



From concept to reality: How blockchain will reshape the financial services industry

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BRITAIN & NORTHERN IRELAND

A report from the UK's Department for International Trade



Written by The Economist Intelligence Unit



Department for
International Trade

Department for International Trade

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The Royal Exchange and the Bank of England,
London, UK



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Executive Summary

Blockchain is a young technology, first conceptualised in 2008. The financial industry has been among the first industries to seize upon the efficiency savings that its distributed ledger technology could deliver, and for good reason: Using distributed-ledger technology could help financial services providers lower the worldwide cost of cross-border payments, securities trading and compliance by \$15-20 billion per year by 2022, according to Spanish banking giant Santander¹.

For now, real-life use of blockchain technology is still limited. Its current use is mostly to be seen in the bitcoins–virtual currency created with blockchain technology–that cross borders with negligible regulation.

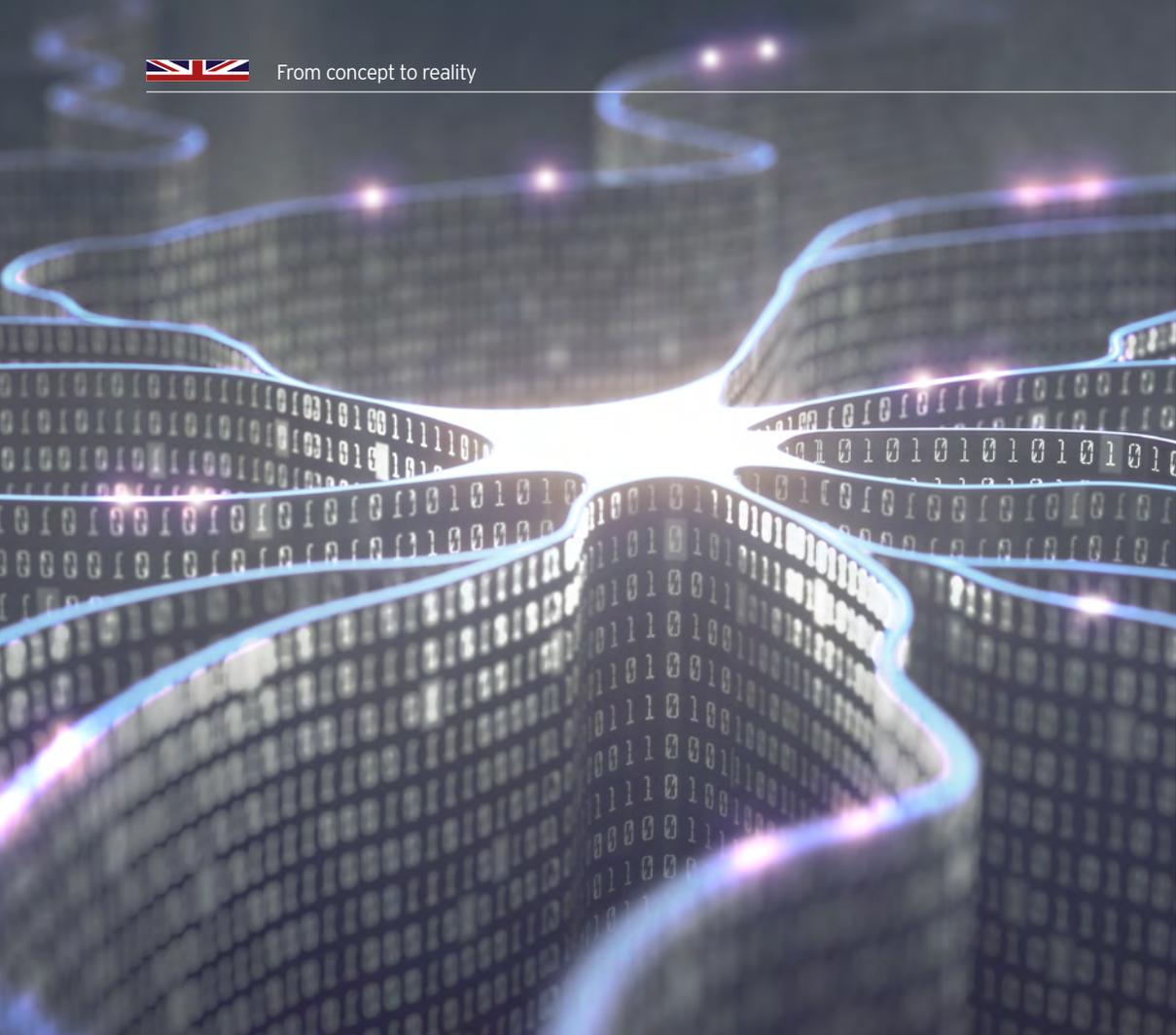
Incumbent banks, asset managers, insurers and technology firms are keen to experiment with the new technology. Their initial trials focus on niche areas of trade finance, payment settlements and reconciliation. While interest in applying the technology is growing, widespread implementation may take years. An all-encompassing financial blockchain is unlikely to emerge from current projects.

Yet the financial industry already has a consistent view of what needs to be done to put private specialist blockchains

1. *The Fintech 2.0 paper: Rebooting financial services*, by Santander InnoVentures, Oliver Wyman, Anthemis Group; <http://santanderinnoventures.com/wp-content/uploads/2015/06/The-Fintech-2-0-Paper.pdf>



From concept to reality





to good use. Here are some of the likely main features of the future use of blockchain in the global financial services industry:

- **Closed systems:**

Collaborative blockchain networks will be closed to outsiders, to ensure that information does not land in the wrong hands and to prevent hackers from disrupting financial stability.

- **Back office first:**

The first objective for introducing blockchain technology will be to save costs. Blockchain will cut the cost of the daily checking and rechecking of ownership and transactions.

- **Regulatory overhaul:**

Financial industry rules may need a worldwide update, along with reforms to broader data protection regulation. Regulators want to encourage innovation but without upsetting stability.

- **Emergency markets:**

The first widespread changes to retail financial services

involving blockchain may take place in emerging markets, where banking, investment and insurance penetration rates are low.

- **Less reliance on cash:**

Widespread use of blockchain technology, together with updates to compliance regulations, will enable central banks to substitute their own regulated, blockchain-based digital currencies for notes and coins. Some central banks, such as the Bank of England and the central bank of Norway, are already discussing discontinuing use of notes and coins entirely.

- **Smarter finances:**

Within 10 to 20 years, embedded smart contracts could transform how bank accounts work and how insurance pays out.

- **SME boost:**

Blockchain could help open up cheaper, non-bank financing to small and mid-sized firms, which provide two thirds of all jobs in Europe.

About This Report

Department for International Trade

‘From concept to reality: How blockchain will reshape the financial services industry’ is a report from the UK’s Department for International Trade, written by The Economist Intelligence Unit. The report assesses blockchain’s impact on processes and functions in the global financial services industry, as well as on the industry’s structure. It also details some of the key changes to products and services that retail and business clients can expect in the years ahead.

The Economist Intelligence Unit bears sole responsibility for the content of this report. The findings and views expressed in the report do not necessarily reflect the views of the sponsor. Paul Burgin, an independent financial journalist, was the author of the report, and Aviva Freudmann, research director, EMEA Thought Leadership for The Economist Intelligence Unit, was the editor.

The report is based on extensive desk research and in-depth interviews with 14 representatives of financial institutions of all types and sizes, including banks, fund management groups, reinsurers and specialised start-ups. The interviews were conducted in March 2017.



*The International Financial Services District,
Glasgow, UK.*



Our sincerest thanks to the following participants (listed alphabetically by surname) for their time and insights:

- Tim Coates, managing consultant, Synchron
- Robert Courtneidge, global head of cards and payments, Locke Lord
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- Mark Højgaard, chief executive officer, Coinify
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- Laurence Leblond, head of operations, Unigestion
- Anthony Macey, head of blockchain R&D, Barclays
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- Keonne Rodriguez, senior manager digital and user interface/user experience lead, Synchron
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Introduction

Since the financial crisis a decade ago, the financial services industry has grappled with eradicating the excesses of the past, and with low interest rates and squeezed profit margins. On top of that, the industry has faced new competition from financial technology (fintech) start-ups. Their slick smartphone apps may lure some of the most profitable clients away from industry incumbents. At the same time, the industry has been dealing with a growing burden of cybercrime as finance goes digital. Spectacular hacks of financial industry data pose a growing threat to a global industry that relies entirely on trust.

Blockchain technology may challenge the industry yet further, as financial services providers use blockchain-based shared platforms to deliver financial services that were previously delivered by traditional means.

In addition to challenges, the new technology may bring the financial industry many benefits. Its distributed ledgers may be used by incumbents and newcomers alike to extend banking to those who have no access, insurance to those who cannot afford cover, and financial security to those who currently cannot save for their retirement. Blockchain could even create new economic systems, upending how we view money and the transfer of value and assets from seller to buyer.

The revolution will start quietly in niche areas of the back-office where ownership and transactions are reconciled.





The potential savings and economic benefits are vast, although mainstream adoption may take 10 to 20 years. This study considers how the blockchain technology may develop within financial services, and the route the technology may take to transforming the industry.

Bitcoin and blockchain explained

Bitcoin is a digital cryptocurrency (a currency in which encryption regulates the generation and transfer of funds) that can be exchanged for goods and services via peer-to-peer networks. A significant feature of bitcoins is that they are not issued by central banks, nor backed by them.

The technology that supports bitcoin is

blockchain. Also known as distributed ledger technology, a blockchain records the generation of bitcoins through a process of electronic 'mining', and stores the data on transactions in sequence, on a network of linked computers simultaneously. The blockchain data structure provides a verifiable history that only can be added to, not deleted or amended.



I. Finance today, blockchain tomorrow

A financial system is based on trust: the belief that a chosen medium of exchange—for example, gold—will be accepted by others as a unit of value.

The modern financial system relies on trust that fiat currencies—the banknotes and coins issued by central banks—represent value. We trust that shopkeepers will accept these notes and coins in exchange for goods and services. We also trust our central banks to maintain the value of our currency. Whether in third century Rome, in 1920s Germany or in Zimbabwe more recently, economies collapse when people lose faith that the currency represents a store of value.

The blockchain revolution represents a change in the nature of that trust. With blockchain, trust is based on a system of distributed ledgers that keeps track of ownership of property and transfers of value. Blockchain-based networks can trade property directly on a platform, with the platform itself providing the basis for trust in the veracity of the parties and the authenticity of the transaction. The technology also allows for self-executing contracts that may streamline today's procedures for reaching and implementing agreements among transacting parties. Hence trust will remain at the core of a blockchain-based financial services future, but participants will place their faith in different entities than they do today.

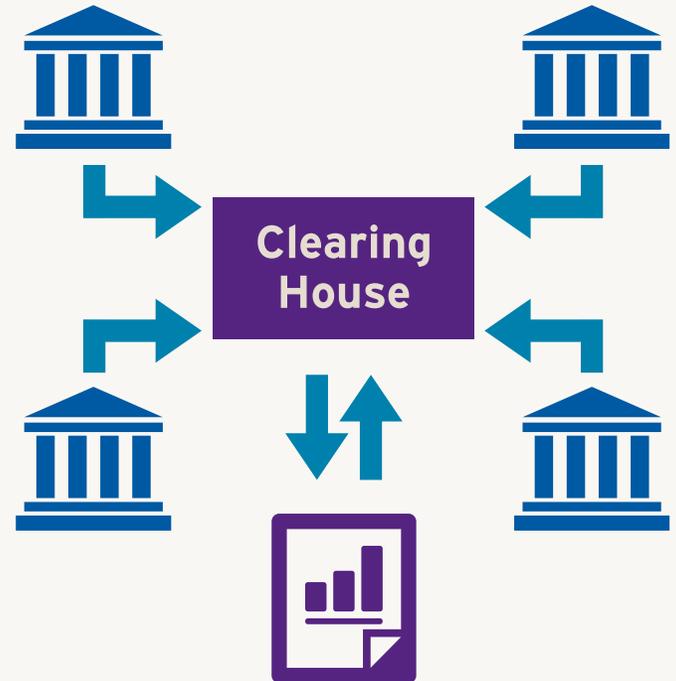


Today: Centralised Ledgers

Today's financial system relies on multiple records of who owns what and at what point ownership has been transferred. In this system, a bank making a payment on behalf of a payer keeps a record of the payer's account and its balances and transactions. The receiving bank does the same.

Between the paying bank and the receiving bank, a payment may also pass through a clearing house, a credit card issuer and/or a shopkeeper. Each step is recorded and reconciled, adding time and cost.

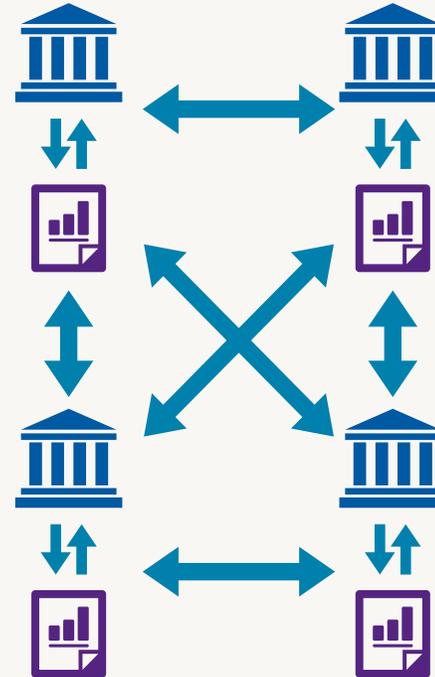
The same reconciliation and record-keeping requirements apply to the transfer of equities, bonds and other financial instruments. Each issuer, seller and buyer of a share or bond keeps its own ledger. A clearinghouse facilitates the transfer of value between them and has its own ledger too.



Tomorrow: Distributed Ledgers

Blockchain's distributed ledger technology represents a radically different approach to reconciliation and record-keeping. In a permissionless system, like that used for bitcoin, anyone can join the network and become a 'node' that hosts an identical version of the database of who owns what and when they trade it.

When new data are added, the network uses algorithms to determine whether they are plausible. As everyone can rely on his or her own identical copy of the distributed database, there is no need for separate ledger reconciliation or centralised clearance. Blockchain's distributed model may eventually replace today's centralised processes, offering cost and time efficiencies in banking, asset management and insurance.



Source: Financial Times, The blockchain and financial markets



II. The first steps: blockchain in financial services sectors

For all the hype, blockchain is actually very dull. It is electronic bookkeeping that structures data and shares it on a network. The data structuring process, known as hashing², also can generate value—in the form of a cryptocurrency—which can be transferred to others via the network.

The concept may be simple, but its potential to alter the financial industry is large. Shared ledgers could reduce friction, costs and delays in transactions of all types, as all parties to a blockchain have access to the same data at the same time. Moreover, self-executing contracts programmed into blockchain networks can deliver efficiencies by automating outcomes in response to the addition of ratified data to a blockchain. These features of the technology are already driving the acceptance of blockchain in various segments of the financial services industry.

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² Hashes are large numbers, and are usually written as hexadecimals, a system of numerical notation that has 16 rather than 10 as its base. BitCoin uses a particular hash algorithm to generate verifiably “random” numbers in a way that requires a predictable amount of computing power.



at the same time. Moreover, self-executing contracts programmed into blockchain networks can deliver efficiencies by automating outcomes in response to the addition of ratified data to a blockchain. These features of the technology are already driving the acceptance of blockchain in various segments of the financial services industry.



Trade finance

Blockchain's earliest wins will be felt in the back offices of banks financing commercial transactions, including international ones.

Global trade operates on the same principle today as it did during the Middle Ages, when the Lombards of Northern Italy accepted documents describing the value of goods to extend credit to traders and settle invoices. A modern exporter still receives a bill of lading detailing what goods were shipped, and where. The exporter adds the invoice and customs forms, and sends all the documents to a bank that issues a letter of credit. All the documents are checked again by the buyer's bank before payment is released.

Blockchain technology can simplify that exchange of documents. ING and Société Générale, for example, have shown how a blockchain ledger process can be used to track the ownership of a cargo of crude oil that was sold three times while on the high seas en route to China.

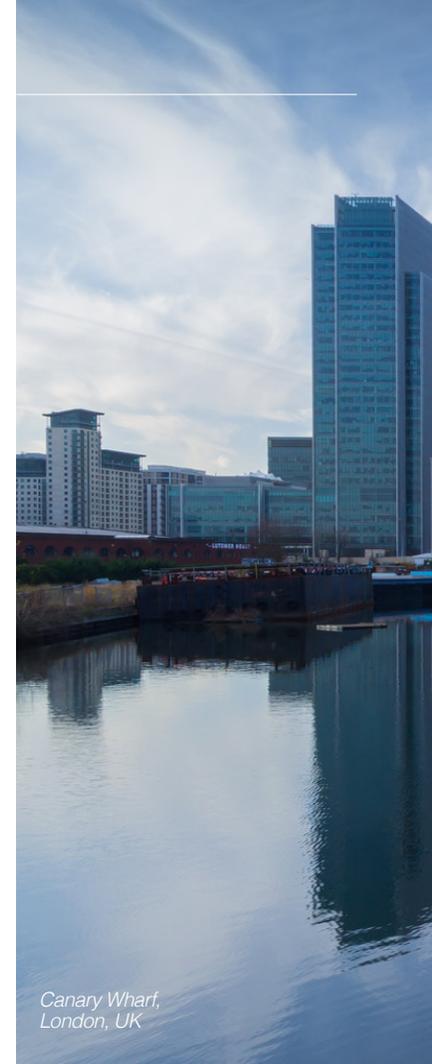
The ING/Société Générale platform allows exporters and ship-owners to upload data, inspectors to confirm quality and insurers to issue cover for a cargo. The experiment showed that a bank's time spent checking each transaction went from three hours to 25 minutes. Traders saw their efficiency rise 33%. The savings could have been greater had more data been digitalised, says ING.

Securities markets

Modern spot trading of energy, metals and currencies is based on simple, standardised contracts, but delays still occur between trade and payment. Blockchain can be used to minimise both the delay and the risk of failed settlements.

Michele Curtoni, head of strategy for emerging technologies at the London Stock Exchange Group, says a global switch to distributed ledger settlement and payments is still 10 years away. He thinks smaller private blockchains will appear more quickly. The London Stock Exchange is testing distributed ledger technology to reconcile its transaction data with that of LCH.Clearnet, a major clearer of bonds, derivatives and swaps.

More complex trades such as over-the-counter derivatives, which involve bets on future prices, generally take longer to be completed. They can be tailored to one-off circumstances, reducing the benefits of standardisation. They may also contain multiple triggers and outcomes, making it harder to build blockchain processes that suit every derivative contract.



Canary Wharf,
London, UK

From concept to reality



Retail payments

Emerging markets in Africa, Asia and Latin America will be early beneficiaries of blockchain-based retail transactions, particularly in the area of speeded-up payments.

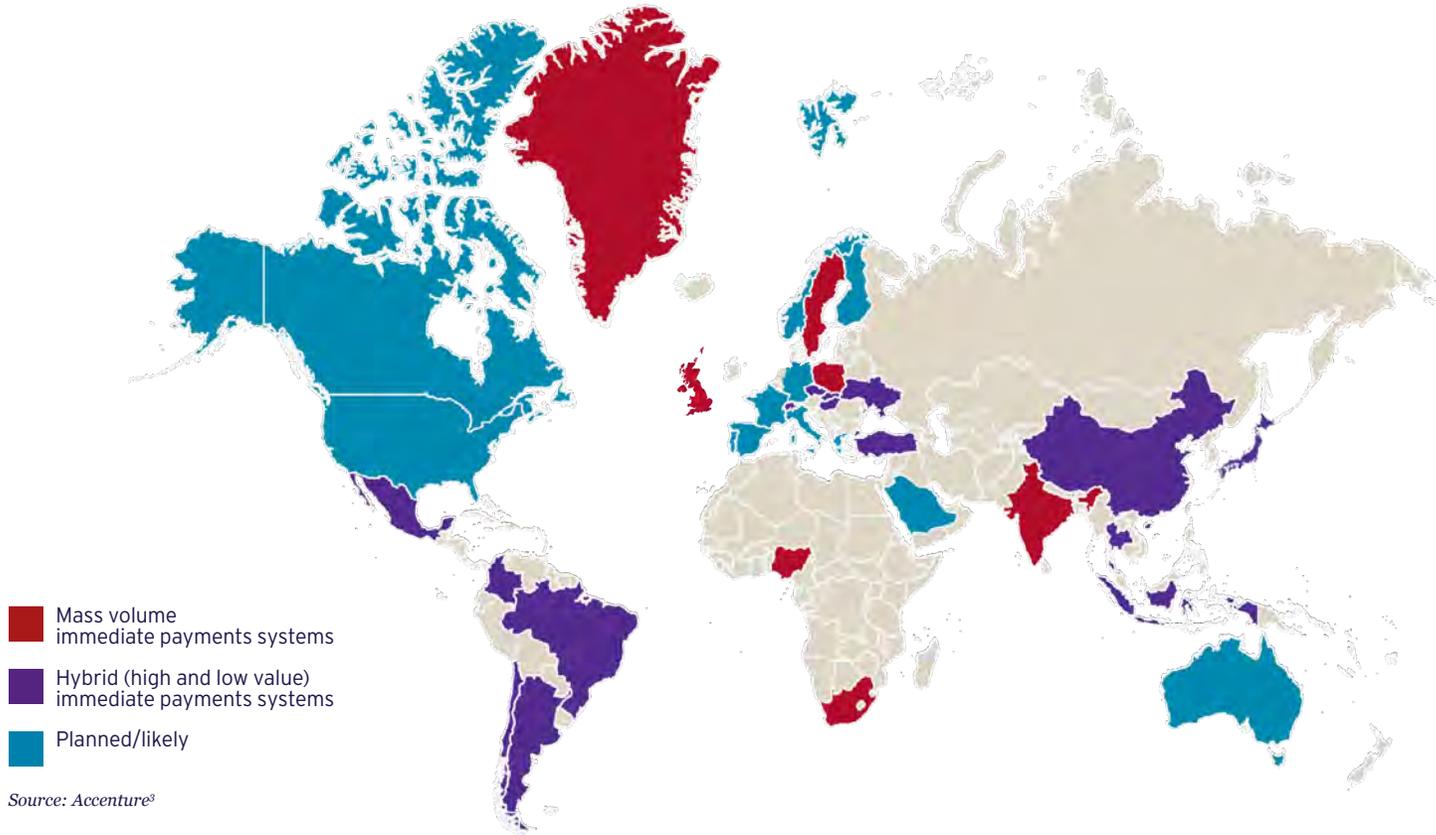
Developed markets already have fast and relatively cheap ways to move money from one person or business to another, and are moving toward nearly instantaneous payments.⁵ Faster payment systems operate in over 30 countries; Japan, Korea and Brazil were first. The European Union's system of faster cross-border payments will take effect in November 2017.

In markets that already have fast payments systems, or expect to have them soon, the case for blockchain investment in systems to move funds quickly is weak. Why rebuild a system that already works?

However, in emerging markets where existing infrastructure for moving funds is weak, blockchain will have a bigger impact. Many of these nations have

inefficient banking systems that are too inaccessible—literally, when a branch is over 100 kilometres away. A blockchain-based system could make a big difference to under-served populations.

Africa is a prime example, says Robert Courtneidge of law firm Locke Lord. In as little as five years, blockchain could help Africa's emerging nations jump from unwieldy and risky cash directly to digital payments via smartphone, avoiding the need for cheques and cards altogether.



Source: Accenture³

3. Accenture, Real time payments for real time banking, https://acnprod.accenture.com/t00010101T000000__w__/_gb-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Dualpub_22/Accenture-Banking-Realtime-Payments-Realtime-Bank.pdf#zoom=50

Asset management and private equity

By law, investment assets are held at arm's length, with custodians guarding the physical shares and bonds that fund managers buy, sell and hold in their portfolios. Transfer agents issue units in funds and ensure dividends are paid on time to each fund's investors. Information is often transferred by fax as back offices reconcile multiple records.

Unigestion, a privately owned asset manager based in Switzerland, fund administrator Northern Trust, IBM and the Guernsey regulator believe blockchain technology can cut the volume of contracts and reconciliation data exchanged by fax. By the end of 2017, Unigestion's head of operations Laurence LeBlond expects their joint project will demonstrate it is possible to attract investors into a new private equity fund and manage payouts via a distributed ledger.

Private equity funds generally have only a few investors, and their holdings are typically long-term. That means there are fewer parties involved, fewer transactions and less reconciliation. Creating reconciliation and record-keeping efficiencies in larger retail funds that trade daily will take longer. Fund groups will have to modernise their fund ownership processes, and incorporate the introduction of distributed ledger technology in the public securities markets where their managers trade. administrative costs of providing insurance.

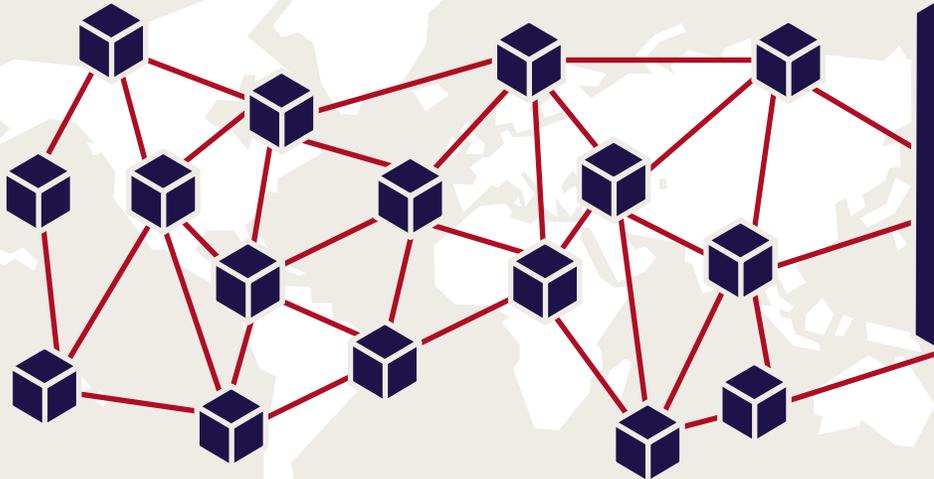


HOW WILL

BLOCKCHAIN

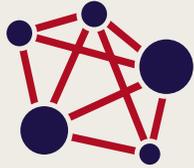
TRANSFORM FINANCIAL SERVICES?

Blockchain, or distributed ledger technology (DLT), is a decentralised database that logs value exchange transactions in real time across a peer-to-peer network.



Transactions are arranged into blocks, with each block chained to the previous one and permanently recorded. All assets - from money to music, votes to contracts - can be entered into the blockchain.

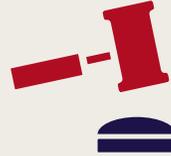
KEY FEATURES



Decentralised



Secure



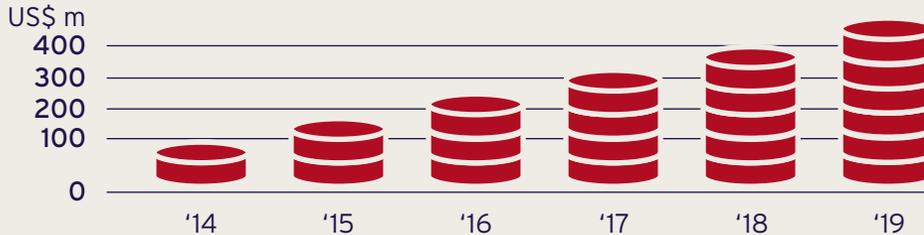
Irrevocable



Self-verified

While banks have been the main focus to date, all financial sectors can benefit.

Estimated bank spending on blockchain technology



Source: Aite Group, *Demystifying blockchain in capital markets: Innovation or disruption?*, 2015

US\$1bn



More than US\$1bn has been invested in blockchain companies globally since the technology's creation in 2009, with a 59% increase in the past year.¹

“What looked like a niche digital specialism is quickly emerging as a billion-dollar opportunity, with some of the world’s largest financial institutions lining up as customers.”

- Ben Brabyn, head of tech accelerator Level39

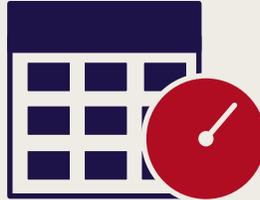
FUND MANAGEMENT

Currently when trading securities, numerous parties are involved, using multiple message formats and duplicated information. Some parties still use fax.

Blockchain strips out all the middlemen:



Fewer errors, instant messaging, greater transparency



Blockchain reduces the settlement timeframe to the trade day or real time, minimising FX risk

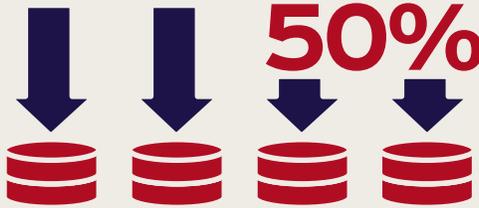


All parties have the same information from the same source at the same time, streamlining the entire process

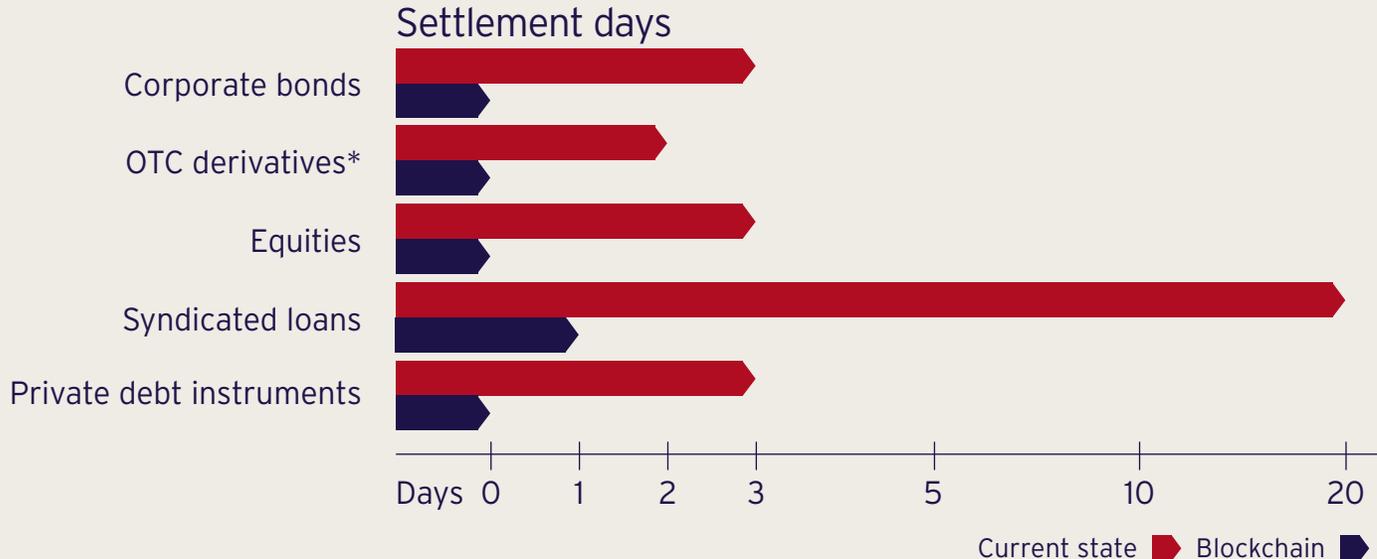
**By 2025
blockchain will be
widely adopted
and integral to the
capital markets
ecosystem.²**

“We are excited about the potential that blockchain can play in the reduction of operational costs, shortened settlement time and the reduction of risk – all of which could help drive transparency and deliver better experiences and outcomes for our clients.”

- Stuart Warner, head of technology, UK and Continental Europe financial services, Fidelity



Business operations such as trade support, middle office, clearance, settlement and investigations could lower their operating costs by 50%.³



Source: Accenture, *Blockchain-enabled distributed ledgers: Are investment banks ready?*, 2017

* ISDA best practices guideline

INSURANCE



Blockchain could reduce insurance fraud by 75%.⁵

“Blockchain could create a scenario in which the customer does not submit a claim and the insurer does not administer it.”

- Tim Coates,
managing consultant,
Synchron

Blockchain helps reduce fraud:

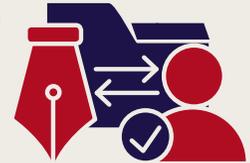
The ledger can log all insurable assets - diamonds, gold, cars, art - confirming origin, ownership and value and eliminating false claims



Smart contracts - computer protocols that enforce contracts using blockchain technology - offer control, transparency, traceability and automation for claims and payouts



Eliminates human error, streamlines data exchange, automates ID verification, improves customer trust



“One area of finance that we’re seeing express a lot of interest these days is insurance. We’re finding that insurance has far fewer barriers to entry from a regulatory standpoint, but also operationally, than other areas of finance.”

- Nick Williamson, CEO and founder of blockchain platform provider Credits

COMPLIANCE

Compliance is a burdensome process, with too many stakeholders, incompatible systems, excessive red tape and too much manual processing.

In 2014, US\$10bn was spent globally on anti-money laundering (AML) compliance.⁶



US\$10bn

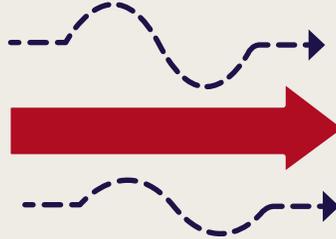


Know your customer (KYC) requests can take 30-50 days to complete, often with duplication of effort.⁷

Blockchain cuts costs and reduces process time:



Automates ID verification



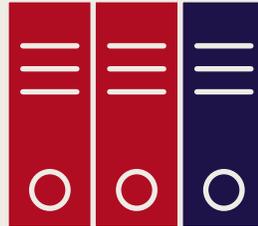
Streamlines account opening process



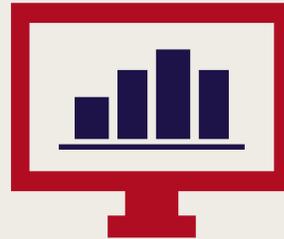
Reduces errors and risk and improves transparency



Encrypts updates for banks in near-real time



Improves record keeping and auditability of transactions



Automatically reports suspicious or large transactions

“The system could theoretically reach near-100% effectiveness.”

- Pawel Kuskowski, co-founder and CEO of blockchain AML risk and compliance platform Coinfirm



Blockchain could reduce compliance costs by 30-50%.⁸

1. PwC, *Blockchain in the insurance sector*, 2016

2. Accenture, *Blockchain enabled distributed ledgers: Are investment banks ready?*, 2016

3. Accenture, *Banking on blockchain: A*

value analysis for investment banks, 2017

4. Association of British Insurers, news release, 2016

5. Synechron, interview with Tim Coates, 2017

6. Deloitte, *Blockchain applications in banking*, 2016

7. Deloitte, *Blockchain applications in banking*, 2016

8. Accenture, *Banking on blockchain: A value analysis for investment banks*, 2017

Insurance

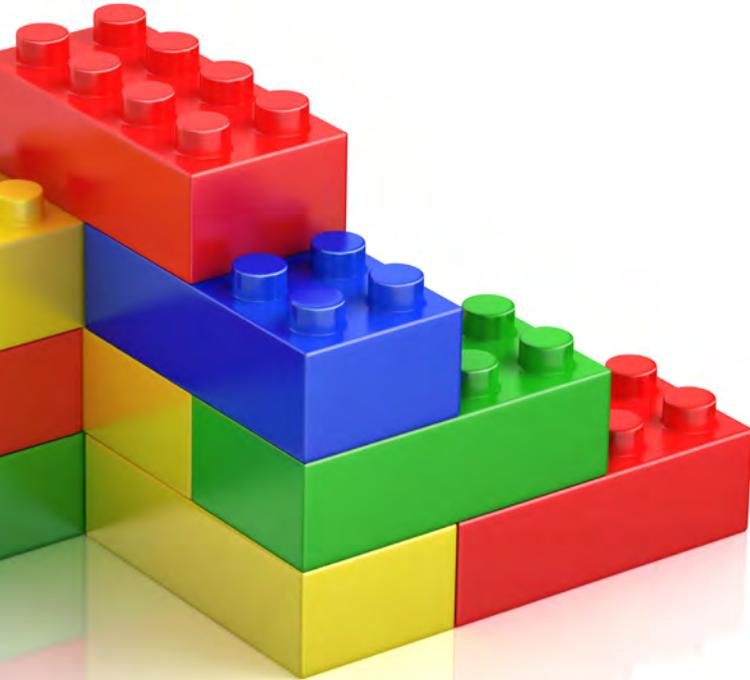
The data-heavy insurance industry involves many parties issuing contracts and filing claims. It could be the perfect venue for applying blockchain technology.

When a claim arises, insurers deploy assessors and risk adjusters to verify the damage and determine who is at fault. Settling claims can take weeks, months or years for the biggest catastrophes. Agreeing the facts of a claim can be speeded up if all parties have immediate access to contracts and claims evidence, such as uploaded photographs.

The case for using blockchain is strengthened by a lack of basic infrastructure for such sharing within the insurance industry. While 11,000 banks in over 200 countries and territories use the secure SWIFT (Society for Worldwide Interbank Financial Telecommunication) messaging network, adoption of the insurance industry's common data standards, developed by ACORD (Association for Cooperative Operations Research and Development),

has languished since 1970. With no secure industry-wide network to send files, many midsize insurers have avoided upgrading their accounting and reconciliation processes.

The process may be speeded up now that financial technology firms are pouring into the sector. Peer-to-peer start-ups already deploy blockchain to maintain contracts and claims data. Over time, an industrywide, blockchain-based shared database of risk could improve the precision of pricing coverage, and lower the administrative costs of providing insurance.



Lego for Insurance

Paul Meeusen, head of finance and treasury services at reinsurer SwissRe, likens blockchain to Lego; the bits make most sense when they are joined up. The same applies to insurance where different players may hold different versions of contracts and different interpretations of events when a claim is made.

Reconciling those different versions of contracts—even when all the information is within a single organisation—can take weeks. Faster, more accurate reconciliation reduces the risk that arises while funds are in limbo;

it also improves reporting of results and increases insurers' liquidity. SwissRe's in-house blockchain prototype showed potential cost and time savings of 30%, says Meeusen.

SwissRe is now working with 14 other reinsurers and insurers in the B3i consortium to speed the writing and management of "excess of loss" contracts (policies that cover the portion of a loss that exceeds the insurer's own retention of risk) in natural catastrophe cases. A prototype product could be out in the summer of 2017, according to Meussen.



III. Financial products of the future

The back-office efficiencies delivered by blockchain should eventually lead to lower costs and faster service for retail customers. However, customers may have to wait longer for blockchain to reshape the actual financial products they buy. Here are some of the blockchain-based product modifications that the industry may introduce in future.

Everyday e-banking via blockchain

Blockchain-based bitcoin has become associated with activities that the law cannot always touch. It has proven an attractive vehicle for capital flight. Regulators have reacted accordingly: Bolivia tried in 2014 to stem the flow of money out of the country as the rate of inflation jumped. Taxing bitcoin is equally tricky, although many countries have tried.

Nonetheless, cryptocurrencies of the official variety may become a feature of the banking system in future. There are more reasons to bring cryptocurrencies into the framework of the legal and financial systems than reasons to try to ban them. Blockchain based payment structures can actually contribute to financial system stability, if they are backed and regulated by a central bank.



Building a government sanctioned structure offers the benefits of speed and instant verification of transactors. Moreover, infrastructure requirements for creating networks of computers linked by blockchain would be relatively low; most emerging markets could piggyback blockchain networks onto their mobile communications systems to allow low cost, low value payments via smartphones.

Access to such a blockchain-backed payments system would require verified identification of users, allowing law enforcement and tax agencies to patrol more efficiently. Governments, meanwhile, may find that a regulated cryptocurrency increases their tax revenue and their control of the economy.

Outlaw currency

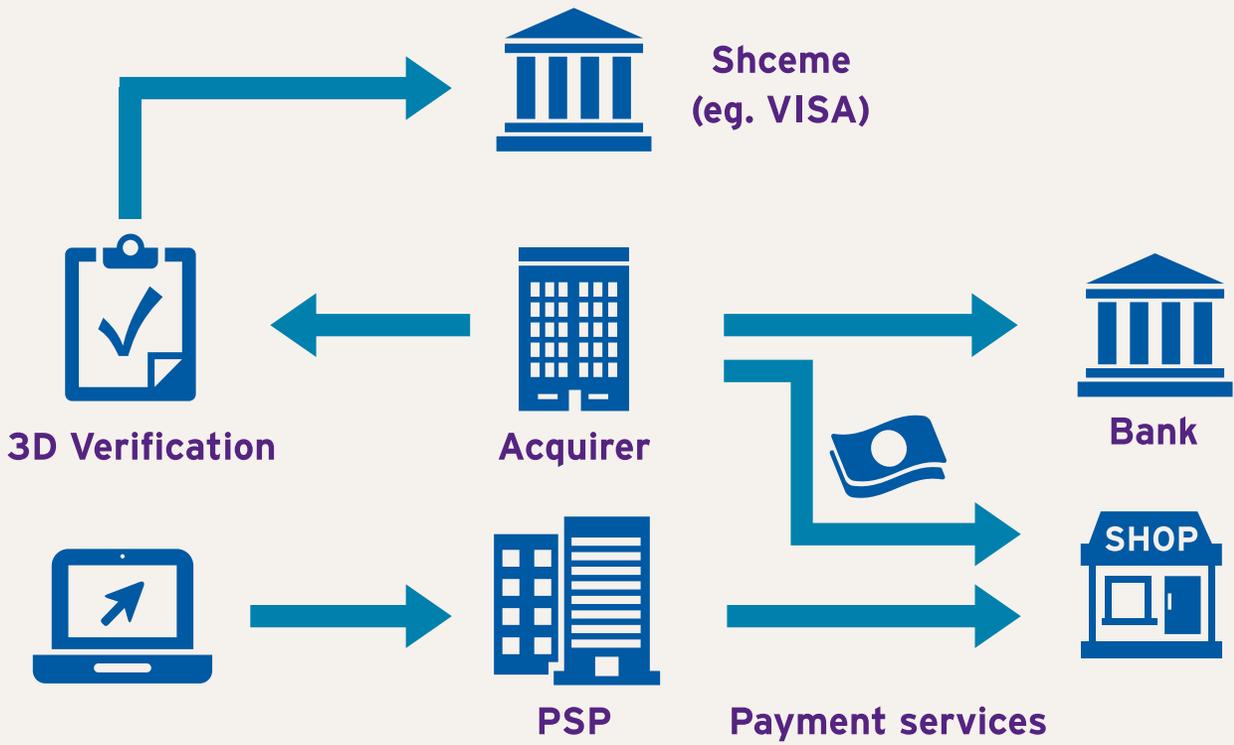
Countries where bitcoin is banned

Bangladesh	2014	Anti-money laundering
Bolivia	2014	Tax evasion, monetary stability
Ecuador	2014	Banned to promote own electronic currency
Iceland	2019	Post-crisis capital controls
Kyrgyzstan	2015	Legal tender

Source: Locke Lord









Online payments

Mark Højgaard, chief executive of Coinify, a blockchain-based payment services provider, says fees paid to payment service providers, merchant acquirers, banks and card issuers globally amount to hundreds of billions of dollars per year, a heavy burden on online retailers. With 45,000 websites using his plug-in software, Højgaard says he can slash processing costs by 99.85% as online bitcoin payments go directly from customer to shopkeeper.

If that sounds like the death knell for retail banks and card companies, it is not. Banks can offer bitcoin solutions, cut their fees and still make profits.

When - not if - blockchain transacting gains traction, Højgaard says smart contracts will add rich functionality to a variety of new payment systems. For example, fans of a particular television programme may give their televisions permission to buy the next episode of the show via a smart contract and the mining of the necessary bitcoins. A credit card could never be that clever.

Cryptocurrencies could eventually take on a life of their own. Self-driving cars could act as blockchain nodes, mining their own bitcoins to pay for fuels or tolls. They might even settle the bill with a mechanic after driving themselves to a garage for a service.



*Placeholder text,
Replace with caption or credit.*



Home purchases

Blockchain may blur the boundaries between financial services and other service providers involved in home sales, even if distributed ledgers are not visible to the retail customer.

Land registries could share their data on properties and owners with estate agents, surveyors and solicitors. Digital deeds could be transferred quickly by distributed ledger technology, and smart contracts could issue mortgage funds as soon as an offer is accepted.

Buying a home in a day may be a decade away. In the meantime, property buyers should see incremental gains in efficiency as different parts of the property-transfer system adopt blockchain technology.

Automated insurance cover

Blockchain technology can be used to provide automated insurance cover to new categories of insureds.

One example is extending crop insurance to farmers and herders in emerging markets. In India, for example, few farmers can afford drought or flood insurance, even though the government subsidises agriculture cover by as much as 80%. Automating insurance payments could help slash the cost of providing that cover.

Blockchain could help lower the costs and extend the coverage of schemes like the World Bank-sponsored Kenya Livestock Insurance Programme (KLIP), in which automatic payments to herders are triggered when satellite data indicates a reduction in available pasture land caused by drought.

Similarly, micro insurance (the protection of low-income people against specific perils in exchange for regular premium payment based on the likelihood and cost of the risks involved) could extend low-cost health cover

to the world's poorest people. Contracts embedded in blockchains could accept digital signatures and automate payments to doctors.

In the developed world, meanwhile, home, contents and car claims could be cheaper to buy and to process when customers are incentivised to photograph and upload pictures of damage for insurers to share on blockchain-based networks. In motor insurance alone, consultancy Capgemini thinks shared servicing and claims handling could cut global claims settlement costs by \$21 billion.





IV. Restructuring financial industries

As smart contracts take hold, financial sectors will have to change how they work or face extinction within two decades. Today's centralised systems require layers of intermediaries, between clients and banks, between banks, and between fund managers and the assets they buy. Blockchain may render certain intermediaries redundant, and may change the concept of money as we know it.

Central banks

Central banks are already thinking about how to issue money when they no longer issue notes and coins. Tunisia and Senegal have beaten Canada, China, Denmark and Sweden to establish regulated e-currencies that could replace today's volatile, unregulated cryptocurrencies.

Central banks have a lot of details to work out concerning how they can adopt blockchain structures for this purpose. For example, would individuals have digital accounts at a central bank? If so, what happens to commercial banks? Central banks also would need to think about how open the system is, and who can see transaction histories.

Data protection and national security laws may need to change too, to protect a nation's cybersecurity.



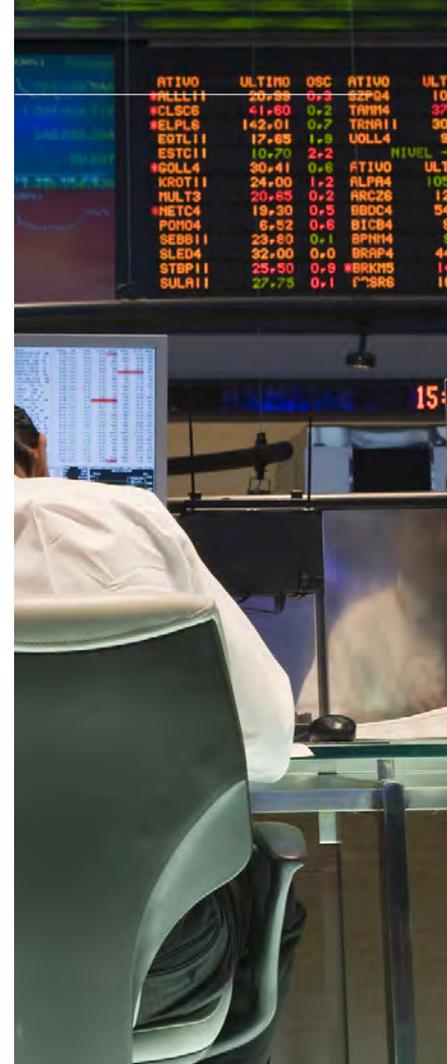


Too much transparency would cause problems for cross-border e-currency initiatives. Linking two e-currencies ledgers would involve two central banks and two sets of regulations that may not always agree. Domestic regulators and central banks would not want to share sensitive data with their neighbours, nor lose their ability to halt money outflows.

Capital markets

Blockchain could help the European Union's plan to boost the availability of non-bank finance for business, particularly for small firms. Europe's capital markets – where companies issue shares or bonds – are fragmented and expensive to access for companies looking to fund their growth. Blockchain ledgers could help remove cost friction, and standardise documentation and procedures to make it easier for companies from one EU member state to raise funds in another.

However, blockchain's instant-settlement feature may not be particularly useful in this regard. To protect investors, regulators are unlikely to allow issuing companies to have direct and unfettered access to investors. While companies seeking loans can bypass banks by using peer-to-peer lending platforms, raising debt and equity is more complex. Issuers of stocks and bonds will still need a counterparty to underwrite and guarantee their new debt. This means that banks, central depositories and brokers will still have a role, says Rob Morgan, managing director of technology and operations for the Association for Financial Markets in Europe.





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Transactions and settlement

Introducing blockchain also raises issues in the subsequent trading of bonds and shares on the secondary markets, where delays and costs currently occur between purchase and settlement.

It has taken over 20 years to move from T+3 (trade plus three working days for settlement) to T+2 in Europe and the US. T+0—one of the promises of using blockchain networks—would reduce the settlement risk associated with that delay. Buyers and sellers would no longer need to post collateral to guard against failed sales when 'the trade is the transaction'. Rules requiring the use of central counterparties could be rendered obsolete.

But instant settlement may be the wrong goal. As Anthony Macey, head of blockchain R&D at Barclays, points out, a delay allows time for institutions to check the identity of their clients and counterparties. In trading, speed is not always the ultimate aim.

Investment funds and pensions

Distributed ledger technology will lower the cost of active fund management. Intermediaries including central depositories and transfer agents may take on new roles as their traditional registration and reconciliation tasks are automated.

Human fund managers are expensive and losing market share to exchange-traded funds that merely track indices like the FTSE 100. If operational costs were lower, active managers could cut their fees, instantly boosting their fund performance. They could also lower their minimum investment requirements, thereby helping attract new investors to the market—including many who currently have minimal long-term savings.



Asset management

Intermediaries are not waiting passively for their jobs to disappear. In Luxembourg, where looking after other people's money accounts for about 40% of GDP, the Fundchain initiative is probing how blockchain and asset servicers can work together.

Laurent Kratz, co-founder of Scorechain, which provides bitcoin and blockchain based services, says its 10 partners are building a product that registers assets, computes fees and handles redemptions and subscriptions on a distributed ledger. Kratz does not expect to see a fully functioning blockchain transfer agency before 2019. Full deployment could take 10 to 20 years.

To remain relevant, agents and registrars could combine forces to monitor the smart contracts that track and verify fund owners, pay dividends and help fill investors' tax filings – electronically, of course.

Agents may even offer new blockchain-related services, looking after the digital keys that fund managers use to access different distributed ledgers.

V. Development of the blockchain industry

It is still relatively early days for the blockchain technology, but some features of the blockchain industry are already becoming visible. While industry participants agree that distributed ledgers will have to be interoperable and integrate with existing infrastructure, systems and rules, development consortia are fighting to ensure that their applications become the industry standards.

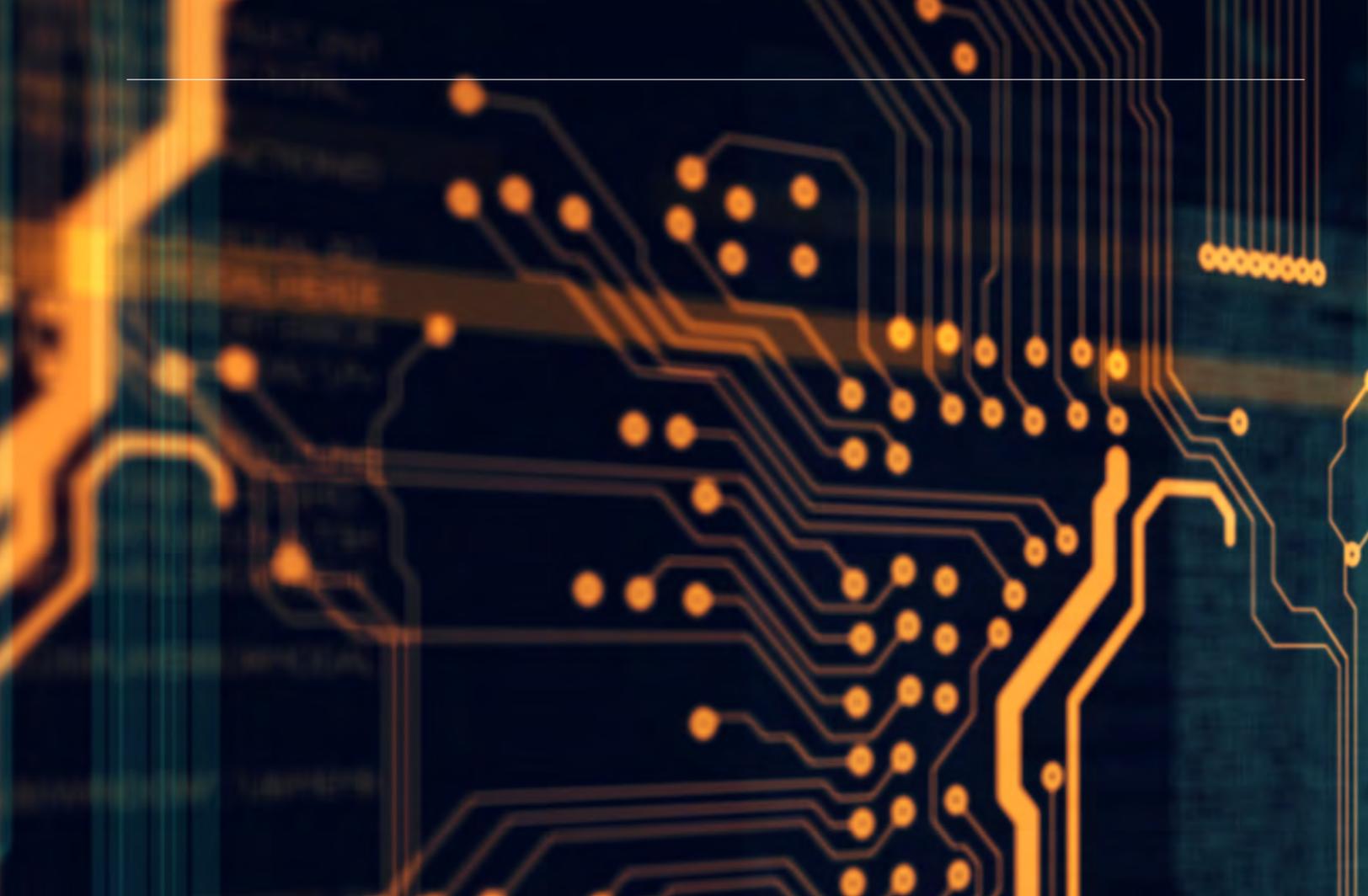
This competition has its advantages, as it can ultimately lower costs and risks and improve cybersecurity. Financial services firms may also prefer to have a choice among blockchain solutions. Nonetheless, for the blockchain industry as a whole, a major challenge is learning to share data and trust in other contributors.

Struggle for dominance

Blockchain is a network business, just like the telephone: the more participants in a network, the greater its potential usefulness to each member. As a result, when it comes to developing a business for a particular application of the technology, the size of the developer organisation often counts: a larger organisation is in a position to reach far and wide for potential users of its network.

To date, dozens of blockchain-based consortia worldwide have raised significant cash and commitment from technology firms and financial institutions to develop applications of the technology. They may struggle to please everyone as their membership grows.

Goldman Sachs, JP Morgan and Santander recently left



the R3 blockchain consortium, a group of more than 70 of the world biggest financial institutions developing a blockchain-based database application. None has given a public reason for leaving; industry pundits have speculated that major players saw their influence reduced as the size of the consortium increased.

Ultimately, the power struggles and personality clashes will determine which applications will dominate the spread of the technology. The risk is that the winner will be based on which groups have the most power, not on who has the best technical solution.

The emerging shape of blockchain-based networks

The vision of the original developer of blockchain was all-inclusive: a single global permissionless blockchain to which everyone has access and everyone can see every block. That vision is slowly receding—at least when it comes to blockchain's financial services applications—in the face of concerns over cybersecurity and struggles for ownership and dominance. Instead, financial services blockchains will be private or permissioned, with access restricted.

Customers, trading partners and regulators will want to ensure that only those who need to see their financial data have access. It may be more simple to maintain and link separate ledgers for different functions such as commerce, taxation and banking, than to develop a larger ledger with more parties and processes involved.

The 'proof of work' mechanism that currently dictates how much bitcoins miners are paid for crunching data may also be replaced. It encourages miners to boost their computing power, which may consolidate mining in a few hands. A

'proof of stake' system could be a better incentive for stakeholders to contribute new data, not just hash it, for the group to share.

The shift toward smaller, permissioned blockchains does not exclude large scale projects. One example of a large, multi-party project is a national trade platform experiment in Singapore aimed at speeding up trade financing and interbank payments. The project involves the Monetary Authority of Singapore (the central bank), multinational banking corporation DBS Group (whose initials stand for Development Bank of Singapore), and others. It may be extended to importers, exporters, logistics providers and customs agencies.

The project is still in development; building a platform linking the various players could take years. It could take far longer, perhaps decades, to link Singapore's trade blockchain to any similar platforms that emerge in Europe, Hong Kong and China.



Protocols and governance

One of the main impediments to progress is the absence of agreed protocols to govern access to blockchains, what data can be added and when, and how the shared platforms would work in practice.

Regulations may also need to change. For example, current banking and capital markets rules require that certain trades are routed through central counterparties that may not be necessary on a distributed ledger.

So far, regulators, including the UK's Financial Conduct Authority, have built experimentation "sandboxes"—projects allowing innovators to work on applications in a controlled environment without risking damage to the wider financial system. Discussions have barely started on the governance rules that will allow these experiments to be translated into the real world, or how they might work alongside existing centralised systems.



A Job For Swift

Last year, SWIFT—the global provider of secure financial messaging services—hosted a project to test whether a distributed ledger could pay out short-term bond coupons correctly and on time. The test was successful. But Damien Vanderveken, head of R&D, labs and user experience at SWIFT, says encryption and self-executing “smart contracts” will not be sufficient to keep the financial system safe.

Vanderveken suggests tomorrow’s permissioned blockchains will address this issue in part by sharing data only with selected nodes, or user points on a network,

rather than with all users. If a user is not party to a transaction, he or she should not hold any information related to that transaction.

Messaging rules will also need an update to ensure security is maintained. SWIFT (the Society for Worldwide Interbank Financial Telecommunication) is the global guardian for ISO 20022 data interchange standards set by International Organization for Standards. Since the emerging financial platforms will require updated protocols to accommodate blockchain technology, SWIFT’s castle-like headquarters in La Hulpe, Belgium, is likely to be a busy place for years to come.

Compliance: Blockchain platforms are not exempt

Since the financial crisis of 2008-09, financial institutions have faced stringent new guidelines to ensure their business is transparent for regulators and resistant to misuse by criminals. 'Know Your Customer' and anti money-laundering rules require banks to verify that their clients and transactions are legitimate. Banks also have to abide by rules aimed at ferreting out public officials who may be vulnerable to bribery and extortion.

Compliance bills are rising fast, yet systems are not failsafe. When banks fail to comply, the fines are substantial. HSBC paid \$1.9 billion in 2012 for failing to spot drug cartel money⁴. BNP Paribas paid \$8.9 billion two years later for violating trade sanctions.⁵

Regulators, police and justice authorities want the financial industry to take a more proactive stance. Compliance procedures could be mid-term beneficiaries of blockchain if banks, asset managers and insurers share data on who and what they know. Finance chiefs may agree with the

cost-cutting benefits of blockchain; legal and compliance departments may need more convincing.

4. US Department of Justice, www.justice.gov/opa/pr/hsbc-holdings-plc-and-hsbc-bank-usa-na-admit-anti-money-laundering-and-sanctions-violations

5. US Department of Justice, US Department of Justice, www.justice.gov/opa/pr/bnp-paribas-agrees-plead-guilty-and-pay-89-billion-illegally-processing-financial



From cost to profit centre

Determining the precise identity of a big new corporate customer is expensive. Banks can spend months and up to \$50,000 verifying a big, new corporate customer, say Tim Coates, a managing consultant, and Keonne Rodriguez, senior manager digital and user interface at Synechron, a technology and consulting company.

They hope to turn due diligence from a cost drag to a profit centre via a distributed ledger. As all banks party to a transaction have to know their clients, but currently collect and verify data separately, it makes sense to share trusted information that has already

been collated.

Participating banks could sell digital keys to other banks that need to know that customers are legitimate. Banks contributing the most “know your customer” records to the group would be paid more bitcoins for their diligence and willingness to share.

Regulatory reporting

Regulators often suffer from too much, too little or just wrong information. A constantly updated record of every transaction would easily overwhelm them, no matter how many data scientists they employ. Blockchain could ensure aggregated reporting is more timely and more insightful.

The European Securities and Markets Authority, the European Union's financial regulator, says that distributed ledger technology was never designed for reporting or risk management, so using it may actually prove more resource intensive. Having to oversee many decentralised ledgers will be more expensive than overseeing just one centralised system, it adds.

Moreover, if regulators and market participants share information on the same blockchain-based network, that creates a conflict of interest—and a moral hazard—for the regulators, who are required to stand apart from the institutions they regulate.

But blockchain does update transactions in real time,

which could lead to more accurate reporting that flags up system-wide risks before they become truly dangerous. Had Ireland's banks delivered better, more timely reports to the Central Bank of Ireland, the regulator may have picked up earlier on the country's banking bubble, and thereby might have led to better decisions. Instead, a lack of reliable data and the unlimited guarantee on deposits cost the country €64.1 billion.



Privacy protections and cybersecurity

While blockchain technology can reduce regulatory compliance burdens and simplify transactions and cash flow reconciliation, it can also clash with broader, non-financial rules, particularly rules governing data privacy.

When the European Union's General Data Protection Regulation is updated in 2018, the 'right to be forgotten' will become a 'right to erasure' of certain personal records from the public domain. That could prove tricky when blockchain records cannot be deleted.

Moreover, blockchain networks are not impervious to cyber attacks. In theory, blockchain is hacker-resistant due to the immutable nature of the records. But last year, hackers made off with \$53 million of Ethereum bitcoins via a flaw in the Decentralized Autonomous Organisation, an online, investor-directed venture capital fund. Ethereum eventually conducted a 'hard fork', effectively resetting the blockchain to an earlier date. Regulators will need convincing that the financial industry's distributed ledgers are more robust.

Size, interoperability and legacy systems: Challenges for blockchains

A certain financial heft is needed for a blockchain to attract the widespread membership required for success as a network business, but size brings its own set of problems. Very large blockchains may prove too unwieldy to manage.

Part of the problem with a large network is dealing with the legacy computer systems that each member brings. A mid-sized bank may have 30 legacy computer systems or more, for example. Linking to new ledgers or incorporating blockchain into these systems will be tough. Problems will be compounded when assets and transactions move across borders.

Even very modern systems cannot always talk to each other. Denmark's wildly popular MobilePay app does not work in Sweden, where Swish reigns supreme, as each relies on national payment infrastructure that does not work across borders. Neither works in Norway where Vipps

has a lead in the smartphone payment market.

A further challenge is that consortia with diverse memberships tend to move at the pace of the slowest member, since technology upgrades must be carried out equally throughout a network. This means that in any given consortium or network, adoption of new blockchain applications will be as slow as the last bank to comply. Even large consortia may find their market ascendance stymied if others in their industry balk at the cost of upgrades. Until they all comply, using blockchain will be a cost drain for the group, as compliance and reporting ledgers will have to mirror existing infrastructure and practices in all the member institutions.



Scalability and speed

Instantaneous execution of transactions means that erroneous trades cannot be recalled. Since human error is inevitable, blockchain can prove a particularly unforgiving technology.

There is a further issue of scalability of the technology. A single transaction on a public bitcoin ledger can take 15 minutes to appear on a block⁶. As the size of a network expands, so does the number of computers that must add each new transaction to its database. Each of these nodes, which may number in the thousands, will have to update its database before a trade will be deemed completed. The sheer scale of that requirement may, in future, make real-time settlement unachievable.

6. Blockchain, <https://blockchain.info/charts/median-confirmation-time?timespan=2years>

A parallel universe

Blockchain began as an intentionally parallel universe, outside the purview of the regulated financial system. That alone poses a challenge to regulators whose job it is to detect criminal transactions and catch the perpetrators. Regulators are already trying to close this gap. Europe's next rules to prevent money laundering bring cryptocurrencies—digital currencies that use cryptography to secure transactions and create units of value—into the regulatory framework.

The European Commission has suggested that voluntary registration by users could counter problems associated with anonymity. No country has yet set out a plan for registration, but self-declared bitcoin account holders may find their cryptocurrency more widely accepted if banks and merchants know they are trustworthy. Perhaps one day, holders of bitcoins may boast of their top rating as a sign of their financial integrity.



Bockchain or Notchain?

What factors must be present for a process to use blockchain technology? The successful use cases show these characteristics:

- Multiple transactors: more transactors and nodes mean greater potential savings
- Digital assets: digitised assets must have a value
- Immutability: assets can be transferred, but transaction histories cannot be altered
- Trust: everyone allowed on the system must be trusted
- Consensus: there is no 'golden' ledger as all copies are equally authoritative
- Security: data integrity will require high levels of security and encryption
- Privacy and isolation: administrators must know all participants, even if they do not know each other



Conclusion

Blockchain revolution: Please hold...

There will be no “big bang” heralding the arrival of blockchain technology in the financial services industry. However, the revolution has already started. The first live implementations of financial applications of the technology are expected within two years. Mainstream adoption will take a decade or two.

In financial services, blockchain's 'distributed' element will be used first in back-office tasks such as reconciliation of transactions and contracts, where the distributed ledgers will allow for faster updating and more accurate record-keeping.

Once trust in immutable records spreads, central counterparties and other intermediaries will find their own roles coming into question. Their functions may not disappear, however, as they provide collateral and guarantees should transactions go wrong.

Mainstream deployment of the technology in the composition of retail financial products will take longer. Even if parts of the financial system adopt blockchain technology relatively early, other changes—such as merging e-currencies into blockchain networks, and

integrating the growing number of internet-connected devices—will take decades.

For widespread adoption of blockchain technology in financial services to take place, two things need to happen. Financial institutions need to change how they interact. Today's centralised system encourages each player to assume others could be at fault. Blockchain will only work if companies learn to share and cooperate, and see themselves as part of a blockchain network rather than solo actors.

More importantly, the consensus approach will require a reworking of current financial regulation. If blockchain is to truly deliver on its promise, then revision of rules that now require the use of various counterparties and clearinghouses will be needed. This reform process is a sensitive task: Regulators are keen to encourage innovation—but not at the cost of promoting instability in the financial system.

From concept to reality





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