

Enterprise Blockchains: Eight Sources of Business Value and the Obstacles in their Way

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For enterprises, blockchain applications potentially offer a number of advantages relative to today's centralized systems. Specifically, blockchain applications promise a significant amount of business value, including transacting directly with trading partners, eliminating the need for reconciliations, instantly tracking and tracing assets, providing data provenance, settling transactions quickly and cheaply, controlling identity better, and enabling a security model that is fault tolerant, resilient, and available. However, the technology is immature. Enterprises need to overcome significant obstacles to transition more blockchains out of innovation labs into live production.

Blockchains for Business: Hype or Reality?

Blockchain evangelists espouse that blockchains will radically change the economic, social, and political landscape of our world, in much the same way that the Internet has already done so. For example:

"I believe that Blockchain will do for trusted transactions what the Internet has done for information." — Ginni Rometty, CEO of IBM in 2017¹

"The blockchain cannot be described just as a revolution. It is a tsunami-like phenomenon, slowly advancing and gradually enveloping everything along its way by the force of its progression." — William Mougaya, Founder of the Token Summit and author of *The Business Blockchain*²

Blockchain dissenters—represented by the two quotes below—counter that blockchains are over-hyped:

"If someone tells you that the invention of the blockchain can be compared with the invention of the Internet in terms of importance, be skeptical." — Alexey Malanov, Malware Expert, Kaspersky Lab³

"The current blockchain landscape is clearly shaping up to be the tsunami of hype cycles in the technology field. Many of the claims and use cases assigned to Blockchain by its proponents are, on their face, overly hyped and destined to fail. I hear these claims repeated by large numbers of people, many of them with little or no technical experience." — Arthur J. Riel, Director, Middleware Engineering and Rapid App Development, The World Bank in 2017⁴

Which set of quotes is more telling? My colleagues and I have been studying the space for two years. We've interviewed executives from 30 enterprises developing blockchain applications, administered two surveys, and used participant observation to investigate blockchain adoption journeys. Our multi-year research project seeks to understand how enterprises are building blockchain-based business applications that promise to deliver real business value. We investigated the challenges faced and the practices necessary to overcome these challenges. We have dozens of case vignettes on companies like BNP Paribas, Deloitte, KPMG, Capgemini, IBM, LO3 Energy, Moog Aircraft, State Street, Stellar, and Wipro representing a wide variety of industries, enterprise types, and development stages. The results are published in Lacity, M. (2018), *A Manager's Guide to Blockchains for Business*, SB Publishing. In this article, we focus on the status of enterprise blockchains and the potential business value that inspires enterprises to overcome the obstacles to delivery.

Wading through the arguments and evidence, we grant that as we hit the middle of 2018, blockchains for business are indeed following a traditional technology hype cycle. We've learned that despite the billions of dollars in blockchain investments worldwide⁵, the thousands of proofs-of-concepts across all industries, and the high-profile groups working to define standards and to develop code, there were very few enterprise blockchain applications in live production by year-end 2017. According to a study by TCS, between 70 and 80 percent of blockchain proof-of-concepts (POC) fail to meet their goals.⁶ A 4th quarter 2017 study of 200 blockchain projects by HfS found that only 5 to 10 percent of blockchain pilots were progressing to production.⁷

Despite the current status, we remain bullish on blockchains; we assert that high levels of experimentation, early failures and slower-than-expected-progress are absolutely normal for an emerging technology. The code bases upon which enterprise applications are built have only been released in the last year or two, and most are still in Version 1.X, including Hyperledger Fabric, Quorum, Chain, and Multichain. If blockchains are following the normal hype cycle (and we believe that they are), upgraded versions of the technologies will be released, the market producers will consolidate, and enterprises will apply the lessons learned from the experimental phase to deliver real business value.

Our research helps map the terrain. We've identified eight significant sources of business value from a blockchain network that keep enterprises committed to their adoption journeys despite obstacles like technical immaturity, the organizational mindshifts required, the lack of standards, and regulatory uncertainty. This article provides a quick functional overview of a blockchain network so that readers can appreciate the eight sources of value. We then summarize the major obstacles enterprises must overcome to put more blockchain applications into production.

Enterprise Blockchains Explained

The best way to understand a blockchain application's potential business value is to compare it to the systems we have today. Let's use a simple scenario. Suppose four enterprises transact with each other (see left side of Figure 1). The four trading partners face counter-party risks—the risk each party bears that the other party will not fulfill its contractual obligations. Trading partners pay fees to a trusted third party (TTP)—perhaps a bank, a certificate authority, or a credit card

company—to mitigate such risks. The TTP performs many vital functions to facilitate trades, such as verifying asset ownership & asset authenticity and ensuring that accounts are funded to prevent double spending. However, today’s ecosystem comes with some serious limitations.

In today’s business world, each party in this scenario maintains their own systems to record debits and credits on their private ledgers, which means there are multiple versions of the truth, leading to disputes that require expensive reconciliations that cause slow settlement times. Each party can only see the transactions coming in and out of its own organization...the rest are opaque. Each party spends significant resources protecting their IT perimeters against cybersecurity attacks. The result: today’s trading ecosystems have high transaction fees, slow settlement times, low transaction transparency, and high security vulnerabilities. Blockchain applications aim to overcome these limitations.

Before blockchains: every organization has their own ledger and relies on a trusted third party:

After a blockchain: every participating organization has an identical copy of a shared ledger and transacts directly

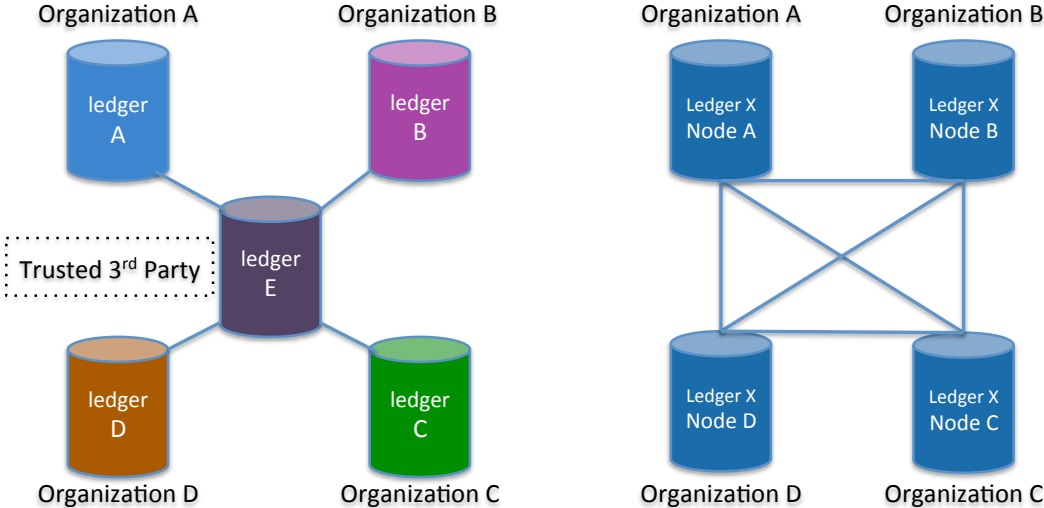


Figure 1: Multiple-centralized systems vs. a shared blockchain application

Now assume the four trading partners agree to participate in shared blockchain network (see the right side of Figure 1). In our simplest blockchain model, each party would operate an independent node in the network. Each node runs the same software and has an identical copy of a shared distributed ledger. No party is in control. No party can alter records after they are validated and recorded on the shared distributed ledger, a property known as immutability.

Because this is a blockchain for business example, we need to add two features to our baseline scenario. Enterprises need to know the identities of their trading partners and therefore want some control over who participates in the blockchain network. Enter the concept of permissioned blockchains. **Permissioned blockchains** rely upon a front-end gatekeeper to enforce the rights

of access (see Figure 2). Unlike a trusted-third party that sits in the middle of transactions, the gatekeeper is like a security guard that checks a badge before allowing entry. It has no ability to alter the ledger.⁸

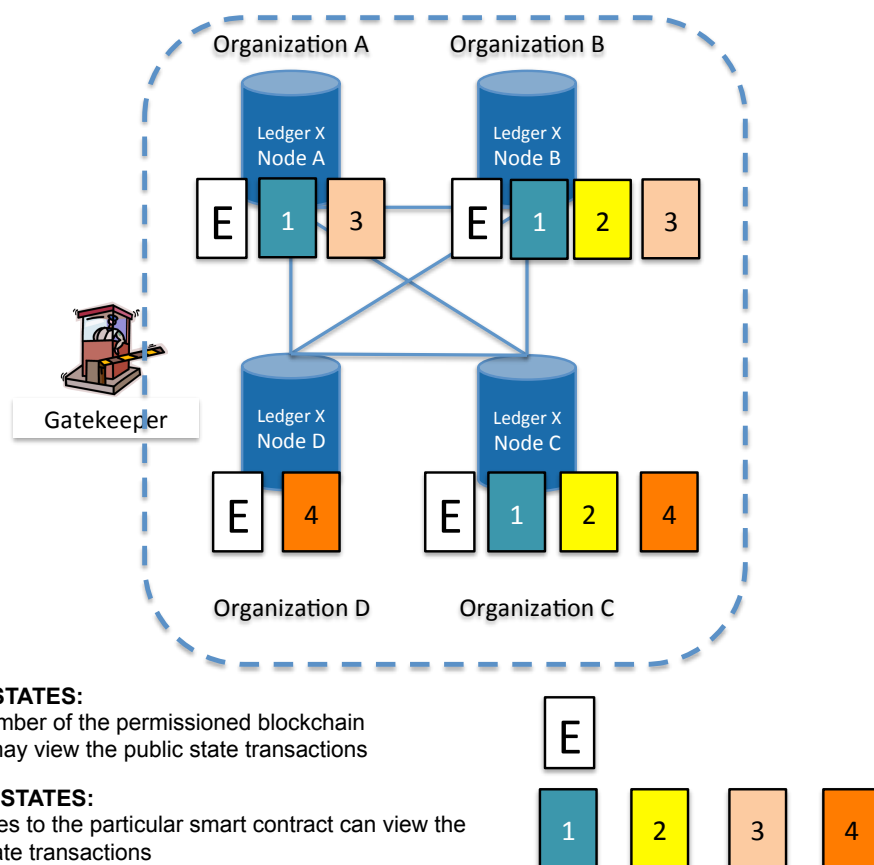


Figure 2: A permissioned blockchain restricts access and nuances read/write access using smart contracts

Organization A is party to smart contracts 1 and 3, but cannot observe smart contracts 2 and 4; Organization B is party to smart contracts 1, 2, and 3 but cannot observe smart contract 4; Organization C is party to smart contracts 1, 2, and 4 but cannot observe smart contract 3; Organization D is part to smart contract 4 but cannot observe smart contracts 1,2, and 3.

Enterprises are also concerned about confidentiality—they only want certain participants to see certain transactions. Enter the concept of smart contracts. **Smart contracts** are pieces of software code that execute the terms of particular agreements among all or a subset of participants within a blockchain network. Smart contracts provide a way to partition the shared ledger so that only parties that are privy to a particular agreement can read or write transactions. Permissioned blockchains thus end up with public states that all authorized participants in a network can observe and private states that only those who are privy to a particular smart contract can observe, validate, and/or write.

With a basic understanding of a blockchain for business, we are ready to see how the model unlocks eight sources of value compared to the centralized systems of today.

Eight Sources of Business Value

Enterprise blockchain applications have at least eight significant sources of value (see Figure 3). These are the pot of gold at the end of the blockchain rainbow.

BEFORE A BLOCKCHAIN:	AFTER A BLOCKCHAIN:
From trusted 3rd parties	to trusted algorithms (1. transact directly)
From many ledgers	to one version of the truth (2. no reconciliations)
From opaque records	to transparent records (3. instant status, track & trace)
From modifiable records	to immutable records (4. data provenance)
From threat of opportunism	to smart contracts (5. automatically execute agreements)
From high transaction costs	to no intermediaries to pay (6. lower transaction costs)
From identity leakage threats	to cryptographic identity (7. one controls access to one's identity)
From perimeter security	to consensus security (8. fault tolerant, resilient, available)

Figure 3: Eight Sources of Business Value

1. **Trading partners can transact directly.** Allowing trading partners to transact directly without relying on trusted third parties (TTP) is the main impetus for a blockchain application. Indeed, it was Satoshi Nakamoto's *raison d'être* for designing Bitcoin. A current business process where the TTPs add significant fees and slow transactions just to verify asset ownership and to prevent double spending is the poster child use case for a blockchain application. The functions of TTPs are now done with sophisticated cryptography and with computer algorithms.

2. **No reconciliations.** With one version of the truth, there are no disputes, thus no need for reconciliations. It's a model where transactions are confirmed before they are committed, moving from a confirm-after-the-fact to a confirm-as-you-go model.⁹ Settlements can occur in seconds.

3. **Instant status, track & trace.** Rather than each party only seeing the transactions coming in and out its own organization, blockchains provide transparency for a transaction's entire process through all business relationships. Trading partners can see all the transactions to which they are permitted to observe, enabling instant status reporting.

4. **Data provenance.** Since the records on the distributed ledger are immutable, all parties can be confident they are dealing with the same set of historical facts, allowing assets to be tracked from commissioning to decommissioning.

5. **Automatic execution of agreements.** Smart contracts are deployed on the blockchain and then automatically execute. Provided parties can specify the rules precisely in advance, there is no counter-party risk that the other party will not fulfill its obligations.

6. Lower transaction costs. By eliminating TTPs and the need to monitor agreements, transaction costs plummet. Regulators could also be given observation rights, thus reducing the costs of compliance. The partners just need a way to finance the operations of the blockchain network.

7. Better control over identity. In a blockchain application, consumers and institutions control their own identities with cryptographic digital signatures, reducing the risks of information leakage and identity theft.

8. An IT architecture that is fault-tolerant, resilient and always available. A blockchain network ignores faulty, malicious, or suspicious transactions and nodes. A blockchain application will continue to operate normally even if a high percentage of nodes are attacked. If, for example, an enterprise's node goes offline, the other nodes in the network will continue to function properly and those other nodes will update the organization's node once back online. Thus, blockchain applications promise resiliency and 100 percent availability. In theory, the only way to break a blockchain application is to commandeer more than 50 percent of the nodes before any of the other nodes notice.

Besides these eight sources of value, there are many others that we describe in our book. For example, many people in the space have worthwhile **social missions** like bringing financial services to the 2 billion people who lack access, protecting the property rights of people with low economic status, and protecting the integrity of political elections. As citizens of the world, enterprises can contribute to such worthy causes.

Overcoming Obstacles

Transitioning blockchain applications from the isolation of innovation labs into full-scale live productions is not easy. Enterprises face a daunting “technology-embeddedness” challenge; blockchain applications must be assimilated within complex institutional, political, regulatory, legal, social, economic, and physical systems.¹ It will take time and considerable effort to overcome the obstacles. Five lessons help:

1. Understand that the technology will mature. Rather than get dissuaded by reports of slow progress and early stumbles, most of the executives in our research were confident the technology is improving. They were more concerned with non-technical issues:

“I am less worried about the technology. Although the technology is not mature, it is less of a problem than standards and regulations.” — Nilesh Vaidya, SVP Head of Banking & Capital Market Solutions at Capgemini

“There still remain those tech challenges, but those will probably be some of the more quickly resolved challenges, whereas a lot of the other ones such as regulatory challenges, challenges in collaboration, those are the ones that are

¹ Lacity, M. and Willcocks, L. (2018), *Robotic Process and Cognitive Automation*, SB Publishing, UK.

probably going to take a lot longer for adoption." — John Burnett, Head of Blockchain Development for State Street¹⁰

2. Wrap your brain around the enterprise mindshifts. All of the promised business benefits sound great on the surface, that is until managers from traditional enterprises realize the implications like relying on open source software, abiding by the wishes and decisions of shared governance bodies, and committing the enterprise's resources to validate and store other parties' data. Blockchain applications require significant mindshifts from old to new ways of thinking. A few enterprises in our study recruited outsiders to help facilitate the mindshifts. For example, State Street hired Moiz Kohari to become Chief Technology Architect in September of 2016 in part because of his long history with open-source projects. He founded Mission Critical Linux in 1998, an open-source company, to build enhancements to the Linux operating system. He said:

"When State Street brought in my team, they understood they were signing up for open-sourced projects. If we were to leverage open source as core components and core technologies, the bank was going to have to participate in the open-source community. We have had senior management support around this from the beginning and I'm very grateful for that." Moiz Kohari, Chief Technology Architect, State Street

3. Participant in several working groups. Working groups, including consortia and non-profits, are defining blockchain standards and developing code bases for business applications. As of August 2017, Deloitte identified 40 major consortia.¹¹ Notable working grouping groups include R3 (founded in 2014), Hyperledger Project (founded in 2015), B3i (founded in 2016), The Enterprise Ethereum Alliance (founded in 2017). Large blockchain consortia may be the best bet for establishing standards in the long run, but some are slow to agree upon standards or to develop actual applications. The value of smaller consortia is that players can move faster; the downside risks are lack of wider-spread adoption or eventual obsolescence if a new standard or platform emerges in the industry. Many enterprises in our study participate in multiple working groups because they do not yet know which standard will reign supreme:

"At this stage in the game, we're not informed enough to pick a winner. There are lots of people vying for this strategic high ground, so I think it's important for us to engage in places and keep our fingers on the pulse of all of them rather than try and pick a winner at a way too early stage." — Head of a blockchain CoE for a global financial services firm.

4. Work with regulators early. Regulators all over the world are examining the blockchain space. Some regulators are supportive, some are not, and still others have yet to deliberate. Many participants in our research study wanted to educate regulators about blockchains, but at the same time, they did not want regulators participating too closely in consortia lest their compliance weaknesses be exposed. Among the 30 enterprises we examined, LO3 Energy was one of the most proactive about dealing with regulators. LO3 Energy, founded in 2012, is building a transactive energy platform to enable neighbors to buy and sell locally produced energy. LO3 hired a number of lawyers early on to work closely with regulators and policy makers to become

licensed as a utility provider in the State of New York. LO3 has also proactively met with US Federal, other US State, European and Australian regulators to pave the way for future expansion:

“We have a very good relationship with the regulators. The regulators in New York are pretty excited about and engaged in what we're doing, particularly for the transactive energy platform.” Lawrence Orsini, Founder and CEO of LO3 Energy

5. Build a critical mass of participants. As Metcalfe's law² reminds us, the value of a network is proportional to the square of the number of connected users in the system. The parties of an enterprise blockchain application will need to ensure a minimum number of participants to make the application worthwhile. IBM's strategy to attract “anchor tenants” like Maersk and Wal-Mart for its major blockchain initiatives hopes that other participants in the supply chains will want to follow the leaders.¹² One interviewee thought this was an effective strategy:

“There's also a little bit of a herd mentality. People are afraid to be left out.” —
Innovation Director for a US healthcare company

Conclusion

At present, there is a gap between the promised business value and the actual business value delivered by blockchain technologies. There's much work to be done on the non-technical side. Enterprises need to work together to define standards and shared governance models; regulators need to clarify compliance requirements; Universities need to educate students. At the very least, managers need to know enough about blockchains to decide whether their respective organizations should lead, be fast followers, or take a slower pace to exploring enterprise blockchains.

About the Author

Dr. Mary C. Lacity is Walton Professor and Director of the Blockchain Center of Excellence at the Sam Walton College of Business, University of Arkansas. She was previously Curators' Distinguished Professor at the University of Missouri-St. Louis. She has held visiting positions at MIT CISR, The London School of Economics, Washington University, and Oxford University. She has published 28 books, most recently, *A Manager's Guide to Blockchains for Business* (2018, SB Publishing, UK). Her publications have appeared in the *Harvard Business Review*, *Sloan Management Review*, *MIS Quarterly*, *MIS Quarterly Executive*, *IEEE Computer*, *Communications of the ACM*, and many other academic and practitioner outlets.

¹ Quote from CEO's speech at IBM's Interconnect Conference, March 21 2017

² Mougayar, W. (2016), *The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology*, Wiley, New Jersey.

² Metcalfe, B (2013). ["Metcalfe's law after 40 years of Ethernet"](#). *IEEE Computer*, 46(12), pp. 26-31

³ Malanov, A. (August 18 2017), “Six myths about blockchain and Bitcoin: Debunking the effectiveness of the technology,” <https://www.kaspersky.com/blog/bitcoin-blockchain-issues/18019/>

⁴ Riel, A. (2017), *Blockchain: Reality Versus Hype*, whitepaper.

⁵ See “[Blockchain in Review: Investment Trends and Opportunities](#)”, October 2017 by CB Insights

⁶ Efsthathiou, A. (Jul 11, 2017), “Adventures in Blockchain: TCS Focuses on the Building Blocks of a Successful Blockchain Ecosystem,” posted on https://research.nelson-hall.com/blogs-webcasts/nelsonhall-blog/?avpage-views=blog&type=post&post_id=694&utm_source=NelsonHall+-+Industry+Insight&utm_campaign=3abeba8088-NH_Industry_Insight_July18&utm_medium=email&utm_term=0_9d9720677e-3abeba8088-316614105

⁷ See Gupta, S. and Mondal, T. (2017), [HfS Blueprint Report: Enterprise Blockchain Services](#).

⁸ This is true provided that the organization that serves as the gatekeeper operates fewer than 50 percent of the nodes; If a gatekeeper does operate 50 percent or more of the nodes, there is little point in using a blockchain except under specific circumstances, such as an intra-organizational blockchain across divisions.

⁹ Lewis, A. (July 24, 2017), “Avoiding blockchain for blockchain’s sake: Three real use case criteria”, posted on <https://bitsonblocks.net/2017/07/24/avoiding-blockchain-for-blockchains-sake-three-real-use-case-criteria/>

¹⁰ Castillo, M. (January 3, 2017), “State Street’s Blockchain Strategy: Big and Bold for 2017, available at <https://www.coindesk.com/state-streets-blockchain-strategy-big-and-bold-for-2017/>

¹¹ Gratzke, P., Schatsky, D., and Piscini, E. (August 2017), “Banding together for blockchain Does it make sense for your company to join a consortium?” available at <https://dupress.deloitte.com/dup-us-en/focus/signals-for-strategists/emergence-of-blockchain-consortia.html - endnote-sup-7>

¹² Marie Wieck, GM of IBM Blockchain, speaking at Consensus 2017: <https://ibmgo.com/interconnect2017/search/?q=blockchain&tags=all&categoryType=video>