to date has been less than expected by its most ardent supporters, the technology has generated positive results in several instances, including projects in emerging countries:

- **Maersk.** The giant shipping firm completed a 20-week proof of concept (POF) to streamline insurance with a blockchain developed by Guardtime (Maxie, 2018). The company also announced a joint venture with IBM and 94 participating organizations to develop TradeLens, a blockchain shipping solution (“Maersk and IBM,” 2018). By mid-2019, five of the world’s six largest carriers with more than one-half of the world’s ocean container cargo had joined the platform (Maersk, 2019).
- **Walmart.** In partnership with IBM, the retail giant completed a 30-day POF to reduce the tracking time of produce from the field to store shelves, cutting the time from six days to 2.2 seconds (McKenzie, 2018). The two companies are also participating with China to create the Blockchain Food Safety Alliance (Aitken, 2017). In 2019, Walmart partnered with Price WaterhouseCoopers (PWC) and VeChain to allow source tracking of food products (Forkast News, 2020).
- **MasterCard.** At the end of 2017, the company offered banks and merchants access to its proprietary blockchain for paying for goods and services (Wieczner, 2017). In 2020, Mastercard granted Wirex, a cryptocurrency platform, allowing cryptocurrencies use as payment (Mastercard, 2020).
- **De Beers Group.** The world’s most famous diamond company developed and is using its own blockchain (Tracr) to allay concerns of blood diamonds by establishing a digital record for every diamond registered on the platform (“De Beer tracks,” 2018).

While blockchain has yet to transform an emerging economy, there are a number of successful projects to date, including:

- **Mumbai and Visakhapatnam seaports.** Two of India’s largest ports are using the blockchain to track incoming shipments and shippers while ensuring that shipping-related payments reach the right parties. Mumbai Port Trust projects savings of more than \$18 billion over two years as a consequence (Haridas, 2018).
- **Andhra Pradesh.** This Indian state has introduced two blockchain projects, one dealing with land records and the second with vehicle registrations. The state’s chief minister Chandrababu Naidu announced plans to make the capital city of Visakhapatnam India’s center of blockchain technologies (Sinha, 2018).
- **Refugee camps, Jordan.** The World Food Programme used blockchain for authenticating and registering beneficiary transactions for over 100,000 people living in two refugee camps in Jordan. People living in the camps can purchase groceries by eye scans at checkout with cash transferred from a beneficiary ‘account’ maintained on the blockchain to the beneficiaries or to the retailers through a commercial financial service provider. (World Food Programme, 2020).
- **Estonia.** The country’s E-Citizenship Program maintains citizen information on a blockchain. The program allows people around the globe to become E-residents, establish a company, and do business in the European Union (Rinne, 2018).
- **Peru.** The government of Peru recently announced that it has partnered with blockchain startup Stamping.io to build a fully transparent, contract-procurement system based on LAC-Chain, a multi-country blockchain ecosystem led by the Inter-American Development Bank (the primary source of multilateral financing in Latin America) (Kantz, 2019).

- **Twiga Foods.** This Nairobi-based business-to-business platform logistics company and IBM developed a blockchain-enabled micro-finance program that verifies the identity and creditworthiness of owners of kiosks and food stalls across Africa (Kinai, 2018).

### **Covid-19 Impact**

The Coronavirus and its economic devastation intensified the transformation to a digital world, exposing new risks and the failures of traditional systems in industries ranging from healthcare to distribution. Institutional trust has declined, as nationalism complicates international alliances and supply lines, escalating the need for reliability and trustworthiness (Kalla, Hewa, Ylianttila, and Mishra, 2020). The Financial News of London proclaimed that the crisis is an opportunity to build a “Blockchain Big Society” (Rutter, 2020).

The consequences of Covid-19 on the efforts of emerging countries to continue the pace of their blockchain programs is unknown. The virus has hit emerging economies especially hard, tightening financial conditions and restricting liquidity (Haroon and Rizvi, 2020). Simultaneously, pressure to continue blockchain development is increasing due to a greater use of cryptocurrency (“Has Covid-19 Helped,” 2020), the need for reliable Covid-19 tracking system (Marbouc, D, et. al., 2020), and the devastation of worldwide supply chains (Dickson, 2020). Public health officials Mashamaba-Thompson and Crayton recently recommended a low cost blockchain and artificial intelligence-coupled self-testing and tracking systems for COVID-19 and other emerging infectious diseases, stating that prompt deployment and implementation has the potential to curb the transmissions of COVID-19 and the related mortalities, particularly in settings with poor access to laboratory infrastructure, i.e., emerging countries (Mashamba-Thompson and Crayton, 2020).

### **CONCLUSION**

In a poll of 25 technology experts by MIT in early 2019, more than one-half believe that the transforming impact of blockchain is at least five to ten years in the future. In the same poll, about one-quarter of the experts believe that the economic world will be significantly transformed in the next five years (“Will Blockchain Transform,” 2019)

Our research suggests that those who doubt a significant short-term impact from the implementation of blockchain will be proven correct, especially regarding its impact on emerging economies. In the latter case, the obstacles are simply too embedded, too intractable, and too prevalent to vanish during the next decade.

Blockchain applications will continue to multiply, though possibly slowed in emerging economies due to Coronavirus. For example, the use of smart contracts to ensure contract compliance before payment will become common in the industrialized and emerging economies. The technology is certainly an improvement over traditional electronic ledger systems, but, in the words of economist R. Preston McAfee, “Blockchain is a distributed ledger. Ledgers matter and are valuable, but hardly transformative against existing technology” (“Will Blockchain Transform,” 2019).

### **REFERENCES**

- Aitken, R. (2017). *OMB & Walmart Launching Blockchain Food Safety Alliance in China with Fortune 500's JD.com*. Retrieved from <https://www.forbes.com/sites/rogeraitken/2017/12/14/ibm-walmart-launching-blockchain-food-safety-alliance-in-china-with-fortune-500s-jd-com/#600509bc7d9c>
- All Cryptocurrencies. (2019). Retrieved from <https://www.investing.com/crypto/currencies>
- Building Blocks: Blockchain for Zero Hunger. (2020). *World Food Programme*. Retrieved from <https://innovation.wfp.org/project/building-blocks>
- Can blockchain guarantee food safety in China? (2020, April 8). *Forkast News*. Retrieved from <https://forkast.news/china-blockchain-report-food-safety/>

- Canesin, F. (2020, May 21). *How COVID-19 Is Impacting Blockchain and Cryptocurrency*. SupplyChainBrain. Retrieved from <https://www.supplychainbrain.com/blogs/1-think-tank/post/31351-the-impact-of-covid-19-on-blockchain-and-cryptocurrency>
- Casey, M. (2016). Could blockchain technology help the world's poor? Retrieved from <https://www.weforum.org/agenda/2016/03/could-blockchain-technology-help-the-worlds-poor/>
- Chaia, A., Goland, T., & Schiff, R. (2010). Counting the world's unbanked. Retrieved from <https://www.mckinsey.com/industries/financial-services/our-insights/counting-the-worlds-unbanked>
- Choi, T., & Luo, S. (2019, November). Data quality challenges for sustainable fashion supply chain operations in emerging markets: Roles of blockchain, government sponsors and environment taxes. *Transportation Research Part E: Logistics and Transportation Review*, 131, 139-152.
- Choudhury, K. (2018). What Blockchain Means for Developing Countries. Retrieved from <https://medium.com/swlh/what-blockchain-means-for-developing-countries-1ec25a416a4b>
- Christidis, K., & Devetsikiotis, M. (2016). Blockchains and smart contracts for the internet of things. Retrieved from <https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7467408>
- De Beers tracks diamonds through supply chain using blockchain. (2018). Retrieved from <https://af.reuters.com/article/investingNews/idAFKBN1IB1DU-OZABS>
- Del Castillo, M. (2017). Threat or Opportunity? Blythe Masters Talks Blockchain Jobs Impact. Retrieved from <https://www.coindesk.com/threat-opportunity-blythe-masters-addresses-blockchain-jobs-impact>
- DeVries, P. (2016). An Analysis of Cryptocurrency, Bitcoin, and the Future. Retrieved from [https://www.researchgate.net/publication/316656878\\_An\\_Analysis\\_of\\_Cryptocurrency\\_Bitcoin\\_and\\_the\\_Future](https://www.researchgate.net/publication/316656878_An_Analysis_of_Cryptocurrency_Bitcoin_and_the_Future)
- Dickson, I. (2020, June 1). *Life after COVID-19: is blockchain the key to supply chain efficiency?* Here360.com. Retrieved from <https://360.here.com/life-after-covid-19-is-blockchain-the-key-to-supply-chain-efficiency>
- Down, M. (2018). How Blockchain Technology Can Serve Emerging Markets. Retrieved from <https://hackernoon.com/how-blockchain-technology-can-serve-emerging-markets-a7585ca2ff43>
- Forbes, S. (2015). How Bitcoin Will End World Poverty. Retrieved from <https://www.forbes.com/sites/steveforbes/2015/04/02/how-bitcoin-will-end-world-poverty/#15fa5d992a5a>
- 4 Ways Blockchain can Power Developmental Growth in Emerging Economies. (2019). Retrieved from <https://www.chipin.com/blockchain-powers-growth-emerging-economies/>
- Gupta, V., & Knight, R. (2017, May 17). How Blockchain Could Help Emerging Markets Leap Ahead. *Harvard Business Review*. Retrieved from <https://hbr.org/2017/05/how-blockchain-could-help-emerging-markets-leap-ahead>
- Haridas, S. (2018). This Indian City Is Embracing Blockchain Technology - - Hers's Why. Retrieved from <https://www.forbes.com/sites/outofasia/2018/03/05/this-indian-city-is-embracing-blockchain-technology-heres-why/#4ca5225b8f56>
- Haroon, O., & Rizvi, S. (2020, July 25). Flatten the Curve and Stock Market Liquidity – An Inquiry into Emerging Economies. *Emerging Markets Finance and Trade*, 56(10). Retrieved from <https://www.tandfonline.com/doi/full/10.1080/1540496X.2020.1784716>
- HAS COVID-19 HELPED OR HARMED CRYPTO AND BLOCKCHAIN? (2020). Retrieved from <https://mindmatters.ai/2020/10/has-covid-19-helped-or-harmed-crypto-and-blockchain/>
- How the Blockchain Rings Social Benefits to Emerging Economies. (2018). Retrieved from <https://knowledge.wharton.upenn.edu/article/blockchain-brings-social-benefits-emerging-economies/>
- Hyvarinen, H., Risius, M., & Friis, G. (2017). *A Blockchain-based approach towards overcoming financial fraud in public sector services*. Retrieved from <https://espace.library.uq.edu.au/view/UQ:7192e96>

- Kalla, A., Hewa, T., Mishra, R., Ylianttila, M., & Liyanage, M. (2020). The Role of Blockchain to Fight against COVID-19. *IEEE Engineering Management Review*. 10.1109/EMR.2020.3014052.
- Kim, H.M., & Laskowski, M. (2018). Toward an Ontology-Driven Blockchain Design for Supply-Chain Provenance. Retrieved from <https://arxiv.org/ftp/arxiv/papers/1610/1610.02922.pdf>
- Kinai, A. (2018). IBM and Twiga Foods Introduce Blockchain-Based Microfinancing for Food Kiosk Owners in Kenya. Retrieved from <https://www.ibm.com/blogs/research/2018/04/ibm-twiga-foods/>
- Kraft D. (2016). Difficulty Control for Blockchain-Based Consensus Systems. Retrieved from <https://allquantor.at/blockchainbib/pdf/kraft2016difficulty.pdf>
- Krishnakumar, A. (2017). IOT Meets DLT and Blockchain meets M-Pesa in Africa. Retrieved from <https://dailyfintech.com/2017/03/24/iot-meets-dlt-and-blockchain-meets-m-pesa-in-africa/>
- Lanz, J. (2019, May 4). Peru sets its eyes on blockchain to fight government corruption. *Decrypt.com*. Retrieved from <https://decrypt.co/6893/peru-blockchain-government-corruption>
- Look, C. (2019). Blockchain Settlement Was Slow, Costly in Trial, Weidman Says. Retrieved from <https://www.bloomberg.com/news/articles/2019-05-29/blockchain-settlement-was-slow-costly-in-trial-weidmann-says>
- Maersk and IBM Introduce TradeLens Blockchain Shipping Solution. (2018). Retrieved from <https://www.maersk.com/news/2018/06/29/maersk-and-ibm-introduce-tradelens-blockchain-shipping-solution>
- Marbough, D., Abbasi, T., Maasmi, F., et al. (2020). Blockchain for COVID-19: Review, Opportunities, and a Trusted Tracking System. *Arab J Sci Eng*. <https://doi.org/10.1007/s13369-020-04950-4>
- Marr, B. (2018). A Very Brief History of Blockchain Technology Everyone Should Read. Retrieved from <https://www.forbes.com/sites/bernardmarr/2018/02/16/a-very-brief-history-of-blockchain-technology-everyone-should-read/#7c2d5e267bc4>
- Mashamba-Thompson, T.P. (2020). Crayton ED. Blockchain and Artificial Intelligence Technology for Novel Coronavirus Disease 2019 Self-Testing. *Diagnostics*, 10(4), 198.
- Mastercard Accelerates Crypto Card Partner Program, Making it Easier for Consumers to Hold and Activate Cryptocurrencies. (2020). Retrieved from <https://investor.mastercard.com/investor-news/investor-news-details/2020/Mastercard-Accelerates-Crypto-Card-Partner-Program-Making-it-Easier-for-Consumers-to-Hold-and-Activate-Cryptocurrencies/default.aspx>
- Maxie, E. (2018). Blockchain Applications: 7 Real-World Blockchain Examples. Retrieved from <https://www.verypossible.com/blog/7-examples-of-real-world-blockchain-examples>
- McKenzie, J. (2018). Why blockchain won't fix food safety—yet. Retrieved from <https://newfoodeconomy.org/blockchain-food-traceability-walmart-ibm/>
- Poberezhna, A. (2018). Addressing Water Sustainability With Blockchain Technology and Green Finance. Transforming Climate Finance and Green Investment with Blockchains. *Blockchain Climate Institute*, pp. 189-196.
- Queiroz, M., & Wamba, S. (2018). Blockchain adoption challenges in supply chain: An empirical investigation of the main drivers in India and the USA. *International Journal of Information Management*, 46, 70-82.
- Rinne, A. (2018). One of Estonia's first "e-residents" explains what it means to have digital citizenship. Retrieved from <https://qz.com/work/1241833/one-of-estonias-first-e-residents-explains-what-it-means-to-have-digital-citizenship/>
- Rutter, D. (2020, August 18). The Covid-19 crisis is an opportunity to build a 'Blockchain Big Society.' *Financial News of London*. Retrieved from <https://www.fnlondon.com/articles/the-covid-19-crisis-is-an-opportunity-to-build-a-blockchain-big-society-20200818>
- Savelyev, A. (2018). Copyright in the blockchain era: promises and challenges. Retrieved from <https://wp.hse.ru/data/2017/11/21/1160790875/77LAW2017.pdf>
- Sharif, O. (2019). Smart Money Said 'Skip Bitcoin, Bet on Blockchain. Retrieved from <https://www.bloomberg.com/news/articles/2019-07-17/smart-money-said-skip-bitcoin-bet-on-blockchain-not-any-more>

- Sharma, K. (2019). *Blockchain brings social benefits to emerging economies*. Retrieved from <https://www.blockchain-council.org/blockchain/blockchain-brings-social-benefits-to-emerging-economies/>
- Sinha, S. (2018). *How Andhra Pradesh is emerging as India's blockchain hub*. Retrieved from <https://analyticsindiamag.com/how-andhra-pradesh-is-emerging-as-indias-blockchain-hub/>
- TradeLens blockchain-enabled digital shipping platform continues expansion with addition of major ocean carriers Hapag-Lloyd and Ocean Network Express. (2019) Retrieved from <https://www.maersk.com/news/articles/2019/07/02/hapag-lloyd-and-ocean-network-express-join-tradelens>
- Wieczner, J. (2017). *MasterCard Will Now Let You Pay with Blockchain-But Not Bitcoin*. Retrieved from <https://fortune.com/2017/10/20/mastercard-blockchain-bitcoin/>
- Will Blockchain Transform Emerging Markets. (2019) Retrieved from <https://sloanreview.mit.edu/strategy-forum/will-blockchain-transform-emerging-markets/>
- Xu, M., Chen, X., & Kou, G. (2019). A systematic review of blockchain. *Financ Innov.*, 5(27). <https://doi.org/10.1186/s40854-019-0147-z>
- Zhao, G., Liu, S., Lopex, C., Lu, H., Elgueta, S., Huilan, C., & Boshkoska, B. (2019, August). Blockchain technology in agri-food value chain management: A synthesis of applications, challenges and future research directions. *Computers in Industry*, 109, 83-99.
- Zhao, J.L., Fan, S., & Yan, J. (2016). *Overview of business innovations and research opportunities in blockchain and introduction to the special issue*. Retrieved from <https://jfin.swufe.springeropen.com/articles/10.1186/s40854-016-0049-2>