

Blockchain Technology in Business and Information Systems Research

Roman Beck · Michel Avital · Matti Rossi ·
Jason Bennett Thatcher

© Springer Fachmedien Wiesbaden GmbH, part of Springer Nature 2017

1 Background and Aspirations

The blockchain is a distributed ledger technology in the form of a distributed transactional database, secured by cryptography, and governed by a consensus mechanism. A blockchain is essentially a record of digital events. However, it is not “just a record,” since it can also contain so-called smart contracts, which are programs stored on the blockchain that run as implemented without any risk of downtime, censorship, or fraud (Buterin 2014). While blockchain is now seen mostly as the technology enabling cryptocurrencies such as Bitcoin, it will most likely become an even more valuable enabler of economic and social transactions, for instance as a general purpose digital asset ownership record (Lindman et al. 2017). This is because the distributed transaction data and cryptographic logic that lies at the blockchain’s core make it extraordinarily tamper-resistant.

The implications of creating a reliable, trustworthy distributed record system, or ledger, may be fundamental to how we organize interpersonal and interorganizational

relationships. The global economic system depends on that individuals and organizations trust other entities to create, store, and distribute essential records. For example, banks construct and maintain the financial records, hospitals construct and maintain health records, and universities construct and maintain education records. Often, records central to our health, social, or professional lives are key records either constructed or maintained by third parties. Such third-party record repositories can be vulnerable to corruption by failure in storage systems or human mischief, which could be mitigated by unbiased and incorruptible blockchain-based digital systems (Nærland et al. 2017).

The financial sector leads the way in developing blockchain applications and business models; but also companies in industries from shipping and transportation to healthcare and entertainment are actively using blockchain applications to coordinate the movement of products, facilitate the creation of e-health records, and to securely manage original entertainment content. While substantial activity exists in practice, less academic research has examined the implications of blockchain for how we organize contemporary economies, society or organizations.

In this special issue, we present early research results that investigate the positive implications of blockchain for modern organizations, specifically in the financial services industry or to manage physical asset ownership. However, the range of potential blockchain applications goes further to cover a multitude of business and social arrangements from tracking shipping containers and pharmaceuticals to recording gambling winnings and marriages based on smart contracts embedded in blockchain applications.¹

Prof. Dr. R. Beck (✉)
IT University of Copenhagen, Copenhagen, Denmark
e-mail: beek@itu.dk

Prof. Dr. M. Avital
Copenhagen Business School, Copenhagen, Denmark
e-mail: michel@avital.net

Prof. Dr. M. Rossi
Aalto University, Aalto, Finland
e-mail: matti.rossi@aalto.fi

Prof. Dr. J. B. Thatcher
Clemson University, Clemson, USA
e-mail: jthatch@clemson.edu

¹ <http://www.coindesk.com/prenup-ethereum-marriage-obligations/>.

2 The Special Issue

This BISE special issue was conceived during the first-ever summer school on blockchain² that was organized in Copenhagen in summer 2016 and refined based on the results of a panel on the blockchain in Information Systems (IS) research at the International Conference on Information Systems in Dublin (Avital et al. 2016). We envisaged the special issue as an outlet for emergent papers on blockchain and distributed ledger technology. The call for papers invited both conceptual and empirical studies, including design science research papers and demonstrations of technology in use.

Five out of the 15 articles that were submitted to the special issue were accepted after an accelerated review process. The papers represent the collaborative work among authors, reviewers, and editors. We are grateful to all those involved for their respective efforts and contributions.

The first paper, “A Blockchain Research Framework: What we (don’t) know, where we go from here, and how we will get there” by Marten Risius and Kai Spohrer presents a blockchain research framework that structures insights of current research, outlines present research scope, including overlooked topics, and sketches out interdisciplinary research approaches. The paper also offers a systematic survey of IS literature to present an overview where current blockchain research in information systems stands.

The second paper, “KYC Optimization Using Distributed Ledger Technology” by Omri Ross and José Parra Moyano proposes a blockchain based approach to solving know-your-customer (KYC) problems of banks. This idea of using a single KYC verification for multiple financial institutions is an elegant and effective solution for an expensive burden for banks. It provides an easily verifiable audit trail and thus enables better transparency for the process. This suggested approach can benefit both financial institutions and their customers.

The third paper, “Trading Real-World Assets on Blockchain—An Application of Trust-Free Transaction Systems in the Market for Lemons”, by Benedikt Notheisen, Jacob Benjamin Cholewa, and Arun Prasad Shanmugam describes a proof-of-concept prototype for trading used cars, implemented in a design research approach. The market for used cars is an interesting domain, since the promised blockchain-based “record of vehicle history to market participants, authorities, and other third parties” is a useful application of blockchain technology that helps to mitigate the information imbalance problem. Used cars are a prime example of a good that evolves (or disintegrates)

over time and where it is of vital importance to be able to track the history of the asset and its ownership. Furthermore, this kind of record can help fight insurance fraud and scrapping of stolen cars for parts.

The fourth paper, “A Blockchain Based Approach towards Overcoming Financial Fraud in Public Sector Services” by Hissu Hyvärinen, Marten Risius, and Gustav Friis presents a blockchain based solution for overcoming tax fraud in cross-border payments of dividends. They propose a solution in which a blockchain keeps track of where and when taxes have been paid to on the one hand avoid double taxation and on the other hand avoid tax evasion.

The fifth paper, “Automated Execution of Financial Contracts on Blockchains” by Benjamin Egelund-Müller, Martin Elsmann, Fritz Henglein, and Omri Ross, presents a domain-specific modeling language based approach for financial contracts. The language allows for the specification of complex rules and their automated execution and checking. The paper presents a demonstration of how this can be implemented on the Ethereum blockchain.

As a whole, the papers provide a state-of-the-art snapshot of the blockchain research and present a portfolio of nascent blockchain applications that illustrate the technology’s potential. As the use cases in this special issue show, blockchain promises to make asset transactions and ownership much more transparent and easier to track over time. We believe that these are just harbingers of the future of the technology.

3 The Future of Blockchain in IS Research

If the blockchain lives up to its promised potential, it will deliver to the digital world a new level of objectivity and trust that even known reputable trustees will not be able to match. In other words, it could provide a decentralized global information infrastructure in which no one is in full control, no one has absolute power, and no one can distort or lie about past or current events.

Early technical research on blockchain suggests that realizing this vision of decentralized information sharing is possible, as suggested by the first article of this special issue, which echoes technical research in the area (see Yli-Huuma et al. 2016). Perhaps, due to the promise of this nascent vision, researchers and practitioners are jumping on the blockchain bandwagon with some revolutionaries trying to realize a vision of a decentralized brave new world characterized by cryptocurrencies, post-national economic institutions, and truly global data repositories. At the same time, incumbents have geared up to fight back and defend their turf, by contributing to the development of new public and private blockchain applications in

² <http://ebccenter.eu/summer-school/>.

industries such as financial services, supply chain management and more (Beck and Müller-Bloch 2017).

Hence, there remain many avenues for IS research, particularly sociotechnical research, on the development and implications of the blockchain for individuals, organizations, and society. Because most of the extant research focuses on platform features and use cases, there is a real need for the field to dwell on the societal implications of the technology and changes brought by the use cases to incumbent business models. The following is a short list of potential topics for further research based on the articles in this special issue and existing conceptual work on blockchain research (Avital et al. 2016; Beck et al. 2016; Lindman et al. 2017).

- New business models and disruption of prevailing models caused by blockchain
- New payment and smart contract platforms
- New types of implementations of trust for better scaling and energy efficiency
- Technical, societal and environmental sustainability of blockchain applications
- Transformation of old currencies to digital currencies
- Standards and interfaces related to blockchain
- Organizational implications of blockchain and distributed ledgers
- Novel approaches to development of blockchain applications
- Actors, such as new intermediaries, in blockchain value chains
- Blockchain developers and communities
- Relationship and interplay of open source and blockchain technology
- Internet of Things applications of blockchain
- Legal issues with smart contracts and blockchain platforms
- Challenges of implementing business logic in smart contracts
- Limits of blockchain applications in large distributed transaction systems

Blockchain evangelists and developers have been criticized for expressing overly optimistic views heavily laden with technological determinism. Instead of liberating society from costly third parties and providing individuals with better control over their private records, critics argue that blockchain technology may end up limiting our freedom to make decisions by forging uncontrollable immutable record trails that cannot be amended or purged. One could envision a dystopian future where, because every event is recorded with precision, actors may lack the freedom to reinterpret events or change their views, essential elements necessary to overcome differences of opinion in human relationships. In such circumstances, the infusion of blockchain technology

may have undesirable economic, social, and ecological effects that are unprecedented.

Therefore, we believe that a more critical perspective on blockchain are necessary. For example, we urge further research on mitigating the risks of blockchain and on the unintended consequences of the technology, including its long-term as well as secondary and tertiary effects. We also call for further research on the effects of blockchain technology on established markets and the livelihood of communities that are dependent on these markets. For example, will blockchain disrupt markets, where socially negotiated value, human capital, and less quantifiable aspects of economies provide the essential lubricant necessary to complete transactions and build relationships? Further, there is a need to understand the ecological implications of powering an expanding network of compute ability required to sustain blockchains. For example, mining bitcoins requires a surprising and ever-growing amount of energy (Vranken 2017). Subsequently, we see a need to study the potential effects of the technology on the distribution of wealth, prevailing social arrangements, and geopolitical balance.

4 Conclusions

The special issue assembles the first batch of IS research papers on blockchain technology. We believe that the research portfolio provides a springboard for aspiring IS researchers to start new research on the topic. The various examples of the use of blockchain in different industries demonstrate the broad applicability of the technology. It is clear that the technology holds great potential for facilitating complex financial transactions and cross-border money transfers. Furthermore, the possibilities of distributed ledgers that track ownership of different kinds of assets will become very valuable in the future when the blockchain standards and infrastructure have developed and matured. There is already now great interest in tracking real-world assets in international shipping, where the needs of traders, shippers, financiers, insurers, and regulators can be met through this technology. Now, as the blockchain technology and platforms are making headway in business and society, is a great time to start IS research programs on the implications and possibilities of this groundbreaking technology.

References

- Avital M, Beck R, King J, Rossi M, Teigland R (2016) Jumping on the blockchain bandwagon: lessons of the past and outlook to the future. In: Proceedings of the 37th International conference on information systems, Dublin

- Beck R, Müller-Bloch C (2017) Blockchain as radical innovation: a framework for engaging with distributed ledgers as incumbent organization. In: Proceedings of the 50th Hawaii international conference on system sciences, Big Island
- Beck R, Czepluch JS, Lollike N, Malone SO (2016) Blockchain—the gateway to trust-free cryptographic transactions. In: Proceedings of the 24th European conference on information systems, Istanbul
- Buterin V (2014) Ethereum white paper. http://www.the-blockchain.com/docs/Ethereum_white_paper-a_next_generation_smart_contract_and_decentralized_application_platform-vitalik-buterin.pdf. Accessed 23 Sep 2017
- Lindman J, Tuunainen VK, Rossi M (2017) Opportunities and risks of blockchain technologies—a research agenda. In: Proceedings of the 50th Hawaii international conference on system sciences, Big Island
- Nærland K, Müller-Bloch C, Beck R, Palmund S (2017) Blockchain to rule the waves—nascent design principles for reducing risk and uncertainty in decentralized environments. In: Proceedings of the 38th International conference on information systems, Seoul, forthcoming
- Vranken H (2017) Sustainability of bitcoin and blockchains. *Curr Opin Environ Sustain* 28:1–9
- Yli-Huumo J, Ko D, Choi S, Park S, Smolander K (2016) Where is current research on blockchain technology? A systematic review. *PloS one* 11(10):e0163477