

Blockchains and Smart Contracts: From Cryptocurrencies to Everywhere?

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The global blockchain technology market is expected to reach \$28.2 billion by 2025.³ Moreover, Gartner forecasts that the business value generated by blockchain will grow rapidly, reaching \$176 billion by 2025 and \$3.1 trillion by 2030.⁴ So what is blockchain? Why is it becoming so popular? And why should we care?

The “Blockchain” a Mediator of Consensus

“Blockchain” technology had its “mysterious” genesis in the bitcoin cryptocurrency realm.⁵ “At the core of bitcoin are the blockchain data structure and related components.”⁶ This data structure and components, or “blockchain,” primarily consists of “a distributed ledger maintained by network nodes, recording transactions executed between nodes via messages sent from one node to another.”⁷ Data inserted into the blockchain is available to all users of the blockchain, but cannot be modified or erased.⁸ In its simplest form, a blockchain is a “distributed database that autonomously maintains a continuously growing list of public records in units of ‘blocks,’ secured from tampering and revision.”⁹ See Figure 1. Blockchain technology has evolved to include variations of design to address “exclusivity, transparency, and maintenance of records.”¹⁰ The aim of all blockchain configurations, however, is to create a “database system in which the parties jointly maintain and edit in a decentralized manner, with no individual exercising central control.”¹¹ Accordingly, a “defining feature” of blockchains is the ability to create and maintain a

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³ Blockchain Technology Market - Global Opportunity Analysis and Industry Forecast (2018 - 2025), Meticulous Market Research Pvt. Ltd. (November 2018), <https://www.meticulousresearch.com/product/blockchain-market/>.

⁴ Rajesh Kandaswamy, David Furlonger & Andrew Stevens, Digital Disruption Profile: Blockchain’s Radical Promise Spans Business and Society, Gartner (February 13, 2018), <https://www.gartner.com/en/doc/3855708-digital-disruption-profile-blockchains-radical-promise-spans-business-and-society>.

⁵ “Satoshi Nakamoto made the Bitcoin software in 2008 and made it open source in January 2009. And in 2010, Satoshi disappeared.” Sudhir Khatwani, Satoshi Nakamoto: 9 Interesting Facts You Need To Know, Coinsutra (March 27, 2019), <https://coinsutra.com/satoshi-nakamoto-facts/>.

⁶ Kandaswamy, supra note 4.

⁷ Valentina Gatteschi, Fabrizio Lamberti, Claudio Demaretini, Chiara Pranteda & Victor Santamaria, Blockchain and Smart Contracts for Insurance: Is the Technology Mature Enough?, Future Internet (February 20, 2018), <https://www.mdpi.com/1999-5903/10/2/20>.

⁸ Nigel Gopie, What are smart contracts on blockchain? (July 2, 2018), <https://www.ibm.com/blogs/blockchain/2018/07/what-are-smart-contracts-on-blockchain/>; Gatteschi, supra note 7.

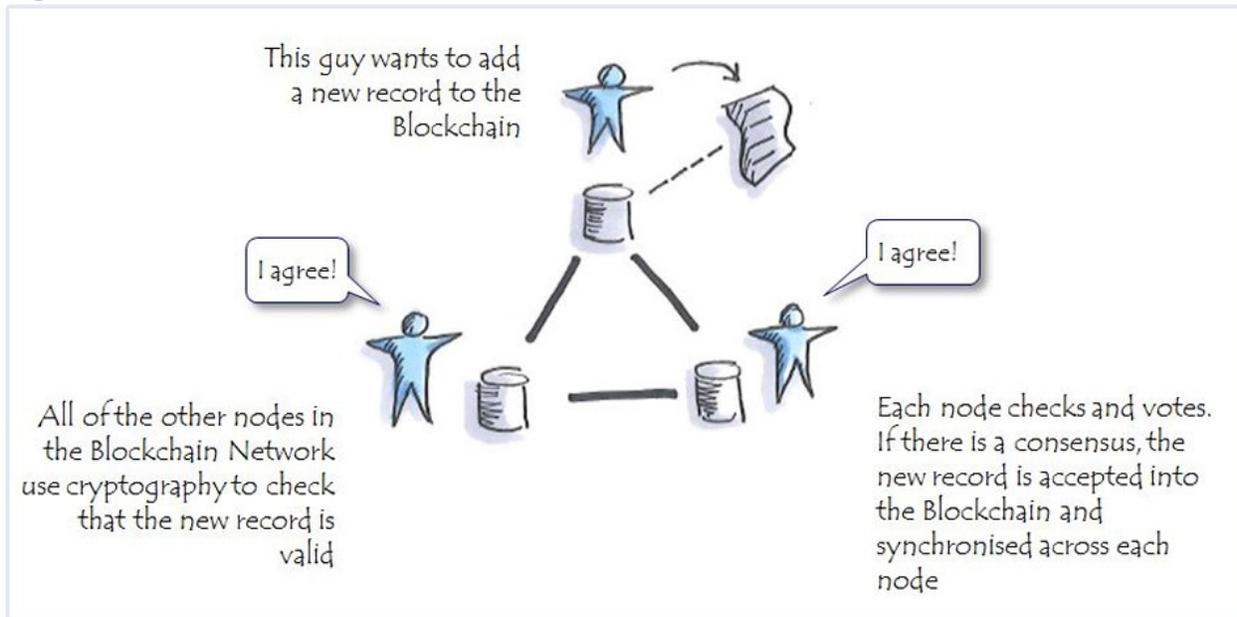
⁹ Lin Cong and Zhiguo He, Blockchain Disruption and Smart Contracts (December 27, 2018), <http://dx.doi.org/10.2139/ssrn.298764>.

¹⁰ Id.

¹¹ Id.

“uniform view on the state of things and the order of events—a consensus.”¹² This creation of consensus is key to many economic and non-economic functions. Currently, third-parties such as governments, courts, and lawyers provide such consensus, “but in a way that is often labor-intensive, costly, prone to tampering, single point failures and monopoly of power.”¹³ Accordingly, blockchains “hold the promise of disrupting many industries by providing consensus in a more decentralized manner.”¹⁴

Figure 1



<https://www.zurich.com/en/knowledge/articles/2016/10/insurers-look-to-blockchain-to-better-serve-their-clients>.

A key component of the blockchain functionality are “smart contracts.” Nick Szabo is credited with introducing the smart contract concept in 1994, “defining a smart contract as ‘a computerized transaction protocol that executes the terms of a contract.’”¹⁵ In general, “[a] smart contract is a computer program or protocol, typically running on a blockchain, which facilitates, verifies or executes business processes that could be triggered by events, on-chain transactions or interactions with other smart contracts. It adds dynamic, programmed behavior to transactions.”¹⁶

A simple example of how a smart contract works is an apartment rental transaction:

Suppose you rent an apartment from me. You can do this through the blockchain by paying in cryptocurrency. You get a receipt which is held in our virtual contract. I give you the digital entry

¹² *Id.* See also Kandaswamy, *supra* note 4; Gopie, *supra* note 8; Konstantinos Christidis & Michael Devetsikiotios, *Blockchains and Smart Contracts for the Internet of Things*, IEEE Access, Vol. 4, 2292 (2016), <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&number=7467408>.

¹³ *Id.*

¹⁴ *Id.*

¹⁵ Christidis, *supra* note 12.

¹⁶ Kandaswamy, *supra* note 4.

key which comes to you by a specified date. If the key doesn't come on time, the blockchain releases a refund. If I send the key before the rental date, the function holds it releasing both the fee and key to you and me respectively when the date arrives. The system works on the If-Then premise and is witnessed by hundreds of people, so you can expect a faultless delivery. If I give you the key, I'm sure to be paid. If you send a certain amount in bitcoins, you receive the key. The document is automatically canceled after the time, and the code cannot be interfered by either of us without the other knowing since all participants are simultaneously alerted.¹⁷

Although a simple example, the above demonstrates the use of specific contract variables to efficiently complete a verified transaction without a third-party intermediary.

Smart contracts are anticipated to be helpful for situations that range from financial derivatives to supply chain, insurance premiums, credit enforcement, financial services, legal processes and crowdfunding agreements. "Such programmatic representation and automation can dramatically scale the ability of organizations to partner with others and have much more fine-grain yet fluid relationships to manage their business."¹⁸ Further, "codifications of rules of engagement and operation can cut costs, remove errors and be more auditable."¹⁹ Figure 2 illustrates the use of a "smart contract" in the context of an increasingly typical online consumer transaction.

Figure 2



<https://blog.syncfab.com/mfg-token-blockchain-responsive-supply-chain/smart-contracts-in-the-internet-of-things-delivery/>.

¹⁷ <https://blockgeeks.com/guides/smart-contracts/>.

¹⁸ Kandaswamy, *supra* note 4.

¹⁹ *Id.*

Smart contracts are far from perfect and have functional and philosophical concerns.²⁰ On the functional level, what if bugs get into the code?²¹ Or how should governmental entities regulate such contracts? Or, how would governmental entities tax these smart contract transactions? On the philosophical level, “there are a number of questions about how smart contracts will deal ... with issues that are fundamental to contract law.”²² “Contracting, in particular, is a deeply social practice in which the parties engage for all sorts of purposes, and the effect of contract negotiation reverberate outside of the ‘four corners’ of a formal agreement, in both time and space.”²³ In a practical sense, “contractual obligations are enforced through all kinds of social mechanisms other than the legal system proper; concomitantly, contracts serve many that are not explicitly legal in nature, or even designed to be formally enforced.”²⁴ These “real-life” issues are hard to address, if at all, in automated contracts.

The Appeal of Blockchain: Consensus, Efficiency and Widespread Utility

As seen above, “blockchain technologies offer new mechanisms to establish and manage trust (regardless of status) across entities and, thus, can be impactful in areas that involve transactions and interactions that involve consumers, businesses, governments and things.”²⁵ In short, build consensus. Further, one of the most attractive aspect of the blockchain is that its decentralized system breeds efficiency by eliminating the need to pay intermediaries, saving time and conflict. “Blockchains have their problems, but they are rated, undeniably, faster, cheaper, and more secure than traditional systems, which is why banks and governments are turning to them.”²⁶ Finally, this emerging technology has a myriad of applications. The ability to execute transactions without a middleman as forecasted will also impact much B2C and B2B activity.²⁷ The “digitization of assets enables trading and sharing of value in new ways that were not possible or economical

²⁰ See Karen Levy, Book-Smart, Not Street Smart: Blockchain-Based Smart Contracts and The Social Workings of Law, Engaging Science, Technology, and Society 3 (2017), 1-15, <https://estsjournal.org/article/view/107>; Ahmed Kosba, Andrew Miller, Elaine Shi, Zikai Wen & Charalampos Papamanthou, Hawk: The Blockchain Model of Cryptography and Privacy-Preserving Smart Contracts, 2016 IEEE Symposium on Security and Privacy (May 2016), <https://ieeexplore.ieee.org/document/7546538>; Kevin Delmolino, Mitchell Arnett, Ahmed Kosba, Andrew Miller & Elaine Shi, Step by Step Towards Creating a Safe Smart Contract: Lessons and Insights from Cryptocurrency Lab, Financial Cryptography and Data Security: FC 2016 International Workshops, BITCOIN, VOTING, and WAHC, Christ Church, Barbados (February 26, 2016), https://www.researchgate.net/publication/307507489_Step_by_Step_Towards_Creating_a_Safe_Smart_Contract_Lessons_and_Insights_from_a_Cryptocurrency_Lab;

²¹ Delmolino, supra note 20.

²² Levy, supra note 20. “In addition, there are a number of questions about how smart contracts will deal technically with issues that are fundamental to contract law, but which are difficult to instantiate in code: issues dealing with temporality (such as mutual mistake in setting forth contract terms, or rescission), or standards that apply to contracts and contractors across the board, even if not represented on the fact of the document (such as the duty of good faith). These issues represent important challenges to the smart contract framework, and there are some extant efforts to address them both technically and legal.” Id. (citation omitted).

²³ Id.

²⁴ Id.

²⁵ Kandaswamy, supra note 4.

²⁶ <https://blockgeeks.com/guides/smart-contracts/>

²⁷ Kandaswamy, supra note 4.

earlier.”²⁸ Moreover, smart contracts within a blockchain “have the potential to evolve and allow for encoded and automation of business agreements and contracts, fundamentally changing business operations and societal interactions.”²⁹ Industry experts believe that benefits of blockchain technology will be more fully realized in external interactions between companies.³⁰ “This aspect, combined with the threat to centralized interaction models, has resulted in competitors coming together with the intent to reshape industry processes or safeguard industry franchise to achieve operational efficiency and economies of scale benefits using blockchain technologies.”³¹ Further, a number of startups have emerged that are attempting to leverage the decentralization concepts of blockchain. “These startups are attempting to create new businesses that never existed or offer new industry-specific solutions.”³² And as noted above, industry analyst are predicting explosive growth in both global blockchain technology market and increased business values.³³

Value for Suppliers and the Supply Chain

Blockchain's decentralization capabilities allow for identity management to move away from central players to the identifiable person, business or items.³⁴ This decoupling of identity management allows users to exchange value directly with anyone else. Control of related services can shift from the central player to the participants, impacting products, services and processes that consume them. Accordingly, blockchain capabilities “can increase traceability and reliability of information in supply chain.”³⁵ Companies can use blockchains to accurately and reliably record product status at each stage of the production cycle. Again, this data is permanent and immutable. This chain of data makes it possible to trace each product from its source and ultimately to the end consumer. For example, one large global retailer uses blockchain to track sales of pork in China. Its system lets the company see where each piece of meat comes from, each processing and storage step in the supply chain, and the products’ sell-by date. In the event of a product recall, the company can also trace affect batches and who bought them.³⁶

Also on the horizon are blockchain-powered identity management tools that “could soon eliminate fears of data privacy theft and unleash a new paradigm of consumer-driven personalization.”³⁷ Blockchain technology has the potential “to support identity registries where people can

²⁸ Id.

²⁹ Id.

³⁰ Id.

³¹ Id.

³² Id.

³³ Blockchain Technology Market, supra note 3; Kandaswamy, supra note 4.

³⁴ See Rob O’Byrne, Blockchain Technology is Set to Transform the Supply Chain, Logistics Bureau, (January 9, 2019), <https://www.logisticsbureau.com/how-blockchain-can-transform-the-supply-chain/>.

³⁵ Fabrícia Fedoci & Tatiana Revoredo, How Blockchain and IoT Add Value to Supply Chain Management (June 25, 2018), <https://medium.com/@tatianarevoredodo/how-blockchain-and-iot-add-value-to-supply-chain-management-9411ba48939d>.

³⁶ O’Byrne, supra note 34.

³⁷ John MacKenna, Consumers Could Drive Data Sharing and Personalization with Blockchain Marketing, Skyword (October 25, 2018), <https://www.skyword.com/contentstandard/marketing/consumers-could-drive-data-sharing-and-personalization-with-blockchain-marketing/>.

accumulate and share data about their buying preferences without revealing any personally identifiable information.”³⁸ This represents a large step forward building consumer confidence and trust and “[i]t’s a hypothetical win-win that gives marketers the specific audience knowledge they need to drive effective campaigns, while placing control in the hands of the customer.”³⁹

Value for End Consumers

Use of blockchain technology in a supply chain setting will increase consumer confidence and drive values for the products sourced via a blockchain supported supply chain. As noted by industry analysts, blockchain technology drives these beneficial outcomes:

Blockchain's immutability and traceability features, permit multiple constituents to rely upon the information being transmitted, drastically increasing the credibility of the information related to product origin and quality. Reduction in the possibility of malfeasance in a system can promote trust and, hence, such systems can offer stronger alternatives for storing important data, whether between a government and its citizens, businesses and their customers or even across individuals.⁴⁰

In addition to the product data derived from a blockchain enabled supply chain, consumers could likewise share in the protection of consumer-driven personalization without the fear of identity theft while enjoying a deeper and more personalized shopping experience.⁴¹

Cutting Edge Application

A leading example of the effective application of blockchain technology with the resulting benefit to all relevant stakeholders is Euranet’s ChoralChain family of solutions. In the food and beverage industry sector, ChoralChain is “a blockchain platform that allows for transparent transactions important to the life cycle of products.”⁴² This innovative blockchain “takes the supply chain to the optimal compliance management level, with easy access and accountability.”⁴³ This cutting-edge application of blockchain technology highlights the numerous benefits to all stakeholders on the supply chain from the producers of the products, regulators, retailers to the end user consumers. See Figure 3. The decentralized and secure nature of ChoralChain delivers the value that industry experts and analyst predict—accurate product lifecycle data⁴⁴ and resulting consumer data for suppliers and increased consumer confidence.⁴⁵

³⁸ *Id.*

³⁹ *Id.*

⁴⁰ Kandaswamy, *supra* note 4.

⁴¹ MacKenna, *supra* note 37. See also Gatteschi, *supra* note 7; Gopie, *supra* note 8.

⁴² <https://www.choralchain.com/>.

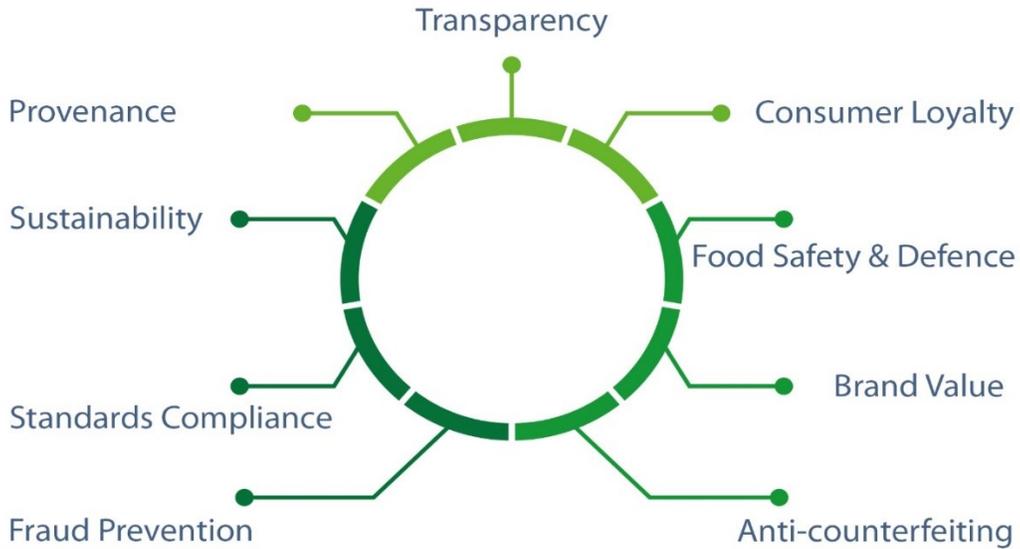
⁴³ *Id.*

⁴⁴ Fedoci, *supra* note 35.

⁴⁵ See, e.g., O’Byrne, *supra* note 34; Fedoci, *supra* note 35; MacKenna, *supra* note 37.

Figure 3

BENEFITS OF CHORALCHAIN



<https://www.choralchain.com/>.

Conclusion

Blockchain technology is maturing at a rapid rate. Its growth from a cryptocurrency technology to its application to real world supply chains has been both “disruptive”⁴⁶ and highly productive.⁴⁷ The promise of these new deeply data rich models is coming to fruition in products like Choral Chain. As blockchain architecture proliferates, as predicted, and “smart contracts’ evolve, the beneficial aspects for all supply chain stakeholders will continue to mount.

⁴⁶ Kandaswamy, *supra* note 4.

⁴⁷ Fedoci, *supra* note 35; MacKenna, *supra* note 37.