Chapter 3

Blockchain and Financial Services

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Key points

- Blockchain is a type of peer-to-peer (P2P) database that uses data 'blocks', all of which update one another automatically as they grow, to build an immutable (permanent) record.
- It is both more secure than other forms of database (because it is harder to insert bad data) and more user-friendly (because it makes it easier to access that data).
- As a distributed ledger technology (DLT), blockchain allows parties who do not necessarily trust each other to co-operate towards shared outcomes, which is useful in a number of financial services applications.
- Central banks have both proposed and trialled a range of blockchain experiments, ranging from land registry to introducing their own central bank digital currencies (CBDCs).[1]

3.1 Introduction

Disruption is rife in the financial services sector. Nimble market entrants and rapidly penetrating technologies are challenging consumer expectations of financial services delivery. As they gradually adopt blockchain technology, large financial institutions will experience dramatic efficiency gains—and equally dramatic cost reductions and reduced risk.

Banks and central banks are the dominant players in exploring the potential of blockchain to drive major institutional change in the financial services sector. Blockchain can eliminate redundant systems, automate processes, introduce new modes of contracting and open business models, drive radical institutional cost reductions and capital market restructuring, reduce risk, and ensure stable economic performance and compliance with international regulation. Recognising the value of these opportunities in relation to digital currencies, the Commonwealth Secretariat published its *Regulatory Guidance on Virtual Currencies* in 2019, paying specific attention to issues of enforcement relating to criminal activity, taxation, financial products, consumer protection and financial inclusion.[2]

In this chapter, we will use real-world examples to describe how the core features of blockchain technology—such as security, transparency, auditability and immutability on a peer-to-peer (P2P) network—are driving its adoption in the financial services sector and are likely to change the ways in which we manage the recording, storage and transfer of digital assets.

We will look at how blockchain technology is maturing alongside complementary technologies, such as artificial intelligence (AI) (see Chapter 2), the Internet of Things[3] and big data/big data analytics (see Chapter 5), to reach beyond financial processes alone.

In the short-to-medium term, we can expect to see blockchain applied to influence domestic and international monetary policy and to introduce new payment channels,

shifting financial services away from the dominant central bank model and helping to restructure debt burdens. With blockchain technologies providing secure data transfer and surveillance, the integration of complementary technology will provide new modes of identification, data structures and management protocols, boosting investor and market confidence and reducing risk. Data that are more reliable will lead to more sustainable lending decisions and—with enforcement automated—improved debt recovery, reducing debt-related costs and burdens.

In the medium-to-long term, we can expect blockchain to facilitate a hyper-personalised digital payments ecosystem, comprising programmable money—a vast suite of digital currencies—underpinned by central bank digital currencies (CBDCs). While we might anticipate that some cash will always remain in circulation, the concept of 'money' in the future will be very different from money as we conceive of it now.

Since 2016, more than 200 banks and 40 central banks worldwide have experimented with blockchain. Also known as distributed ledger technology (DLT), cases in point include applications targeting:

- financial inclusion;
- payments efficiency;
- payment system operations;
- cyber resilience;
- trade finance;
- the provision of Single Euro Payments Area (SEPA) credit identifiers (SCIs);
- bond issue and management;
- interbank securities settlement;

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- know your customer (KYC) and anti-money-laundering (AML) processes;
- wholesale and retail CBDCs; and
- improved data management and information sharing.

The primary motivation behind efforts to develop and deploy DLT is its potential to reduce or even eliminate the operational and financial inefficiencies—or to smooth the other frictions—that result from current methods of storing, recording and transferring digital assets throughout financial markets.

Banks with experience of blockchain cite benefits such as:

- wide-ranging oversight of trade transactions, from trade to settlement;
- reduced risks of discrepancy and delayed settlement;

- real-time access to a shared ledger among multiple stakeholders;
- automation of traditionally manual processes;
- reduced reliance on external settlement networks;
- efficiency gains in capital velocity; and
- reduced counterparty, market and credit risks.

Blockchain is a secure, decentralised digital ledger of data, organised into blocks and linked across a public, private or federated cloud-hosted network. A public blockchain (such as Bitcoin or Ethereum) may have millions of nodes authorising transactions on the network; a private or federated network may have as few as three nodes on the network. The number of nodes on the network affects the transaction speed. Public blockchains may consequently be criticised for slow throughput, because potentially millions of computers on the network must be co-ordinated. Instances of institutional application therefore increasingly centre on private and federated networks. Popular blockchains in the financial services sector include Hyperledger, AWS, IBM, Multichain, R3's Corda, the Linux Foundation's Hyperledger Fabric, J P Morgan's Quorum or private configurations of the Ethereum blockchain.

Blockchain's proponents posit that DLT could help to foster a more efficient and safer payments system, affect the way in which payment, clearing and settlement (PCS) activities are conducted, and change the roles that financial institutions and infrastructures play in the financial services market—or even fundamentally change that market's structure. While

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others believe that effective real-world applications of blockchain technologies are still years away, the financial services sector has already witnessed several significant early-stage developments. Indeed, while traditionally cautious, banking institutions have been early adopters of blockchain technologies, incentivised by potential operational cost savings, competitive market positioning (particularly among emergent and disruptive fintech start-ups), and the potential for efficiency gains in capital markets.

3.2 Context

The transfer, trade and settlement of payments, securities, commodities or derivatives involves time-consuming steps that are facilitated and overseen by financial intermediaries—also known as financial market infrastructures (FMIs)—such as payment systems, securities settlement systems (SSSs),

central securities depositories (CSDs) and central counterparties (CCPs). These intermediaries provide services, manage financial, operational and legal risks, and are responsible for good governance structures for themselves, their customers and the markets they serve. End users, such as households and businesses, typically trust intermediaries such as banks and broker-dealers to store and maintain records of the users' assets and then to transfer those assets on the users' behalf. When a user initiates a transaction, their bank or broker-dealer will interact with one of these FMIs.

As transaction volumes have risen and market participants have become more complex, frictions have emerged and increased both the costs and the risks of transacting in financial markets. Such frictions, including operational and financial inefficiencies, have prompted market participants to seek solutions in areas such as payments, the transfer of money, cross-border trade and the trading of securities. Thus far, these solutions have comprised either developing technology or changing market structures, or a combination of both. The availability and maturity of technology are key factors in determining which of the two will best address a particular friction or inefficiency.

To date, blockchain—a nascent technology—has been piloted in cross-border transactions. Research by the World Economic Forum also indicates proof of concept for forthcoming deployments in financial services contexts, including:

- establishing syndicated loan joint ventures to reduce transaction times;
- providing utility settlement coins to make clearing and settlement efficient;
- settling high-value securities transactions in minutes by reducing paper-based processes;
- reducing bond issuance and settlement from days to minutes;
- mutualising KYC servicing to reduce compliance costs;
- efficiency gains in cross-border transactions and verification;
- simplifying and improving foreign-exchange balance-sheet reconciliation;
- creating back-office business management efficiencies by using smart contracts (i.e., self-executing computer programs with defined business logics) to automate processes; and
- providing secure interbank letters of credit efficiently using smart contracts, addressing issuesof data forgery.[4]

In any case, introducing new technology in financial services often requires the restructuring of markets (consider, for example, the radical difference the internet has made to previously paper-based processes such as stock issue). The functionality of blockchain is therefore likely to reshape the architecture of financial markets by facilitating disintermediation and eliminating redundant processes.

3.3 Description

We can organise the applications of blockchain into three broad categories:

- the storage of digital records (identities, assets or voting rights);
- the exchange of digital assets (via direct P2P transactions that eliminate intermediaries); and

- the recording and execution of smart contracts.

The structure and functionality of the blockchain network offers multiple opportunities for cost savings in the financial services sector. The P2P network disintermediates numerous parties responsible for processing and approving the registration and transfer of assets, and the use of smart contracts automates these processes.

Smart contracts are lines of code that execute automatically when certain conditions are met, which can eliminate time-consuming and costly manual processes, for example, by paying on a derivative when a financial instrument meets a certain benchmark or resetting the interest rate on a debt when it reaches a certain balance. Smart contracts are already digital, yet Oracle's external data warehouses could automate them further, even more transparently, for example, by automatically calculating an interest rate reset on a floating-rate mortgage. Accordingly, blockchain would reduce the associated costs of human resources and third-party professional support. It would reduce the need for financial analysts and lawyers, because blockchain-enabled smart contracts can assess delinquency rates, compile monthly repayment reports and trigger enforcement action where required automatically. Indeed, in a 2017 report, Accenture found that repointed operational, risk and finance systems represent long-term return on investment in blockchain: investment banks report up to 70 per cent savings on central finance reporting and 50 per cent in business operations such as trade support, middle office, clearance, settlement and investigations.[5]

In addition to these radical cost reductions for financial services firms, blockchain promotes reduced counterparty and market risk, and it supports efficient capital markets. If a shared, transparent ledger is populated automatically with real-time financial data, investors can be assured of a prospect's creditworthiness and overall organisational financial performance, enabling a swift response to collateral performance and economic stability. Smart contracts and permissioned ledgers can thus provide investors and creditors with unprecedented confidence in data reporting and accuracy by enabling more accurate forecasting, improved risk management and sustainable financing, the impact of which contributes to efficient securitisations and ratings.

Automated collection and reconciliation of information, the reduced potential for human error and secure network integrity can all increase stakeholder faith in blockchain technology. In financial services, we see this trust emerging as the technology matures from nothing more than a way of managing financial processes to become a way of resolving economic policy concerns. In May 2019, the Monetary Authority of Singapore—Singapore's central bank—and the Bank of Canada piloted a currency swap: the first successful trial between two central banks. This activity repositioned DLT as not only a reliable method of facilitating a near-instantaneous currency swap, but also a tool with which to ensure that central banks inside and outside of the G20 can trust one another.

Blockchain also builds stakeholder trust in collection and recovery. The immutability of the data allows loan pools to be audited and independently verified, using the digital signature of the source provider as proof of authenticity and confirming compliance with underwriting guidelines. In the event that a delinquency trigger is tripped, custody of a loan

on blockchain facilitates outreach to borrowers in default and ensures that subsequent special servicing complies with servicing guidelines. Furthermore, blockchain simplifies the enforcement of investors' rights and protects asset values by immutably recording on chain the beneficial owners of assets in every transaction—including ownership transfers—and hence building a comprehensive and secure ownership registry that ensures deals can be credit-positive.

Existing market participants, including large financial institutions, are using blockchain to achieve these effects and to leverage competitive advantage.

- **Provenance.io** is the first blockchain to support the successful origination, financing and servicing of loan assets on chain, permitting evaluation of real-time financial performance.

- The **National Bank of Cambodia** will use blockchain technology in its national payments system in a full-scale deployment across 12 banks by the end of 2020.

- **Globacap** offers investment in tokenised assets. The token's smart contract automatically fulfils all legal and administrative requirements for the registration and transfer of assets.

- The **Commonwealth Bank of Australia**, in partnership with the World Bank, created Project BOND-I in 2018—the world's first bond to be created, allocated, transferred and managed through its life cycle using blockchain technology.

- In France, **Project MADRE** has replaced the centralised process for the provisioning and sharing of SCIs with smart contracts using a private Ethereum implementation.

- The **People's Bank of China** announced the launch of a yuan-denominated blockchain-based CBDC in 2019, shortly after Facebook launched Libra.

Banking institutions are adopting blockchain not only to drive interbank efficiency, but also to raise levels of financial inclusion. The National Bank of Cambodia, for example, has implemented blockchain to provide access to retail banking for Cambodia's underbanked, supporting interoperable retail payments between citizens and businesses. By encouraging citizens to adopt bank accounts, the government is supporting individual savings, promoting financial stability and supporting economic growth.

Moreover, this rare instance of a national rollout of blockchain technology demonstrates the ability of technology to leapfrog traditional wholesale interbank processes, providing a highly efficient PCS process that other, similar countries in the Association of Southeast Asian Nations (ASEAN) could easily replicate. The Bank of Thailand has launched its Scripless Bond project: in a successful trial using HyperLedger Fabric, Thailand reduced to just 2 days a bond registration and issuance that has traditionally taken 15 days.[6]

The Government of the People's Republic of China (PRC), meanwhile, caused both interest and alarm in governmental, public and private sector circles when it announced its digital yuan. To some extent, it was a response to launch of the Facebook-backed Libra project a few months previously[7] and, with one of the world's largest economies now supporting a CBDC, we can expect other governments to accelerate their own efforts in the near future.

3.4 Key Considerations for Future Development

With consumers becoming more digitally aware and questions being asked about the future of cash, new market entrants are challenging traditional expectations of bank-based service delivery. So-called programmable money may diversify the range of currencies and shift the focus away from stalwarts such as the US, Canadian or Australian dollar; CBDCs may become familiar as part of the financial services ecosystem.

Central bank digital currencies offer benefits such as a resilient payment system and the potential to improve AML/KYC functionalities while reducing illicit activities. There are, however, equally significant risks to CBDCs, including financial exclusion should populations not bridge the digital divide, financial instability as a consequence of bank disintermediation and new risks that may yet be unknown. There has consequently been a lot of research into CBDCs and most early-stage pilots have focused on their domestic use.

Some of the central banks currently considering digital currencies include:

- the **Bank of Thailand**, whose Project Inthanon is exploring how a CBDC can make interbank payments and liquidity management more efficient;
- the **Eastern Caribbean Central Bank**, which is exploring DLT in the context of economic growth, payments system resilience and financial inclusion; and
- **Sveriges Riksbank** (Sweden's central bank), which is investigating a blockchain-based digital krona as an alternative to cash as the use of cash in Sweden declines.

Because pilots often occur in countries whose domestic interbank payment systems are already efficient, however, early conclusions are that there is no significant value in centring a CBDC on this goal alone—as the Bank of Canada's Project Jasper, the South African Reserve Bank's Project Khokha, and the European Central Bank and Bank of Japan's joint Project Stella all demonstrate. In a 2017 report, for example, Dansmarks Nationalbank (Denmark's central bank) explicitly noted its uncertainty that a CBDC would be of any benefit to Denmark's existing payment solutions.[8] Where domestic interbank payment systems are *not* yet highly efficient, however, such as in some developing economies, a CBDC has positive potential.

More broadly, some experts believe that we may see forms of CBDC facilitate alternative or bilateral international payments systems that operate outside the current dominant models. A blockchain-based state currency could supersede the Society for Worldwide Interbank Financial Telecommunication (SWIFT) system, diversifying and moving international payment processes and monetary systems away from the US dollar.

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In this way, a CBDC might offer states and financial actors more autonomy over international payments. For example, in February 2018, Venezuela allegedly issued its petromoneda (or petro) digital currency on NEM's blockchain platform in a bid to attract government financing during rapidly deteriorating domestic economic conditions and a plummeting bolívar, while China's digital yuan, today focused on M0 money supply, could readily be expanded. Given China's global importance as an economic superpower, the digital yuan could be a ready vehicle to facilitate trade.

Blockchain technology is therefore an ecosystem enabler—but it is not a panacea: as it is implemented more widely, complementary technologies will mature, and blockchain will come to be only one element in blended technology.

Endnotes

1 For more in-depth guidance on digital currencies, see Commonwealth Working Group on Virtual Currencies (2019). *Regulatory Guidance on Virtual Currencies* [online]. Retrieved from https://thecommonwealth.org/sites/default/files/key_reform_pdfs/D16999_GPD_Virtual_Currncs.pdf; Boar C, Holden H, Wadsworth A (2020). 'Impending Arrival: A Sequel to the Survey on Central Bank Digital Currency'. Bank for International Settlements (BIS) Papers No. 107 [online]. Retrieved from www.bis.org/publ/bppdf/bispap107.pdf; Ye C, Desouza K (2019). 'The Current Landscape of Central Bank Digital Currencies'. *Brookings*, 13 December [online]. Retrieved from: www.brookings.edu/blog/techtank/2019/12/13/the-current-landscape-of-central-bank-digital-currencies/

2 Commonwealth Secretariat (2019). *Regulatory Guidance on Virtual Currencies* [online]. Retrieved from: https://thecommonwealth.org/sites/default/files/key_reform_pdfs/D16999_GPD_Virtual_Currncs.pdf

3 By the 'Internet of Things', we mean the informal network of connected electronic devices that helps to provide us with ubiquitous data about the world around us.

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