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The Complete Guide to Blockchain Business Networks

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Foreword

At ConsenSys, we are committed to growing the global blockchain ecosystem and educating our clients on the development of the technology. This paper explains how Blockchain Business Networks (BBN) can be leveraged by organisations of any size. For enterprises to realise the maximum value of blockchain business networks, collaboration is essential. Our global team of business and technology experts have the proven credentials to make blockchain more than a tech stack for a single organization, but a collaborative tool for competitors in any industry.

After mapping a consortium-wide business model and network, I encourage you to reach out to my team to learn more about how we can support you on the technical implementation.



Joseph Lubin,
Founder and CEO of ConsenSys,
Co-Founder of Ethereum

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Executive Summary

This paper aims to give the reader an understanding of what blockchain technology is and how it can be leveraged to create **Blockchain Business Networks (BBN)**. These networks are not your traditional means of doing business, but a new way to transact and transfer value using blockchain and distributed ledger technology.

Before we explain blockchain business networks, we begin with explaining traditional business networks and how they compare to blockchain business networks and the benefits blockchain technology can bring to organisations. Once the readers base level of knowledge has been established, we then move on to discuss:

1. The strategic shift for organisations and why they should leverage blockchain business networks
2. Why these organisations need to work with their competition and collaborate to create effective and efficient networks
3. Define how decentralisation plays a key role in blockchain business networks and what is the business case for organisations to use this network type
4. Detail the architecture and process required to gradually move your organisation from centralisation to decentralisation
5. Highlight case studies of organisations and industries who have created their own blockchain business networks and what benefits they are seeing from leveraging the technology

We aim for this paper to act as your complete guide to Blockchain Business Networks and how best you can leverage the technology to create your own successful network for you and your industry.

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What is Blockchain?

Blockchain is a distinct type of Distributed Ledger Technology (DLT). DLTs involve ledgers, or databases, where the input and maintenance of data on the ledger are controlled on a peer-to-peer (P2P) basis. This P2P nature means that there is no central trusted party or intermediary required to control the ledger, and so they can be said to be decentralized. Blockchain is a decentralized ledger, which simply means that a ledger is spread across the network among all parties in the network, and each party holds a copy of the complete ledger. Blockchain DLT technology takes its name from the way in which the ledger is structured, where inputs onto the ledger are grouped into blocks of transactions, which are then validated and transmitted to the network to form a chain of blocks.

How Does Blockchain Work?

The two most important concepts which were combined to create blockchain technology were asymmetrical cryptography and distributed IT architecture.

Asymmetrical cryptography is a system of public and private keys which allows users to confidently exchange encrypted information with unknown third parties. A public key is a string of numbers and letters which can be made available to everyone (think of your email address), while the private key remains secret, and is used to access any data which is sent to your public key (think of your password used to login and access your emails).

A distributed IT system is a series of independent computers, known as nodes, which can communicate with each other over a network with no central node, much like the Internet. As all the nodes are connected to each other on a P2P basis, when one goes down it does not bring the entire network down with it, also known as automated redundancy.

Blockchains allow users to store information in a decentralized manner. Each authorized user may sign a piece of information (using their private key) and send it to other nodes with a request that the data should be written into the ledger. Users who write the data into the ledger are known as validating nodes, and a range of consensus algorithms are used for all the nodes to agree on a single version of the truth, the most prevalent of which are proof-of-work, proof-of-authority and proof-of-stake. Validating nodes aggregate the new data into blocks, which are added to the chain and shared with the network. Each block contains a hash of the previous block, which means that if any data in the previous block was altered in any way, the hash of the block would also change, and so the link to the chain would be broken. This means that once a block has been added to the blockchain, it is prohibitively difficult for it to be changed, making blockchains effectively immutable and tamper-proof.

Beyond The Transfer Of Currency And The Birth Of Ethereum

The original Bitcoin blockchain was created specifically for the transfer of bitcoin, or digital currency, between peers. However, it could not be programmed to transfer anything beyond this. In 2015, Vitalik Buterin launched Ethereum, which was the world's first fully-programmable blockchain. Ethereum crucially supports the creation of smart contracts. These are contracts between two or more parties which are digitally programmed and automatically execute clauses of the contract on the completion of certain events. The events which cause the automatic execution can be external to the blockchain, and the data concerning it is fed into the blockchain by a trusted third party known as an oracle. Think for example of sensors on a property which can detect flooding, data from which could be fed into a smart contract through an oracle, leading to an automatic execution of flood insurance claims. These oracles are often linked to Internet of Things (IoT) connected devices, which allows for the automation of the collection of data into the blockchain and gives the confidence that there is accuracy in the data which the contract is being executed against.

Public And Private Blockchains

The original Bitcoin blockchain, as well as Ethereum's Mainnet, are both examples of what are known as public blockchains. This means that anybody in the world with access to the Internet and appropriate hardware can access the shared ledger, store a copy of it on their machine, and begin to modify it through using their computing power to validate transactions. While public blockchains are extremely powerful in ensuring the true distribution of the network and transparency, they are not always suitable for

enterprises which may want to control the access and permissions of users on their chain. This is where private or consortium blockchains are useful, and many of the enterprise blockchain applications currently in production in the Financial Services industry are hosted on a private or consortium chain.

Types of Consensus Algorithms

Proof Of Work

Proof of Work (PoW) is an algorithm which uses mining to solve computationally intensive puzzles to validate transactions and create new blocks.

Proof Of Stake

Proof of Stake (PoS) is an algorithm which uses a pseudo-random election process to select a node to be the validator of the next block.

Proof Of Authority

Proof of Stake (PoS) is a reputation-based consensus algorithm which leverages the value of identities, meaning that block validators are not staking coins to be the validator but their own reputation.

Enterprise Private Blockchains

A private blockchain is one where a central authority controls the right to access or post transactions to the ledger, which are verified through a proof-of-authority consensus mechanism. These chains can be incorporated into enterprises alongside their existing systems and provide an encrypted audit trail of transactions between members of the enterprise or group of enterprises. The primary enterprise blockchains are outlined below.

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Enterprise Private Blockchains on Ethereum



Hyperledger Besu

Hyperledger Besu is an open-source enterprise blockchain client built in Java, created by the PegaSys team within ConsenSys. Hyperledger Besu is mainnet-compatible and includes features like consensus algorithms that are applicable to enterprise use. Hyperledger Besu provides the following benefits for enterprise clients:

- Built from the ground up with enterprise-friendly licensing
- Vendor supported by PegaSys engineers
- Secure and dependable permissioning and privacy features
- Stable consensus that enables fast, reliable transactions



PegaSys Plus

PegaSys Plus is a commercially licensed Ethereum platform. It offers all of the same functionality as Hyperledger Besu with additional features designed to accelerate production of enterprise blockchain solutions such as:

- Increased security of data when it is at rest and most vulnerable
- Advanced monitoring for consistent uptime



Quorum

JP Morgan, along with the Enterprise Ethereum Alliance and ConsenSys, created an enterprise-focused Ethereum version called Quorum, which tries to improve blockchain technology with its own solution. The objective behind this is to provide a permissioned implementation of Ethereum which supports transactions and contract privacy. Here is how Quorum's capabilities differ from the Ethereum public blockchain:

- Network and peer permissions management
- Enhanced transaction and contract privacy
- Voting-based consensus mechanisms

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Introduction to Blockchain Business Networks

Traditional Business Networks (TBN)

Today, we can see a number of different terms used to describe business networks. From our research referenced below, the terminology appears to change based on the individual writing the definition. Economists and business experts alike use the concept interchangeably with clusters, incubators, entrepreneurship ecosystems etc. Based on this information business networks define their network according to their unique experiences.¹ This approach is manageable at a local or regional level, but it will struggle to scale and will present challenges to business operations at a pan-European or, indeed, at a global level. Considering the above points in mind, we have found the following a strong definition to frame our discussion throughout this article:

“A business network is a form of inter-firm cooperation that allows companies, located also in different regions or countries, to collaborate together on a basis of common development objectives expressed in a cooperation agreement/contract. The companies decide to join their strengths, share information and create synergies to become more innovative and competitive on the domestic and international markets, while keeping their autonomy, not creating a separate legal entity. This cooperation model is suitable for any kind of business activity and sector”²

The analysis of business networks can be focused into three complementary levels:

1. The level of actors
2. The level of business relationships
3. The level of the entire network configuration, or network structure

Actors are referred to as nodes — identified as economic agents such as firms, managers, individual entrepreneurs and institutions. Actors’ behaviour is interpreted in the context of multiple motivation theories, developed by organisation science and economics. Relationships in business networks are studied in the context of actors’ strategic decisions and choices to select interacting counterparts and to engage in a repetitive exchange of goods or services. **Business relationships** involve transfer of value under a formal or informal contract (or agreement) between two or more economic agents. The **structure of business networks** is interpreted as collaborative business communities, strategic alliances, inter-firm and supply networks which is visually displayed on the next page.

¹ Seebacher, S. and Maleshkova, M. (2018). A Model-driven Approach for the Description of Blockchain Business Networks. [online] Karlsruhe Institute of Technology. Available at: <http://hdl.handle.net/10125/50330>

² Spanikova, D. (2014). Business Networks. [online] Ec.europa.eu. Available at: <https://ec.europa.eu/docsroom/documents/5563/attachments/1/translations/en/renditions/pdf>

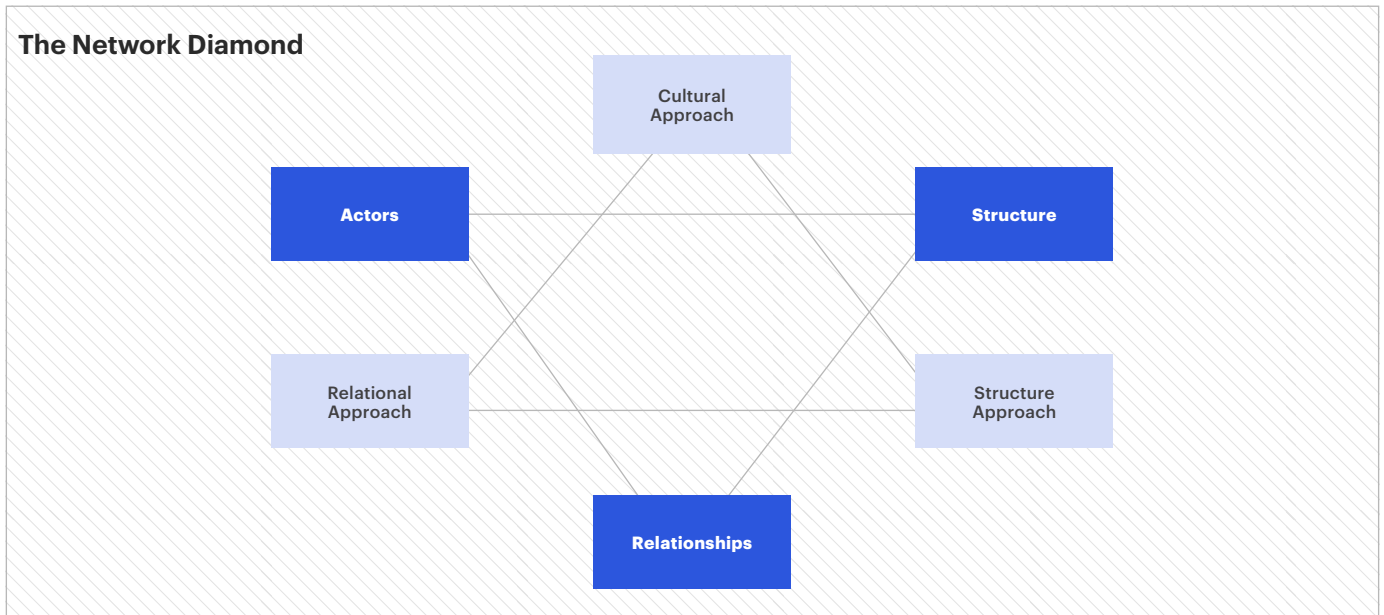


Figure 1. The Network Diamond ³

Blockchain Business Networks (BBN)

As previously outlined in section 1, a blockchain is a type of business ledger which records all of the transactions of a business. The key difference between a blockchain ledger and a traditional business ledger, is that it is decentralised. This core feature of decentralisation means that no one entity will have complete control over the ledger, and this can lead to powerful benefits for business, which will delve into later. Traditional businesses have always required two ledgers for a business to process a transaction and transfer value. This is referred to as double-entry bookkeeping. As an alternative for each business creating their own ledger and managing it, we propose using a blockchain business network to create a decentralised and distributed ledger system where each company in the network can share one single ledger and transact in a secure peer-2-peer (P2P) way without the need to go through costly intermediaries who often manage multiple ledgers.

A blockchain business network can offer a number of different advantages compared to the more traditional way of conducting business.⁴ Blockchain networks are becoming more scalable, and as a result, adoption of the technology is becoming more widespread in the business community. The benefits of decentralisation over traditional networks means that it can prevent particular individuals or groups from taking control of the underlying network or potentially undermining how the system would effectively operate. This ensures that all participants in the network are equal, and they are abiding by the same set of protocols or rules. Participants in the networks can be individuals, government agencies, small or large multinational companies, and a combination of them all if the use case and network requires it.

³ Todeva, E. (2011). Business Networks. [online] ResearchGate. Available at: https://www.researchgate.net/publication/228215998_Business_Networks

⁴ Boaventura, A., (2018). Where And How Can Blockchain Be A Better Option Than The Traditional Centralized Systems?. [online] Medium. Available at: <https://medium.com/oracledevs/where-and-how-blockchain-can-be-a-better-option-than-the-traditional-centralized-system-model-edb0e3e1c9ee> [Accessed 10 March 2020].

How Do Traditional Business Networks Compare With Blockchain Business Networks?

Current business ledgers and networks have a number of different problems. They can be inefficient, costly, non-transparent, and subject to fraud and misuse. These problems stem from centralized, trust-based, third-party systems, such as financial institutions, clearinghouses, and other mediators of existing institutional arrangements.

These traditional systems can also be a hindrance in terms of slowing down the time it takes to settle transactions and creating a distinct lack of transparency for those businesses in the network. This lack of transparency will inevitably lead to information being corrupted and furthermore, fraud and disputes can develop. The costs involved in solving these issues can be excessive and in turn, guide towards more expense being placed on the businesses in the network. Additionally, business ledgers that are not correctly managed and kept up to date can lead to each participant in the network making poor business decisions because they are leveraging incorrect information.⁵

Compared to traditional networks, a blockchain business network’s goal is to remove trust-based intermediaries, such as clearing houses from the network, the benefits of which are reduced transaction fees, faster settlement times and lowering the barrier to entry for transaction-based participants. But when you remove these trust-based entities, you are also left with the question of who will create the trust? This is a second important feature of a blockchain business network. The trust is built into the network. When you add a transaction or a piece of information to the blockchain, it is time-stamped and directly linked to the individual or organisation who posted it to the network. The blockchain network also shows a complete audit history or trail of any changes that have been made to the network to ensure its immutability can never be called into question by the participants of the network. And as discussed previously, we know that blockchain business networks are extremely safe and secure due to public-key cryptography protecting the information on the network.

Traditional Business Networks vs. Blockchain Business Networks

Traditional Business Networks	Blockchain Business Networks
Traditional Business Networks tend to be controlled by an administrator and are centralised	Blockchain is decentralised and has no centralised controller. BBNs typically start as a private blockchains that will eventually develop on to the public network
TBNs databases utilise a client-server architecture	Blockchain uses a distributed ledger network architecture
Malicious actors can alter database data	Blockchain data supports integrity
TBNs utilise a database that supports CRUD (Create, Read, Update and delete)	Blockchain utilises read and write operations
TBNs are best suited to online transaction processing that needs to be fast	BBNs are best suited to transferring and storing value

Table 1.⁶

⁵ Catalini, C. (2018). Why Blockchain Can Be Good For Competition. [online] Forbes.com. Available at: <https://www.forbes.com/sites/christiancatalini/2017/10/30/why-blockchain-can-be-good-for-competition/#30302fca768e>

⁶ Singh, N., (2019). Blockchain Vs Database: Understanding The Difference Between The Two. [online] 101 Blockchains. Available at: <https://101blockchains.com/blockchain-vs-database-the-difference/#prettyPhoto> [Accessed 9 March 2020].

The Benefits Of A Blockchain Business Network

As discussed in the traditional business networks section, we know that these transactions can be slow, expensive and potentially open to manipulation. The benefits of a blockchain business network allow participants to save time and reduce costs while minimising their exposure to risk. In terms of pure cost savings, a report from Santander InnoVentures produced in 2015 found blockchain could potentially save \$15-20 billion in infrastructure costs in the financial services sector.⁷ More recently, a study undertaken by Juniper Research claimed that were financial services institutions to implement blockchain technology for cross-border settlement transactions, they could stand to generate savings up to \$27 billion by 2030, a cost saving amounting to 11%.⁸ With regards to time savings, we will see later in our komgo case study how the time to issue a letter of credit has been drastically reduced by the adoption of blockchain technology. Blockchain technology also generates improved levels of trust and transparency among the willing participants in the network. And not to forget superior levels of automation, ledger customisation and of course the overall quality of the ledger level due to its validation and consensus mechanisms.

Blockchain consensus mechanisms provide the benefits of a consolidated, consistent dataset with reduced errors, near-real-time reference data, and the flexibility for participants to change the descriptions of the assets they own. As no one participating member has complete ownership of the information stored on the shared ledger, blockchain can create higher levels of trust and integrity in how the transaction information will progress through the participating members of the network.⁹

Finally, immutability is a core feature that cannot be overlooked for participants of blockchain business networks. Immutability allows for a reduction in the cost of auditing and regulatory compliance due to improved transparency. The benefits of executing agreements and contracts on blockchain mean that they can become self-executing and the process can become almost completely automated with credit to smart contracts. This automation feature will be added to our growing list of benefits including increased speed of execution times, reduced costs, and less risk with timely settlements of contracts. The business value-add of blockchain will grow to slightly more than \$176 billion by 2025, and then it will exceed \$3.1 trillion by 2030.¹⁰

⁷ Santander Innoventures., (2015), Rebooting Financial Services. [online] Available at: <https://santanderinnoventures.com/wp-content/uploads/2015/06/The-Fintech-2-0-Paper.pdf> [Accessed on 10 March]

⁸ Emem, M., (2018), Blockchain Adoption to Save Banks \$27 Billion Annually by 2030: Research. [online] Yahoo Finance. Available at https://finance.yahoo.com/news/blockchain-adoption-save-banks-27-173755809.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xLLmNvbS8&guce_referrer_sig=AQAAAGVBx5hvQwECbEuRnYQVnSN7T9E_JoQaLrYNYZwIM6dlPIgdv0MvOG9yn7EVTiG8SyV9rWvjefWk77aOLz6BysxEQVexcnURFUDGhj5NuC5s-reybAa41r2_Yz6Rc6fuutReqDJHIB_TWN_UxG2UQFhZk0TBF5BJcmaUmEkghl1_p [accessed on 9th March 2020]

⁹ Brakeville, S. and Perepa, B. (2020). Blockchain basics: Introduction to business ledgers. [online] Finyear. Available at: https://www.finyear.com/Blockchain-basics-Introduction-to-business-ledgers_a36159.html

¹⁰ Granetto, B., Kandaswamy, R., Lovelock, J. and Reynolds, M., (2020). Forecast: Blockchain Business Value, Worldwide, 2017-2030. [online] Gartner. Available at: <https://www.gartner.com/en/documents/3627117/forecast-blockchain-business-value-worldwide-2017-2030> [Accessed 11 March 2020].

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The Strategic Shift For Business

Co-Opetition: A New Paradigm For Innovation

As blockchain technology continues to grow and develop, conversations around the technical challenges and its ability to scale to meet business demand are being left behind as we will evidence in our case studies section. What were once considered speed bumps in the development of enterprise adoption, are now in the rearview mirror. But looking forward, a potential new challenge could be on the horizon and it's not a technical one, but human-centred **competition**.

For enterprises to realise the true value of blockchain business networks they need to work with their competitors to create the systems to develop a new way of doing business. Organisations who can successfully work with their competition can cut the costs of doing business together by removing costly intermediaries and increasing the velocity in which they can transact and improve settlement times on a distributed ledger. This is not an easy challenge to overcome, but it is a surmountable one. For enterprise blockchain pioneers to be unequivocally successful, they will need the support of their competitors in the market. This can take time to achieve and a number of iterations may be required to build trust and deliver on the final shared vision for its participants.¹¹

For your blockchain business network to be successful, it will require more than one isolated organisation. Research has found that creating an ecosystem that is built on developing cooperation between competing organisations is still a difficult challenge. But in the digital age we now live in, we have seen a growing number of companies working in partnership with each other.¹² One example when two directly competing businesses came together was Apple and Microsoft. When Steve Jobs returned to Apple in 1997, the company was on the verge of failure. One of his first moves was to sign a deal with Microsoft, which invested \$150 million in Apple, signed a patent cross-licensing deal, and agreed to develop Office for the Mac on the same schedule as Office for Windows.¹³

Given enough time, blockchains may very well rewrite what drives competitive advantage, with collaboration championing over pure competition. But you must not forget that a blockchain business network is only as strong as the weakest participant and the information on the network must be complete and honest - *garbage in, garbage out*. So if you are planning on making an investment in this technology, you must learn how to collaborate and share information with your competitors if it is to be a success.

¹¹ McCauley, A. (2019). Is Collaboration The New Competition? [online] Forbes.com. Available at: <https://www.forbes.com/sites/alisonmccauley/2019/05/23/is-collaboration-the-new-competition-blockchains-flip-conventional-mba-wisdom/#5af991cf52da>

¹² CB Insights (2019). Blockchain Trends In 2019 - CB Insights Research. [online] CB Insights Research. Available at: <https://www.cbinsights.com/research/report/blockchain-trends-2019/>

¹³ Billington, J.,(2015). Microsoft Invested In Apple In 1997: 'It Might Have Been The Craziest Thing We Ever Did'. [online] Business Insider. Available at: <https://www.businessinsider.com/microsoft-invested-in-apple-in-1997-2015-10?r=US&IR=T> [Accessed 10 March 2020].

Collaboration: Better Serve Your Clients

Now that we understand competition and the implications it can have on blockchain business networks. The real question your organisation should be asking is what benefits can collaboration bring? For blockchain technology to gather mainstream adoption, collaboration is fundamental to ensure its success. The greater the collaboration that can be created between blockchain developers and the business community the faster you will realise tangible benefits for your clients. And the more collaboration with your clients, the higher likelihood you will be able attract them to use your blockchain business network.

From a financial services perspective, collaboration around blockchain business networks will lead to major shifts for the industry.

1. We see the potential of competing financial institutions coming closer together and making global collaboration much easier.
2. We see more efficiencies about the way banks process data.

A. We are already seeing the first shift develop around the industry as a number of financial services consortiums and working groups are bringing the technology forward. *Fear of missing out (FOMO)*, may have played a role in this development, but overall, we believe this is due to the industry needing to invest collaboratively to make financial services use cases viable for the industry. A powerful example of this is the **Utility Settlement Coin**. These coins or tokens, represent digital cash that is recorded on a blockchain network and connects commercial institutions with central

bank backed currency. The benefits of this proposition are higher levels of efficiency and lower levels of risk in wholesale markets.¹⁴ In 2018, ConsenSys worked on a similar concept with The South African Reserve Bank which is called Project Khokha. We discuss this further in the case study section of this paper.

B. The second shift is in product and performance innovations. Financial institutions have a number of use cases for blockchain to improve performance. These can include the enhancement of payment infrastructure and the use of smart contracts to standardise post-trade processes, and efficiently connecting parties in trade finance and syndicated lending ConsenSys Codefi is one of our products that we have developed in this space, and is further discussed in the case study section of the paper. For many large financial institutions, a massive improvement will be seen in the processing of data at these different institutions. Today the reconciliation process is inefficient due to variations in the way each institution processes information and the data format not being standard across the industry. Blockchain business networks can offer a solution to these problems by distributed ledger technology to create an agreed standard or format for information that can be automatically synchronised across the network to ensure each party has the most accurate information available. Solving what some might describe as a simple problem, could amount to billions in savings for the industry with an Accenture study suggesting that by utilising a blockchain it could reduce financial reporting by 70% due to improved data quality, transparency and internal controls.¹⁵

¹⁴ Braine, L. (2019). How Barclays is exploring blockchain? [online] Barclays. Available at: <https://home.barclays/news/2019/7/less-hype-and-more-collaboration--how-barclays-is-exploring-bloc/>

¹⁵ Finextra.com (2017). Blockchain could slash investment banks cost by 30%, [online] Finextra. Available at: <https://www.finextra.com/newsarticle/29995/blockchain-could-slash-investment-banks-costs-by-30>

Institutions may be concerned around the risks of such collaborative engagements, but there are ways for organisations to work together and limit their exposure to risk. One such method that is gaining positive attention are regulatory sandboxes. Regulatory sandboxes for financial services are extremely competitive to join. The United Kingdom is credited with creating the first sandbox, with other countries like Australia and Singapore following shortly after.¹⁶ These sandboxes allow for the testing of innovative technology in a safe and collaborative way, with the eventual goal of understanding what

the technology can, and cannot do.¹⁷ These sandboxes come with the added benefit of having a regulator involved to detail what is possible from a regulatory standpoint. Real results are attributed to these sandboxes with around 90% of firms that completed testing in the first cohort of the FCA regulatory sandbox continuing toward a wider market launch following their test including companies like Billon, who developed a technology to store and transfer regulated currencies and other data using a proprietary blockchain who were issued an FCA e-money licence after the sandbox completed.¹⁸

¹⁶ Asic.gov.au. (2020). Fintech Regulatory Sandbox | ASIC - Australian Securities And Investments Commission. [online] Available at: <https://asic.gov.au/for-business/ine> at: <https://www.fca.org.uk/publication/research-and-data/regulatory-sandbox-lessons-learned-report.pdf> [Accessed 9 March 2020]. <https://www.fca.org.uk/publication/research-and-data/regulatory-sandbox-lessons-learned-report.pdf> [Accessed 9 March 2020].

¹⁷ Fca.org.uk. (2017). Regulatory Sandbox Lessons Learned Report. [online] Available at <https://www.fca.org.uk/publication/research-and-data/regulatory-sandbox-lessons-learned-report.pdf> [Accessed 9 March 2020].

¹⁸ Billon Group (2018). Billon issued with new FCA e-money licence, [online] Billon Group. Available at: <https://billongroup.com/en/billon-issued-with-new-fca-e-money-licence/> [accessed 9 March 2020].

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Decentralised Business Networks

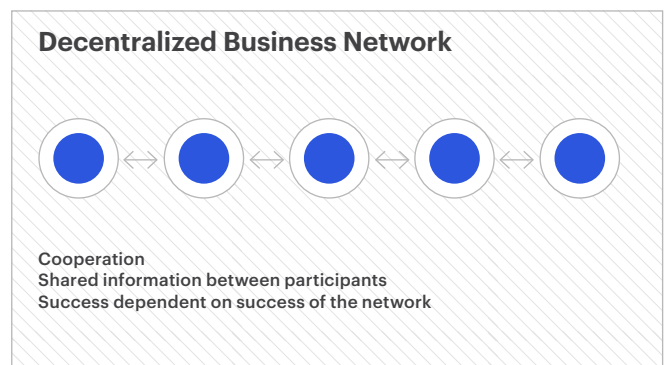
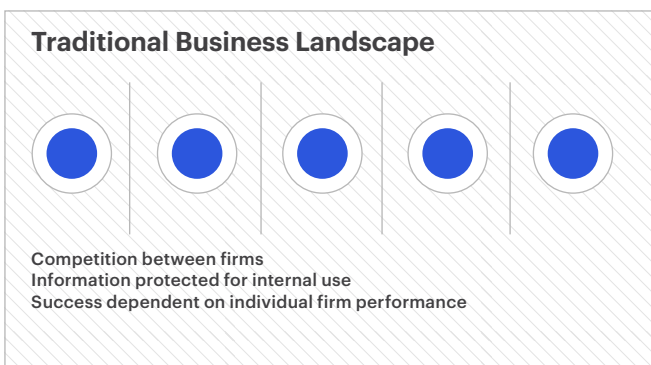
Coopetition And Blockchain

Joining a blockchain business network requires “coopetition” between independent businesses. Coopetition challenges the traditional rivalry between companies by proposing the view that collaboration is a more effective way of creating opportunities and market value. In PwC’s 2018 survey of 600 executives, it found that 45% believe that trust could delay adoption of the technology.¹⁹ It’s important that this figure decreases so stronger business relationships can form.

In the business blockchain context, this manifests itself in the sharing of information between network participants. The trust inherent in a blockchain system allows these collaborating companies to share verifiable information with the network without revealing sensitive pieces of data. According to McKinsey & Company, this process minimises the risks of all network participants by making available key information which would have been costly if not impossible to gather alone.²⁰

As a result, the success of each individual participant is based on the success of the group as a whole, creating a strong business case for commitment to strengthening the network. One such example is komgo, a blockchain-based open platform that is bringing commodity trade finance into the 21st century by optimising financing processes and accelerating operations with digitised transactions and a trusted source of documents to reduce fraud.²¹

Whilst coopetition appears contrary to traditional business logic, this sharing of data allows companies to leverage their complementary strengths and thereby increase the capabilities and opportunities of each individual organisation. Companies that are prepared to be willing to adopt this collaborative approach will be better prepared to meet market needs and anticipate new risks.²²



¹⁹ PwC. (2018). Blockchain Is Here. What’S Your Next Move?. [online] Available at: <https://www.pwc.com/gx/en/issues/blockchain/blockchain-in-business.html> [Accessed 12 March 2020].

²⁰ Carson, B., Romanelli, G., Walsh, P. and Zhumaev, A. (2018). Blockchain beyond the hype: What is the strategic business value?. [online] McKinsey & Company. Available at: <https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/blockchain-beyond-the-hype-what-is-the-strategic-business-value>

²¹ Consensus.net. 2019. Consensus Banking And Commodity Trade Finance Komgo. [online] Available at: <https://pages.consensus.net/consensus-banking-and-finance-komgo> [Accessed 24 March 2020].

²² Ovenden, J. (2019) Coopetition in Tech: How Blockchain Could Help. [online] Available at: <https://medium.com/primalbase/coopetition-in-tech-how-blockchain-could-help-6953e338085c> [Accessed 1 March. 2020].

The Business Case For Blockchain

The ability to verify truth at a minimised cost is set to create a shift in the entire structure of business models over time. In the same way that the internet dramatically cut costs of communications, leading to a reshaping of business models, blockchain technology's ability to minimise the need for expensive measures of creditworthiness and internal audits will require executives to rethink the way in which their businesses are structured.

The transparency of a blockchain ledger allows parties to gain instant access to data needed in decision-making processes. In the insurance industry for example, insurers, brokers and clients may track the process of a claim by making the documentation accessible to all parties. As the claim proceeds, each party may monitor the developments and review any changes which have been made. By making this collaborative approach possible, the blockchain platform reduces the delays and costs associated with a traditional claims process and creates an increased legal certainty and confidence in the claims process.

Similarly, LVMH in partnership with ConsenSys and Microsoft, announced AURA, a platform that aims to serve the entire luxury industry with powerful product tracking and tracing services, based on Ethereum blockchain technology and utilising Microsoft Azure. AURA makes it possible for consumers to access the product history and proof of authenticity of luxury goods – from raw materials to the point of sale, all the way to second-hand markets. During production, each product is recorded on the shared ledger,

irreproducible and containing unique information. At the time of purchase, a consumer can use the brand's application to receive the AURA certificate containing all product information. Decentralized and immutable, blockchain technology provides transparency and a single source of truth for the consumer: it ensures the authenticity of the product, provides details on product origin and components (including ethical and environmental information), instructions for product care, and the after-sales and warranty services available.²³

According to KPMG's report titled "Realizing blockchain's potential"²⁴ the above characteristics can offer exciting possibilities, but the challenge is that they also bring with them their own specific risks. For example, with blockchain's immutability, data on a blockchain cannot be deleted. In a use case where customer information is included in a blockchain transaction, blockchain participants may find themselves in breach of privacy regulations (e.g. General Data Protection Regulation - GDPR Article 17) if they cannot comply with a request of a customer enacting their "right to be forgotten".

²³ ConsenSys. (2019). LVMH, Consensus And Microsoft Announce AURA, A Consortium To Power The Luxury Industry With Blockchain Technology | Consensus. [online] Available at: https://consensus.net/blog/press-release/aura_consensus_press-release_may-16-2019-2/ [Accessed 9 March 2020]

²⁴ Maguire, E., Nagaraj, K., deVries, D. and Wyner, S., (2018). Realizing Blockchain's Potential. [online] Assets.kpmg. Available at: <https://assets.kpmg/content/dam/kpmg/co/pdf/2018/09/kpmg-realizing-blockchains-potential.pdf> [Accessed 13 March 2020].

The Elements Of Decentralised Business Networks

Within decentralised business networks, **Operating Nodes** exist to perform functions such as enforcement of policies agreed upon by network participants and monitoring of network transaction volumes. This operator plays a role in the daily management of the business network, however, given the distributed nature of the network, the operator usually does not participate in the transactions between nodes.

These operator nodes tie together some of the core elements of a decentralised business network to make them operationally efficient. The sharing of information facilitated by these networks creates large amounts of data which must be properly maintained and managed. The operator may monitor network activity via transaction volumes for commercial or regulatory reasons and, depending on the function of the network, may bill members through the tracking of these transactions. In instances where traditional communications are insufficient, the operator may distribute announcements by integrating it into the application and where policies detail the process of adding new nodes to the network, the operator may facilitate new additions.



REPORT

The Architecture of Decentralised Business Networks

In order to support the information we have spoken about throughout this paper regarding blockchain business networks, it is important to address the 3 architectural layers (Figure 1) that make up such networks. These layers range from a business model view to a code based perspective all of which are as important as the next. Each layer is interconnected and influences one another. The technical implementation influences the network composition, which in turn has an important impact on the business model layer.

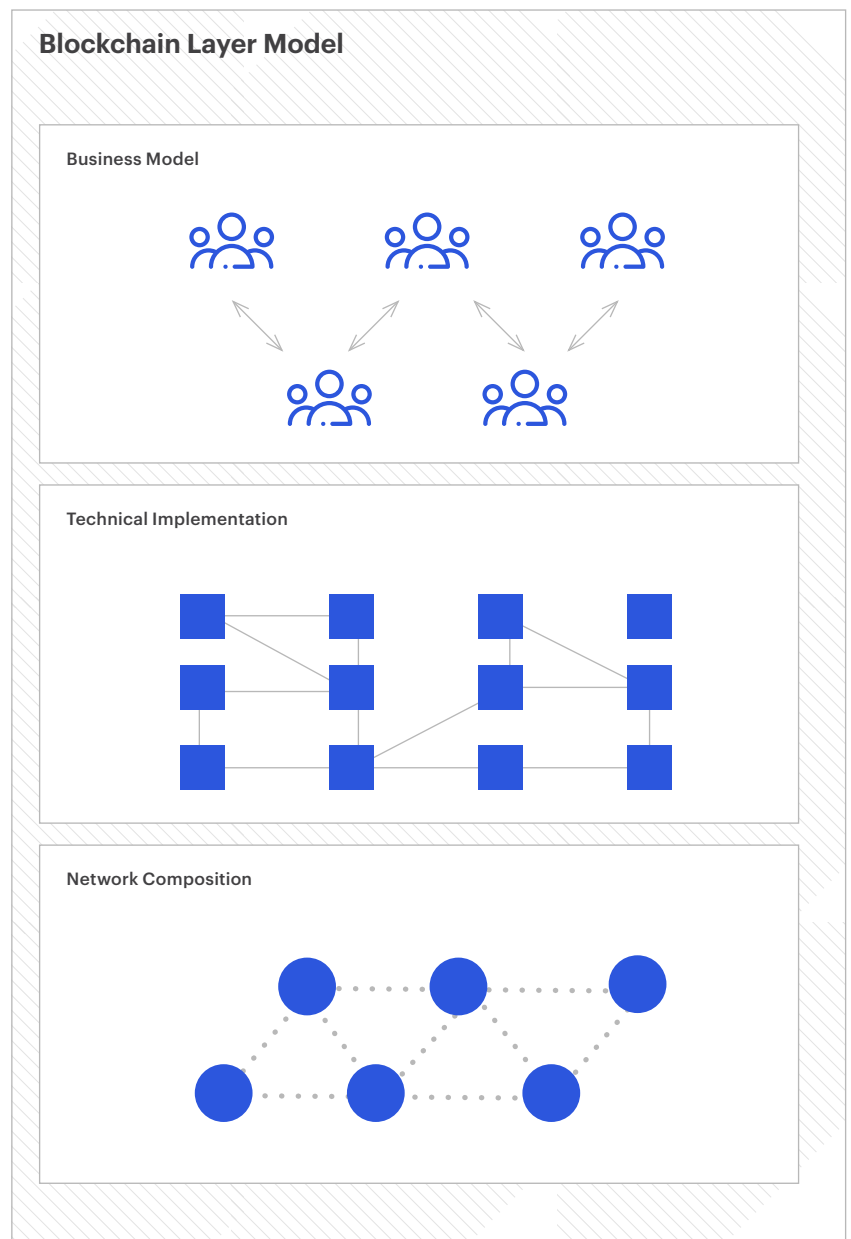


Figure 3 ²⁵

²⁵ Todeva, E. (2011). Business Networks. [online] ResearchGate. Available at: https://www.researchgate.net/publication/228215998_Business_Networks

Business Model

The first layer within a blockchain business network focuses on the description of the business model of the specific network. When describing a business model in this context we refer to an architecture or structural template describing the business logic that the network is to achieve. The business logic in this context provides insights into the different business entities involved in the network, processes it is focusing on and the components and rules which must be adhered to.

Network Composition

Understanding the basic characteristics is another important layer to address when a business or consortium is mapping out the architectural layer of a blockchain network. Characteristics such as who are the participants who will be interacting with each other on the network and what patterns do you intend such participants to communicate. These characteristics may, for instance, vary depending on the specific blockchain platform, or a respective use case.

Technical Implementation

The final layer of a blockchain business network is the code-based structure and content. In this context, the implementation level describes the general architecture, in which the business network is translated into logic.

Journey To Production: From Centralized Deployment To Gradual Decentralisation

Public blockchains such as Bitcoin and Ethereum sparked a new technology revolution since late 2008. The early versions of such systems did not support transaction privacy and as a result private blockchains were the preferred blockchain developed for enterprise clients. These centrally controlled blockchains facilitate

privacy in transaction data by appointing a central authority to validate the transactions. This allowed companies who had initial reservations on the security of the technology to dip their toes in the blockchain technology space without the fear of exposing confidential information. The initial approach of centralised blockchains had their limitations as the value proposition of this technology is its decentralised nature.

Consortiums

Consortia have become a popular means for enterprises to work together on blockchain technology. Deloitte research has found that more than 40 blockchain consortia have formed globally, some of which have attracted significant investments,²⁶ mostly from industry players in financial services, including Bank of America, Merrill Lynch, Citigroup, Credit Suisse, Goldman Sachs, and JP Morgan.

These platforms are generally private to a limited collection of participants or a particular industry segment. Consortiums are helping facilitate the synchronization of sensitive customer and transactional data without breaching privacy laws. An example of a successful consortium is the **Ethereum Enterprise Alliance**. The EEA is a member-driven standards organisation whose charter is to develop open, blockchain specifications that drive harmonisation and interoperability for businesses and consumers worldwide. Their global community of members is made up of leaders, adopters, innovators, developers, and businesses who collaborate to create an open, decentralised web for the benefit of everyone.²⁷

Findings from a study conducted for Ernst & Young suggests that the era of private blockchains will be soon be coming to a close.²⁸

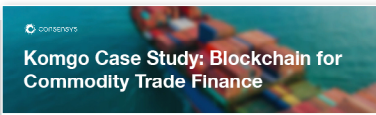
²⁶ Gratzke, P. and Schatsky, D., (2018). Banding Together For Blockchain. [online] Deloitte. Available at: <https://www2.deloitte.com/us/en/insights/focus/signals-for-strategists/emergence-of-blockchain-consortia.html#endnote-sup-8> [Accessed 12 March 2020].

²⁷ Boring, P., (2020). Home - Enterprise Ethereum Alliance. [online] Enterprise Ethereum Alliance. Available at: <https://entethalliance.org/> [Accessed 9 March 2020].

²⁸ Assets.ey.com. (2019). Seize The Day: Public Blockchain Is On The Horizon. [online] Available at: https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/blockchain/ey-public-blockchain-opportunity-snapshot.pdf [Accessed 10 March 2020].

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Decentralised Business Networks Case Studies



Komgo Case Study: Blockchain for Commodity Trade Finance

A blockchain-based open platform that is bringing commodity trade finance into the 21st century by optimizing financing processes and accelerating operations with digitized transactions and a trusted source of documents to reduce fraud.

Problem Statement
Rapid globalization has impacted the trade finance industry, leading to a significant increase in cross-border trade. This has led to a rise in fraud and a need for more secure and efficient trade finance solutions. Komgo was created to address these challenges by providing a secure and transparent platform for trade finance transactions.

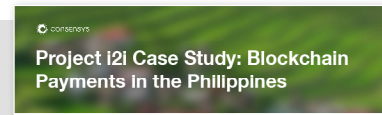
Solution & Partnership
The Komgo platform, backed by 15 of the world's largest commodity trading groups, banks, trading companies, and oil majors, includes a fully licensed blockchain solution. Komgo is a "turnkey by design" platform, with a blockchain-based ledger and a smart contract layer. The platform is built on the Ethereum blockchain and is designed to be scalable and secure. Komgo is a fully licensed platform, with a blockchain-based ledger and a smart contract layer. The platform is built on the Ethereum blockchain and is designed to be scalable and secure.

Goals Achieved
After 1 year of pilot programs and plans, Komgo is now a fully operational platform. The platform has been used to process over 100 trade finance transactions, with a total value of over \$1 billion. Komgo is now a fully operational platform, with a blockchain-based ledger and a smart contract layer. The platform is built on the Ethereum blockchain and is designed to be scalable and secure.

Technology Partner
KALEIDO

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Enterprise Ethereum is the foundation for many industry blockchain use cases and case studies.
Find out more about blockchain applications on consensys.net/enterprise-ethereum

Download Komgo



Project I2I Case Study: Blockchain Payments in the Philippines

An Enterprise Ethereum payment network driving financial inclusion in the Philippines through more accessible and more efficient domestic transactions.

Problem Statement
The Philippines is a rapidly emerging economy with a population of over 100 million. However, the lack of a formal banking system and a high level of financial illiteracy have led to a significant portion of the population being unbanked. This has led to a need for more accessible and efficient financial services.


Solution & Partnership
I2I is a blockchain-based payment network that is designed to be accessible and efficient. It is built on the Enterprise Ethereum platform and is designed to be scalable and secure. I2I is a blockchain-based payment network that is designed to be accessible and efficient. It is built on the Enterprise Ethereum platform and is designed to be scalable and secure.

Goals Achieved
I2I is now a fully operational payment network, with a total value of over \$1 billion in transactions. I2I is now a fully operational payment network, with a blockchain-based ledger and a smart contract layer. The platform is built on the Enterprise Ethereum platform and is designed to be scalable and secure.

Technology Partners
KALEIDO, **Diligence**, **Microsoft**, **Amazon**

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Download Project I2I



Project Khokha: Blockchain for Central Banking in South Africa

Increasing transaction volume and network resilience while maintaining confidentiality requirements for real-time gross settlement.

Problem Statement
The South African Reserve Bank (SARB) is looking to increase the volume and network resilience of its real-time gross settlement (RTGS) system. The current system is based on a centralized architecture and is not designed for high transaction volumes. The SARB is looking for a more scalable and resilient solution.

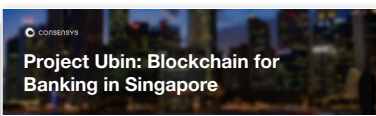
Solution & Partnership
The SARB is working with ConsenSys Solutions and Quorum to build a blockchain-based RTGS system. The system is built on the Enterprise Ethereum platform and is designed to be scalable and secure. The SARB is working with ConsenSys Solutions and Quorum to build a blockchain-based RTGS system. The system is built on the Enterprise Ethereum platform and is designed to be scalable and secure.

Goals Achieved
The SARB is now a fully operational RTGS system, with a total value of over \$1 billion in transactions. The SARB is now a fully operational RTGS system, with a blockchain-based ledger and a smart contract layer. The platform is built on the Enterprise Ethereum platform and is designed to be scalable and secure.

Technology Partners
Quorum, **A**

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Download Project Khokha



Project Ubin: Blockchain for Banking in Singapore

A consortium effort that explores the benefits of distributed ledger technology on implementing a real-time gross settlement solution in central banking.

Problem Statement
The Monetary Authority of Singapore (MAS) is looking to explore the benefits of distributed ledger technology (DLT) for central banking. The current system is based on a centralized architecture and is not designed for high transaction volumes. MAS is looking for a more scalable and resilient solution.

Solution & Partnership
MAS is working with ConsenSys Solutions and Quorum to build a blockchain-based RTGS system. The system is built on the Enterprise Ethereum platform and is designed to be scalable and secure. MAS is working with ConsenSys Solutions and Quorum to build a blockchain-based RTGS system. The system is built on the Enterprise Ethereum platform and is designed to be scalable and secure.

Goals Achieved
MAS is now a fully operational RTGS system, with a total value of over \$1 billion in transactions. MAS is now a fully operational RTGS system, with a blockchain-based ledger and a smart contract layer. The platform is built on the Enterprise Ethereum platform and is designed to be scalable and secure.

Technology Partner
Quorum

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Download Project Ubin



MATA CAPITAL CASE STUDY

Catalyzing real estate investments with blockchain technology

Problem Statement
Mata Capital is a real estate investment platform that is looking to increase the volume and network resilience of its real-time gross settlement (RTGS) system. The current system is based on a centralized architecture and is not designed for high transaction volumes. Mata Capital is looking for a more scalable and resilient solution.

Solution & Partnership
Mata Capital is working with ConsenSys Solutions and Quorum to build a blockchain-based RTGS system. The system is built on the Enterprise Ethereum platform and is designed to be scalable and secure. Mata Capital is working with ConsenSys Solutions and Quorum to build a blockchain-based RTGS system. The system is built on the Enterprise Ethereum platform and is designed to be scalable and secure.

Goals Achieved
Mata Capital is now a fully operational RTGS system, with a total value of over \$1 billion in transactions. Mata Capital is now a fully operational RTGS system, with a blockchain-based ledger and a smart contract layer. The platform is built on the Enterprise Ethereum platform and is designed to be scalable and secure.

Technology Partner
Codefi

CONSENSYS SOLUTIONS
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Enterprise Ethereum is the foundation for many industry blockchain use cases and case studies.
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Conclusion

Blockchain business networks will represent a radically new way for businesses to securely transact and transfer value using blockchain. Potential technology limitations aside, organisations are continuing to place more strategic importance on the technology. As adoption continues to grow, businesses are benefiting from the technology's ability to scale faster, create new levels of trust and generate faster processing and settlement times using a shared ledger across a network. Thanks to the key concepts of cryptographic security, decentralised consensus mechanisms and a shared ledger (with its properly controlled and permissioned visibility), blockchain technology will completely change the way we construct our economic, social, political, and scientific activities.

For businesses to unlock the benefits of blockchain technology, the following points should be considered:

1. Traditional networks can be easier to create, but BBNs have already shown that they create more business value than TBNs eg. komgo and LVMH.
2. Your organisation needs to make a strategic shift and focus on working with competition to build a cooperative relationship for the benefit of your BBN.
3. The business case you develop must focus on the sharing of value and not only sharing of information.
4. The journey your business will take from a traditional network to a BBN can be done gradually to ensure you are not over exposing your organisation to new challenges.
5. Your business should continue to grow and refine your blockchain business network to ensure it is meeting all needs of its stakeholders and your clients.

For organisations who are not open or willing to change and adopt blockchain business networks, this shift will create new challenges for your business. Not investing in new technologies can be expensive in the long-term and may mean your business could be left behind. This could be in the form of industry working groups or consortiums that are developed to generate change for your specific industry. To realize the full impact of blockchain on your business, a blockchain strategy is crucial to ensure you have your strategic moves planned and are able to quickly create or become a part of a blockchain business network.

Start Your Blockchain Journey Today

[Contact our Solutions team](#) to consult our experts about how blockchain technology can be leveraged by your organisation. Our global Solutions team offers blockchain training, strategic advisory, development and implementation services and opportunities for joint ventures and co-creation.

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