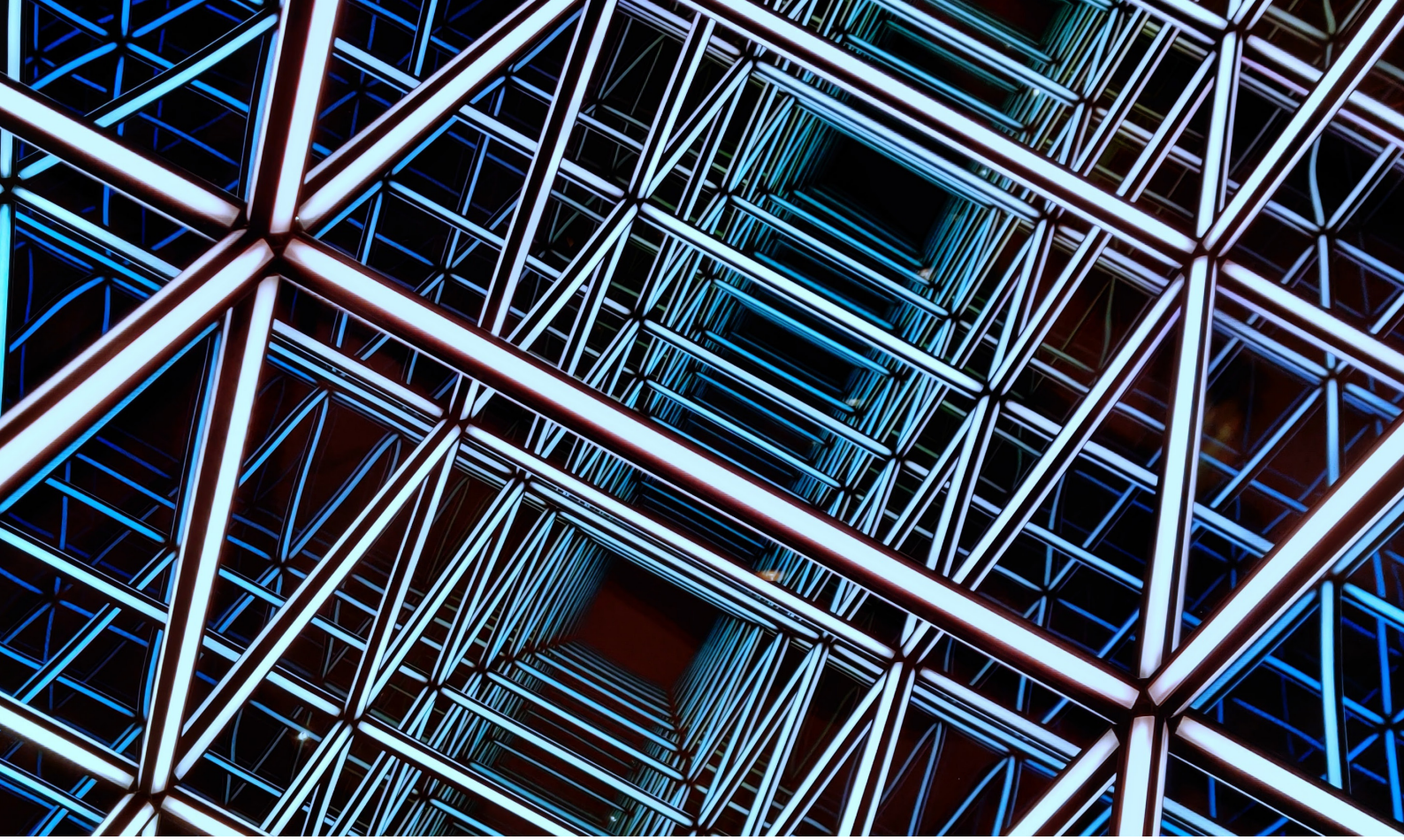
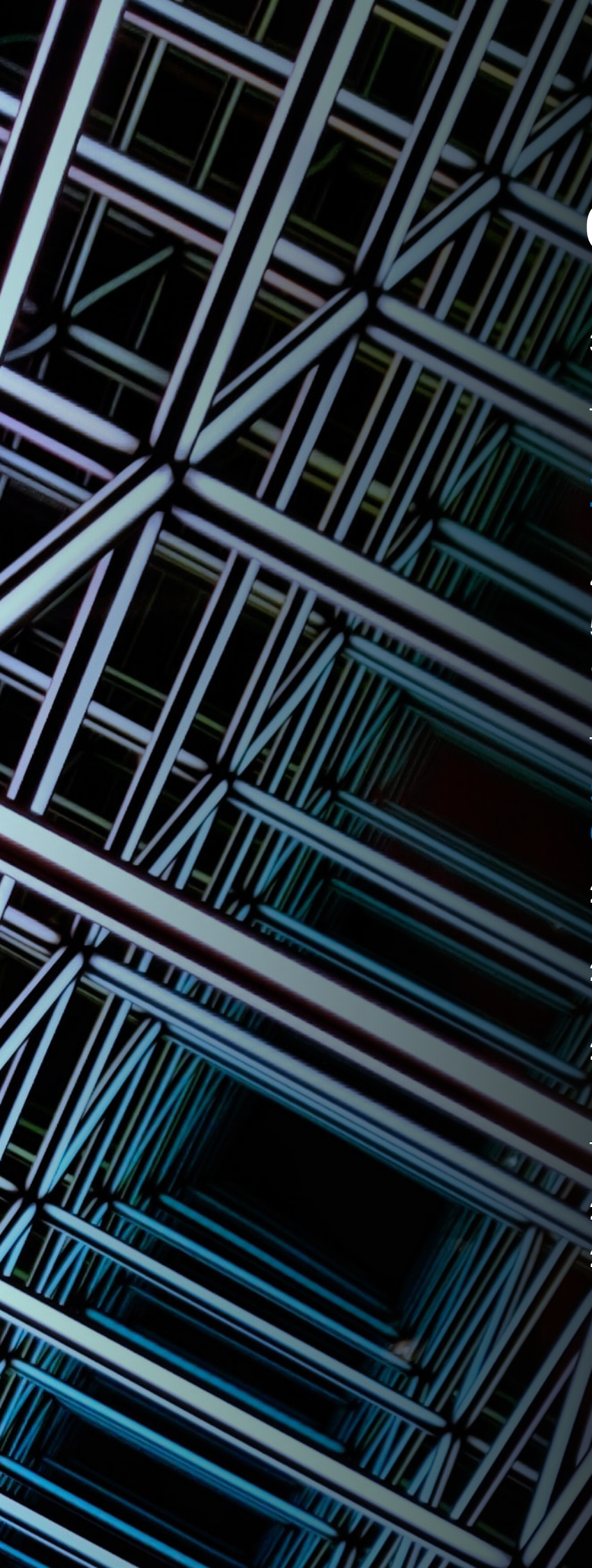


The role of blockchain in banking

Future prospects for cross-border payments

OMFIF

建行大学 CCB University



Contents

Preface

In this consultation paper, OMFIF and CCBU investigate the effects of blockchain and distributed ledger technology on financial institutions' business models.

The study focuses on the motivations underpinning financial institutions' decision to adopt blockchain, their participation in consortia – groups of companies collaborating to develop common objectives and standards for blockchain and DLT – and the critical practices and lessons they have learned so far. It is based on in-depth interviews with representatives of major global banks and financial technology companies. The people we spoke to are innovation officers and managers responsible for deploying practical blockchain and DLT use cases in areas like cross-border payments, trade finance and foreign exchange settlement. OMFIF and CCBU engaged with experts representing other diverse perspectives and sectors, including fintech and technology providers from the blockchain and DLT industry. Analysis of financial technology regulation and public policy papers complements our research.

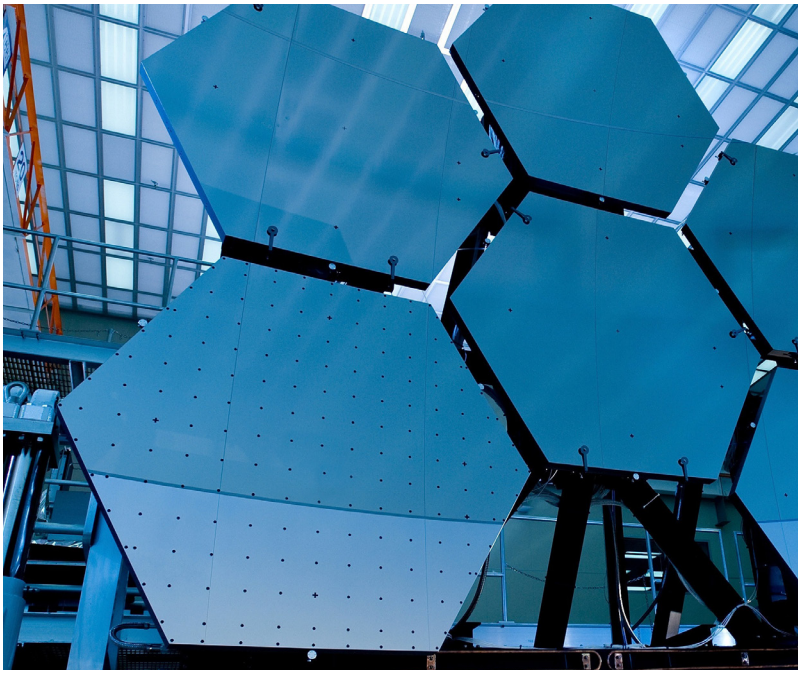
Contributors' insights are reflected throughout this paper and summarised faithfully to give an overview of blockchain and DLT in the financial industry, as well as the opportunities and risks that major global banks face by innovating in this field.

Section 1:
The blockchain solution

Major banks and financial institutions are realising that blockchain technology could vastly improve the efficiency of their processes – particularly in cross-border payments – and reduce costs. Many have joined forces to research new applications, though regulatory barriers remain.

Blockchain: functions and limitations

Distributed ledger technologies – collectively known as blockchains or blockchain-based platforms – have moved from the margins of public interest to being touted as paradigm-changing technologies. At their core, blockchain and DLT are novel systems to digitally manage data in a decentralised manner, transforming how individuals, companies and institutions can transact and trade with each other. Mainstream interest in blockchain arose after the 2008 financial crisis in tandem with the development of the world's first peer-to-peer cryptocurrencies. Its best-known application is bitcoin, the cryptocurrency developed by Satoshi Nakamoto in 2008. Bitcoin employs blockchain technology to allow, in principle, any anonymous individual or entity to perform transactions without a trusted third party. Other subsequent public blockchains such as ethereum are based on similar principles. However, bitcoin's lack of wider integration with technological infrastructures and its uncertain position in existing regulatory frameworks have hampered mass adoption of blockchain.



Large businesses and governments are increasingly interested in exploring the potential merits of blockchain and DLT. In contrast to bitcoin's open architecture, the development of enterprise-grade blockchains in the financial industry and other economic sectors has focused on permissioned systems. Federated blockchain models offer the most promise as potential enterprise-grade systems within financial services and other industries.

Smaller settings require fewer nodes to generate consensus, and therefore do not need nearly as much computational capacity to secure the network, allowing for greater scalability. Unlike public blockchains, there is no need to incentivise validators – those responsible for verifying transactions within a blockchain – to compete with hashing power for cryptocurrency rewards, as maintaining network security is a shared interest. In effect, the financial sector is prioritising blockchain models that can offer security and scalability rather than decentralisation, see Fig. 1.1.

Fig. 1.1 Financial sector favours permission-based consortium model
Three types of blockchain systems

	Public blockchain	Consortium blockchain	Private blockchain
Managing entity	All participants (decentralisation)	Participants in the consortium	One central institution holds all the authority
Governance	It is very difficult to change the rule that has been made	Rules can be changed easily through the agreement among consortium members	Rules could be changed easily according to the decision made by the central institution
Transaction speed	Difficult to expand the network, and transaction speed is slow	Easy to expand the network and transaction speed is fast	Very easy to expand the network and transaction speed is fast
Data access	Everyone can access it	Only authorised users can access it	Only authorised users may access it
Identifiability	Pseudo-anonymous	Identifiable	Identifiable
Transaction Proof	Proof of transaction is decided by algorithms such as PoW and PoS, and cannot be known in advance	Proof of transaction is known through authentication, and transaction verification and block generation are made according to the rules agreed in advance	Proof of transaction is made by central institution
Examples	Bitcoin	R3, Hyperledger Fabric, Quorum, Ethereum	Linq, a stock exchange platform for Nasdaq unlisted companies

Source: Financial Services Commission (2016)

The industry approach

After the initial hype, industry proponents have adopted a more pragmatic approach:

- Focus on pain points in existing businesses, from the perspective of efficiency and cost-savings. This is a departure from blockchain's early days, when it was touted as a generator of digital transformation and a new revenue driver.
- Contrasting technology and fintech start-ups.
- Form or participate in a technology consortium. With blockchain technology still in its nascent phase, being part of a consortium is a more cost-effective way to share information, learn about the underlying technology, grow the community to garner network effects, and nurture an internal innovation culture.

Maximising benefits, limiting risks

The properties of blockchain are especially suited to maximising mutual benefits and limiting business risks from collaboration and co-investment. Blockchain enables banks to work together on a common solution using a decentralised database. For one major bank, 'Many advantages of blockchain, such as immutability, are useful but really the core tenet is the idea of decentralised data that allows many countries and competitors to work and co-invest on a common platform. Everyone keeps their own data and only permission certain data to each other when they want to interact and trade.'

While novel use cases (or business cases) for blockchain are still emerging, some of the common areas it has been applied to in the financial industry include know-your-customer procedures, trade finance and primary security issuance. The technology suits various core banking functions and back-office scenarios such as payments, clearing and settlement, see Fig 1.3.

The industry has identified five main pain points that DLT could address: security, speed, transparency and traceability, risk and cost management.

The centralised nature of legacy financial

Fig 1.2 Cross-border payments dominates use cases
Blockchain use cases, 2019 market share, %

Source: Institutional Deposits Corporation 2019

systems makes them vulnerable to single points of failure. For example, a single-point attack on an intermediary responsible for payments, clearing or settlement could suspend services to the entire system, leading to widespread outages among payments services. By creating a distributed network, a DLT-based system could eliminate these single points.

Speed remains an issue in legacy systems. Authentication, verification and data-sharing are usually manually undertaken by different intermediaries. For example, in trade finance, a shipment of goods could be delayed due to multiple checks by intermediaries and numerous communication points.

Multiple platforms and different data recording methods could cause fraud or audit issues if there are multiple versions of the truth, or errors in the way information is stored. At its core, blockchain is a ledger offering visibility into the entire lifespan of a transaction or value exchange within a bank's operations. It can reduce the need for expensive and time-consuming third-party verifications along a payment process or funds transfer. Documents can be linked and accessible through blockchain and reviewed and approved in real time, reducing the time it takes to initiate the shipment of a good or delivery of an asset.

Current banking models require a trusted third-party intermediary to remove the credit risk between two parties in a transaction. Credit risk is present when one leg of the transaction is made first, such as the delivery of goods or an asset or cash payment, meaning there is no guarantee that the second leg of the transaction will occur. DLT platforms allow the recording of transactions of any arbitrary asset – money, equities, bonds, over-the-counter derivatives – as well as cash, allowing multiple, simultaneous changes to the ledger. This would mean that the concept of delivery v. payment – where one asset changes hands only if the other asset does as well – can be achieved simultaneously, with no ambiguity as to which leg occurred first. This extends to invoices and payments – two parties can know the status of an invoice at any time, and the payment can settle at the exact moment the invoice is marked as paid, with both parties having visibility of this change of status. This could mean that transactions recorded on DLT could on aggregate be cheaper than transactions recorded across multiple siloed accounts, and remove the credit risk.

Greatest return

Respondents say the greatest return from blockchain was its use for cross-border payments. Banks identify several pain points causing inefficiencies, costs and risk to daily operations. Most of those surveyed expect faster payments, especially across borders, to be the most important use case. One respondent notes that blockchain could help solve some of the most cumbersome issues in payments systems. Cross-border payments, as well as extending the 'opening hours' of central bank payments systems by decentralising infrastructure, were identified as key objectives early on.

Spotlight: BCTrade

From identifying these inefficiencies and pain points, the industry has developed a number of blockchain use cases. One prominent use case is trade finance. Facilitating the movement of physical goods and commodities is burdensome, with paper processes such as issuing letters of credit, bills of lading and invoices used to reduce payment and delivery risks. DLT can speed up transaction settlement time (which currently takes days), increase transparency between all parties of a trade and free up capital that would otherwise be used to pre-fund trade finance transactions. For example, China Construction Bank launched BCTrade, a blockchain trading platform, of which 60 financial institutions are members. So far, 3,000 users from banks, manufacturers and import and export trading firms, have used the platform to transact more than Rmb440bn in forfeiting, domestic letters of credit, international factoring and re-factoring and logistics finance.

Industry focused on cross-border payments

The banks surveyed are largely concerned about pain points in cross-border payments, particularly high costs and inefficient processes. Respondents feel that DLT would provide the tools to surmount these issues. A 2019 Institutional Deposits Corporation study on blockchain spending found that cross-border payments was the use case receiving the most annual investment at $453m, equivalent to 16% of market share, see Fig 1.2.

Proponents of blockchain maintain that DLT offers several advantages over current payments technology. These include facilitating near-frictionless settlement at any time, global interoperability, high security, and ultimately, quicker and lower-cost transactions. To understand the rationale and use cases for blockchain technologies in cross-border payments, the next section examines the incumbent methods for international transactions and their principal limitations and disadvantages.

The cross-border payments system relies heavily on correspondent banking networks facilitated by financial intermediaries at multiple levels. A correspondent bank will have either a nostro or vostro account with a counterpart bank in another

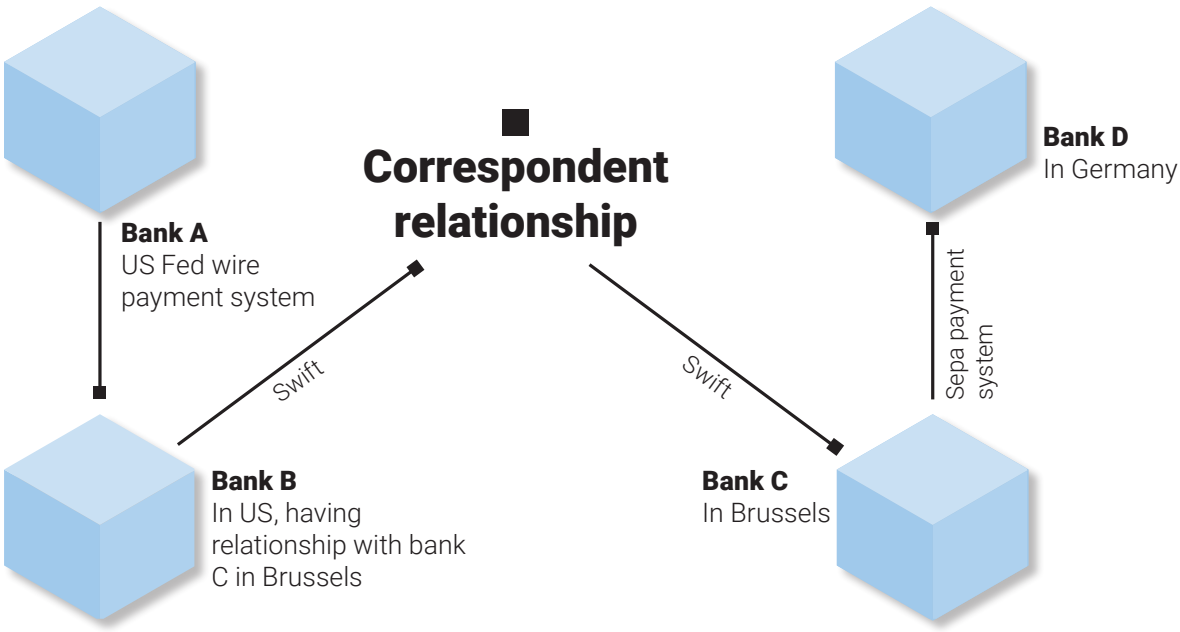
Fig 1.3: Regulatory concerns across applications
Prominent industry use cases of DLT

	Typical financial actors	Blockchain and DLT use cases	Strategic innovation motives	General regulatory attitude
Back-office (settlement, reconciliation, messaging etc.)	Banks and fintech firms, incumbent service providers e.g. Swift	• JP Morgan Interbank Information Network • Settlement Clearing Systems e.g. Citi-Nasdaq Blockchain • Intra-bank foreign exchange settlement e.g. HSBC FX Everywhere Network	• Digital transformation in strategic but methodical manner • Insulate incumbent positions from future disruption • Optimise operations and lower costs on existing payment rails • Streamlining inter and intra-bank workflows • Partner with existing market leaders to quickly deploy new technologies at scale	• Regulatory concerns over legality and contractual enforceability of transactions and settlement finality • Driving base-layer interoperability and common technical standards
Compliance procedures (KYC, AML, CFT etc.), documentation, information-sharing	Banks and fintech firms, incumbent service providers e.g. Swift	• Streamlining trade finance processes such as letters of credit, bills of lading, invoicing e.g. We.Trade • Customer compliance, KYC and collateral management e.g. CLS-IBM LedgerConnect	• All of the above • Potential for market disruption to a limited extent as interoperability/ standardisation can expand opportunities for service providers	• Regulatory concerns over security and privacy related to digital identities and data storage • Entry of new intermediary actors involved in compliance • Need to enhance regulatory capacity to engage and integrate new technologies into supervisory/audit processes
Means of payment (account v. token-based)	Typically fintech firms, now big tech and some banks on limited basis.	Retail remittances, B2B payment solutions e.g. Ripple's XRP, Facebook's Libra, Visa B2B, Santander One Pay FX	• Challenge/ complement mainstream financial system infrastructures • Broaden financial inclusion among peripheral markets and institutions	• Ambiguity over legal status of payments and nature of assets • Transparency issues for taxation and compliance • Anti-trust concerns over competition and governance within new payment infrastructures • Unsuitability as a means of payment due to volatility concerns
Central bank digital currencies	Central banks	PboC DCEP, Riksbank e-krona, among others to issue retail CBDC	• Enhance consumer protection, • Financial system stability and resilience • Respond to private-sector innovation	• Unknown implications for conduct of monetary policy and financial stability

Source: OMFIF analysis

Fig 1.4 Correspondent banking model

Bank A sends euro amount to euro account of Bank D in Germany



Source: InfoSys, OMFIF analysis

country. A nostro is the account of a local bank held by a correspondent bank in another country, in its foreign currency. A vostro is the account of a foreign correspondent bank, held by a local bank in its domestic currency. This reciprocal system of accounts facilitates foreign exchange transactions and the flow of funds between countries.

Swift's network allows participants to exchange electronic transaction messages detailing instructions for cross-border payments. However, it provides neither clearing nor settlement. Correspondent banks participating in a transaction must still process the messages individually on their back-end and subsequently settle any transactions through foreign exchange markets, see Fig. 1.4.

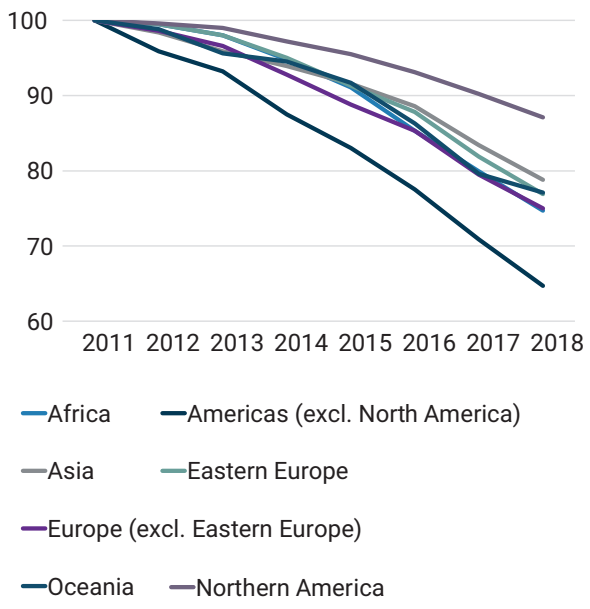
Consequently, cross-border payments are generally more cumbersome and expensive than domestic payments due to the number of financial intermediaries involved in the process. Smaller financial institutions that have not established correspondent relationships with foreign counterparts may be disadvantaged. One respondent says, 'Getting another bank to use our system is a difficult discussion to have and can be a non-starter [in cross-border partnerships]. Swift is the only workable example of third parties hosting a network that anyone can join, but it is not a platform that extends to corporates. It's really just bank-to-bank messaging, so again it falls short.'

Shrinkage and consolidation in the number of correspondent banking channels have reinforced higher costs associated with cross-border payments as institutions seek to reduce their risk exposures, see Fig 1.5. A 2018 World Bank report on the decline of correspondent banking noted that this trend of de-risking tends to disproportionately affect financial institutions in small, developing countries at the periphery of cross-border payment corridors.

Circumventing this costly system is widely regarded as the main motivation for applying DLT to cross-border payments, as there are real efficiency gains to be achieved.

Fig 1.5 International decline in correspondent banking

Number of active correspondent banks by region, Indexed 2011=100



Source: Bank for International Settlements and OMFIF analysis

Alleviating pain points

As highlighted, cross-border payments tend to be riddled with inefficiencies and transaction costs. Interbank settlements require a minimum level of pre-existing trust between intermediaries. Establishing and verifying trust generates tangible transaction and compliance costs for financial institutions in terms of money, time and uncertainty. A recent McKinsey Global Institute study on cross-border payments found that the bulk of costs (nearly 35%) in existing international transactions methods are related to nostro-vostro liquidity and

'What we were looking to do was put a ledger in between different entities, to update the life-cycle of the transaction and have a single version of truth between the different entities and systems.'

reconciliation due to a lack of real time data and differences in end-to-end payment processes, see Fig 1.6.

Blockchain-based cross-border payments offer several advantages in streamlining verification and reconciliation procedures. Blockchain-based transactions diminish the role of any intermediaries, central institutions, and correspondents in the cross-border payment process. Transactions can be executed directly between the parties who have entered into a bilateral agreement on the platform, thereby reducing the need for interpersonal trust between transacting parties. This lack of centralisation, and the nature of immutable and secure transactions, present benefits in terms of efficiency, transparency, security and cost.

The reduction of intermediaries such as correspondent banks or central agencies can help minimise charges incurred along the payment chain. Currently, transaction settlement relies on financial intermediaries and service providers. As a result, post-trade processes require a considerable amount of reconciliation. A peer-to peer model reduces the need to update and reconcile multiple accounts in the post-trade cycle. Enabling direct transmission of information and assets between parties could optimise the operational costs of cross-border payments, as any lack of standardisation can be minimised, see Fig.1.7. A 2017 Accenture study estimated that full-scale blockchain adoption among global investment banks could reduce reconciliation and other infrastructure costs by 30% on average, an amount ranging from $8bn-$12bn. One respondent says, 'The main pain points stem from intermediaries doing away with old correspondent banks, central banks' opening hours slowing settlement finality, and preventing new risks like market risk, which can arise from cryptocurrencies, or credit risk. If a commercial bank issues the coin or stable coin, this can lead to credit or legal risk.' Our respondents note that this is the most important way in which DLT in cross-border payments can achieve key cost savings – by avoiding having to channel foreign exchange through a cumbersome network of pre-funded legacy banks.

Similarly, balances can be duly maintained in real-time, eliminating the need for a central clearing house such as a central bank. One bank shares that DLT is valuable as 'getting rid of the single point of failure by decentralised validation and synchronisation reduces systematic risk'. Synchronising payments could allow blockchain and DLT to mitigate settlement risk along a payments chain. Thus, blockchain technologies could streamline processing times, improve risk management processes, cut back-office costs involved in reconciling data across organisations and reduce overall friction in the system.

Shift to tokenisation

Importantly, these benefits could be the basis for tokenisation – that is fundamentally shifting from account-based to token-based payments systems. The lengthy and costly infrastructure for intermediaries, compliance and verification procedures are essential to conduct transfers of claims upon payments recorded within an account. DLT-based transactions could allow for the authenticity and value of exchanged payment objects (tokens) to be verified independently, precluding the need for messaging, clearing and settlement systems.

Many respondents emphasise that while there are feasible alternative solutions to cross-border payments (e.g. Swift gpi), blockchain and DLT have proven to be catalysts to push the financial industry's outdated infrastructure to the cusp of technological upgrading.

The question of momentum and timeline is important . Large financial institutions tend to be conservative in their approach to DLT – before delving head-first into new endeavours, banks want to make sure that the technology is right and that they can secure full regulatory approval. Most of those surveyed say that the nature and depth

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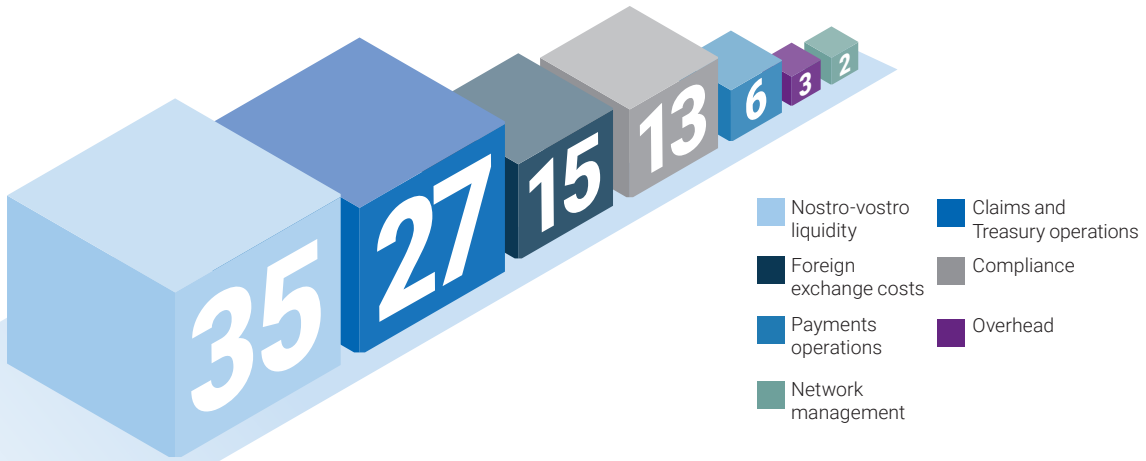
Full-scale blockchain adoption among global investment banks could reduce reconciliation and other infrastructure costs by 30%

Fig 1.6 High costs in international payments related to nostro-vostro liquidity and reconciliation

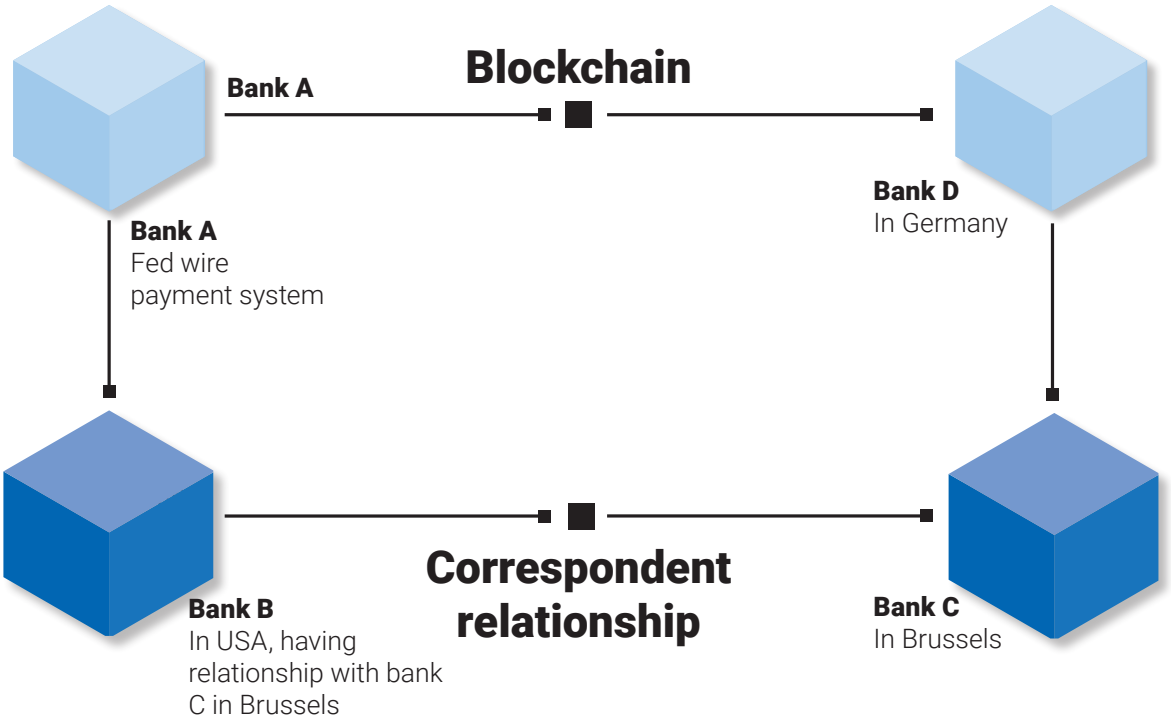
Cost breakdown for international payments transactions



Source: McKinsey Global Payments Map 2019

Fig 1.7 What benefits does blockchain bring in, when leveraged got cross border money transfer

Money transfer from Bank A to Bank D through blockchain eliminating the 3rd party as highlighted



Source: Infosys, OMFIF analysis

'Along the way, with better understanding and more knowledge of blockchain, these banks create their own use cases and move to bigger projects. They see blockchain as an opportunity to create new competitive advantages over other banks.'

of regulatory engagement will determine which innovations become predominant and their pace of adoption. As one bank notes, 'Getting the regulators on board… with regards to DLT should be priority number one.'

Deepening industry disruption

The payments industry is keenly aware of the pain points in cross-border payment processes, with various institutions taking different measures to solve them. A key question is whether or not technological innovation in this sector will be gradual and evolutionary, or more radical and potentially disruptive.

Although the benefits of blockchain and DLT were traditionally perceived as opportunities confined to back-office efficiency gains and optimising intra-bank compliance workflows, front-offices are now also seeing the benefits. Recent developments in the technology and payments landscape are impelling innovation at a deeper, strategic level among banks. Blockchain and DLT services are becoming important differentiating factors affecting end-user experiences.

Before 2017, DLT was viewed from an innovation perspective. The narrative from 2017 onwards was driven by business (mainly efficiency), and to a lesser extent, revenue. Institutions are now approaching DLT more strategically, with Facebook planning to launch its cryptocurrency, Libra, and the People's Bank of China working on its Digital Currency Electronic Payment. With major commercial and central banks innovating in comprehensive DLT platforms, the industry as a whole may be forced to consider to what degree they should replace front-to-back office infrastructures. Another bank respondent elaborates: 'Along the way, with better understanding and more knowledge of blockchain, these banks create their own use cases and move to bigger projects. They see blockchain as an opportunity to create new competitive advantages over other banks'.

In increasing order of potential disruption, blockchain and DLT innovations might alter back-office processes, compliance and means of payments. To the extent that DLT could lower back-office costs and increase efficiency in compliance, these innovations could facilitate an orderly transition where incumbent financial institutions gradually deploy new technologies. However, other products or business services derived from DLT, such as a token-based payments system, could bypass existing intermediaries and stimulate more disruptive shifts in market structures.

Contrasting bank and fintech activities

Traditional financial institutions have a vast customer base and deep pockets, but legacy systems hold them back. Put simply, it is a battle between innovation and distribution, and it remains to be seen whether financial technology firms will achieve distribution before banks innovate fully. The future of the banking industry depends on its ability to leverage the power of customer insight, advanced analytics and digital technology to provide services that help today's tech-savvy customers manage their finances and better manage their daily lives.

In general, small fintech companies' activities span all three of these areas. Yet there is also a tendency for new entrants to be more radical and ambitious in their innovation approach to cross-

Fig 1.8 Banks commit to methodical digital transformation
Blockchain networks to address cross-border pain points

	Large global banks	Medium-sized commercial banks	Fintech: cryptos	Central banks
Example/ approach	JPM. Lead, build, partner and invest	Signature Bank. Learn, partner with fintech (Tassat)	Ripple. Partner with banks and financial institutions.	MAS's Project Ubin. Learn, monitor, incremental
Business / policy imperatives	Digital transformation: Strategic but methodically; compliant, leadership, market share, control and protect incumbency	Compliant, digitalisation; new solutions; keep existing customers and grow market.	Innovation, scalability, crypto economy	Consumer protection, system stability and efficiency
Angle	Efficiency, cost-saving, liquidity management and capital efficiency. 'pain points'	Agile, solve real problem, more open to alternatives; marketing tool for new business.	Young population, built from bottom-up for payment; alternative to Swift	Shadow banking and other leaks in the banking system, informal economy and non-banked
Initial focus	Intra-bank info-sharing and workflow within own network	Compliance, full stack solution, B2B, intra-bank	Solutions to non-bank FIs, B2C mass market	RTGS fintech, crypto, sandbox, interoperability
Use cases	Compliance apps in IIN; Treasury services for corporate customers and capital markets	Treasury services (cross-border payment, cash management, asset transfer)	Retail remittance, SME payments solutions,	Digital money
Tokenisation availability and characteristics	None for IIN; new apps for capital market through 'JPM Coin', which pegged to the dollar; within IIN network	Private token backed by bank deposits, digital cash, digital wallet, virtual account; within the network	XRP, public-traded over exchanges, controlled by Ripple	Distributed through commercial bank wallet; on central ledger.
Governance/ Platform	Quorum	Private Ethereum	Decentralised Ripple network	Quorum, R3, alternative DLT, even non-blockchain
Deployment stage, volume	Internal, within consortium	Live, private/ permissioned network of banks and their corporate customers, billions per month	Live, daily transaction volume: hundreds of millions.	Pass the PoC stage; cross-border, and (phase 5) explore commercial viability with banks and private sector
Regulatory status	Information-sharing piece is live; conservative approach	First blockchain-based bank payment solution approved by a US bank regulator	Not regulated, not a MSB; only technology provider	Behind the learning curve

Source: OMFIF analysis, CCBU

Spotlight: **Interbank Information Network**

Launched as a pilot in 2017, JPMorgan's Interbank Information Network aims to develop a meaningful group of bank users focused on harnessing emerging technologies such as blockchain to better address the complexities and pain points in cross-border payments. Initially, JPMorgan tested moving money within internal entities and was successful. Since then, the bank has stepped back from real-money transfers, and focused on one pain point, information-sharing.

With an extensive network of 397 banks, IIN involves a mutually accessible ledger built on JPMorgan's private blockchain, Quorum. It allows permissioned banks to exchange information about compliance checks and other exceptions preventing completed payments.

Within the IIN platform, for JP Morgan's customers and potentially for other financial institutions, 'Resolve' emerged as one of the first use cases to address a compliance pain point: 60% of Office of Foreign Assets Control (a financial intelligence and enforcement agency within the US Treasury Department) inquiries relate to client data as simple as date of birth, name and address. 'Resolve' enables the real-time sharing of client data, cutting processing times to minutes from up to 16 days. In future, JPMorgan may expand the network for internal payments and real money transfers, between different entities within the group. Other developments may include bond issuance, real-time security settlement and repo collateral management. JPM Coin could facilitate such transfers and settlements.

Fig 1.9 Eliminating information efficiencies

Current model	**IIN Vision**
Manual	**Faster turnaround**
Costly	**Reduced costs**
Slow	**Direct communication**
Inefficient	**Secure network**

Source: OMFIF analysis, CCBU

border payments, see Fig.1.8. Commenting on the general strategic thrust of small fintech firms, one blockchain technology provider does not expect an overhaul of the financial markets infrastructure, given the investments into existing technologies, thus opting for 'integration with existing [payment] rails such as Swift and applications such as Murex, Omgeo, Aladdin'. This approach is, however, atypical according to the firm. Most other blockchains being independently developed by fintech companies take a 'neoliberal approach' intended to supplant existing financial market infrastructures.

Playing it safe

In comparison, banks' engagement with cross-border innovation has hitherto been largely confined to analytics and digital technology. Banks prefer to play it safe through regulatory dialogue, rather than seeking to establish a competitive advantage by staying ahead of the 'tech curve' and engaging in riskier bets on new blockchain applications. However, they are disadvantaged vis-à-vis new 'challenger' and 'neo' banks or smaller fintech firms that enjoy a lighter regulatory burden and more manoeuvrability in testing new solutions, thus potentially establishing first-mover advantages. Some banks are prioritising 'co-development' with outside fintech start-ups. This greater agility notwithstanding, new fintech firms seeking to overhaul financial market infrastructures face another constraint. To be as competitive as banks, they must construct a connectivity base from scratch. Small firms acting independently are likely to lack sufficient institutional commitment and regulatory alignment to drive more disruptive changes via DLT.

Banks do not tend to have the same appetite for radical, disruptive innovation as smaller companies. However, collaborative activities executed via consortia may help introduce more extensive industry changes in cross-border payments. For one technology provider, systematically revamping cross-border processes to remove 'residual friction in the transparency of fees' would entail a combination of technological innovation and commitment from banks. Another fintech respondent concurs, adding that 'support and financial commitment from bank leadership is the key to the success of a blockchain project'. For this reason, banks have sought out methods of capitalising on their scale and incumbent positions by collectively pooling innovation resources to best situate themselves within this new and volatile space. One of the preferred methods in this vein is the use of consortia.

Co-operating with leading consortia

Half of respondents, in particular those from banks, identify consortia as their preferred way of implementing an enterprise blockchain solution for cross-border payments. In the words of one respondent, 'You can only achieve success and gain interest from all the different parties if you start with sufficient core coverage, and that's why you

Spotlight: **Ripple**

Rather than compete with large banking companies, Ripple plans to partner with leading financial institutions and provide them with a blockchain solution.

Instead of converting dollars into other currencies, which entails exchange rate costs, processing fees and slow transaction times, one bank can transfer, for example, $5m worth of XRP to another bank's Ripple portfolio, which can then be converted into local currency.

Ripple is seeking to position itself as an alternative to Swift. Its software controls the relevant banks' funds and updates each party's accounting books. The settlement process is completed in seconds.

By consolidating liquidity to service international payments from many, disjointed, international nostro accounts into one XRP pool, respondent banks allocate less total liquidity to service the same volume of global payments. The bank only has to hold its domestic currency and maintain one account with XRP, with only enough XRP to service its largest expected payment obligation. The process minimises the number of intermediaries and their markup on spreads.

'You can only achieve success and gain interest from all the different parties if you start with sufficient core coverage, and that's why you need to participate in a consortium.'

need to participate in a consortium.'

Large banks could leverage the technology to create their own solutions or consortium. They operate at great scale and within extensive networks. As such, they are prime candidates to build the blockchain technology – either on their own or by partnering with a fintech firm – that will help them maximise efficiency and revenue opportunities.

One fintech respondent explains that smaller banks, or those with less understanding of the technology, may find it useful to join a consortium. This way, they can have a voice in the industry, exchange information on cutting-edge technology and application development, and a marketing platform.

In addition, a distributed ledger system would benefit from network effects, and a permissioned consortium could allow banks to better leverage this network for cross-border payments. The blockchain can allow for the updating of sensitive customer and transactional information between members, with the use of unique identifiers, while smart contracts ensure only 'need-to-know' participants can view certain transactional information.

If a bank decides to start a consortium, it must determine which type best suits its requirements. Consortia therefore vary on the level of access, data sharing, and governance.

Designing an acceptable and competitive governance structure requires developing and agreeing on consensus mechanisms, tokenisation, access and permissions, and hosting of nodes. Consortium members can determine how to share data, the level of input and control each participant will have, as well as how to assess consortium performance and growth potential.

Consortia considerations

When joining an established permissioned platform, a bank becomes either a 'follower' or a 'leader' in that consortium. This is ultimately decided by the consortium's governance structure. A bank is unlikely to join as an outright leader, unless it holds a large enough stake within the group. Most respondents are members of multiple consortia, and are leaders in one consortium and followers in the others.

For banks, the decision to join consortia is based on a number of key characteristics. First, they seek to balance wide membership with quality participants. That is why they join different groups– 'it hasn't been a pick one winner approach, it's been more backing a few horses,' as one respondent puts it – and look to involve different parties in their consortia to get a broad range of views and adequate coverage. In the case of the latter, banks cite geographical coverage as a specific concern. The aim of this is to ensure that eventually, the strength of a consortium's network will allow a leading member bank to persuade other players to remain part of their 'ecosystem'.

Finding common ground on the specific factors of a consortium's operating model may include establishing common ground on:

- Business, technology, and regulatory risks
- Legal entity structures and liability attribution
- Intellectual property management, funding, use case development
- Technical considerations such as platform design
- Data management, privacy and ownership
- Dispute resolution
- Service-level agreements indicating resource input and required levels of participation

In practice, banks must consider their specific objectives when joining a consortium and whether it is the optimal fit for them. A bank may use membership as an opportunity to learn and see how to approach the technology, and structure projects from a resourcing perspective. But as one bank respondent suggests, the core of the use cases in their respective consortium were Europe- and UK-focused, far from the bank's regional priority, meaning there was little opportunity to participate in many of the consortium's projects. In some circumstances, membership fees could be used to access research portals or resourcing a bank's internal teams to develop their own expertise.

The reality of multiple consortia

There is a clear consensus among surveyed banks that membership in different consortia – with different use cases and roles in each – is a good thing, in moderation. Yet the lack of an agreed set of universal standards makes the issue of interoperability difficult. For example, ISO2022 is the standard used for transaction messages in

'You can't go it alone with blockchain, that would not be productive. The whole point is getting the whole value chain on one network or a collection of meshes.'

cross-border payments. For a legacy system to work with a newly implemented DLT-based system, it would have to be able to interpret and transform these transaction messages, and record them on the ledger. The system must be able to execute a transaction from its end and export it so that older systems – based on ISO2022 – can accept and authenticate the payment order. Solving this data transfer between blockchain and legacy systems, and between two different blockchain-based systems, will solve the issue of interoperability.

For banks, working across multiple consortia could help solve this quandary, as different networks can connect and share data. In the words of one respondent, 'by joining multiple networks, you solve the interoperability' through a 'cross-participation' model. Consortia fuel network effects, allowing a group to grow and gain influence in the long run. The incentives of joining a consortium, therefore, are geared towards 'co-opetition' rather than competition.

One of the drawbacks of Swift is that it is membership based, therefore its services are limited. In contrast, the blockchain consortia business model is not necessarily geared towards consolidation. A single group is unlikely to gain critical mass, meaning future standards reflect a wider group of banks and fintech firms, instead of being built around one dominant bank. Rather, there is a tendency towards interoperability that reflects the changing nature of interaction between consortium members.

The global banking and commerce sectors are unlikely to form a single blockchain network. One bank respondent suggested that being part of multiple consortia could alleviate interoperability problems arising from fragmentation across payments and transaction rails. Cross-participation would enable data to be moved from one platform to another, without the need for networks to communicate.

Another bank respondent said a rulebook on settlement finality was a key asset in their foreign exchange cross-border network, as it gives them 'comfort on how we would interoperate or permission people onto our ledger.' However, 'ultimately, many systems will use ledgers, and the technology for each of these DLTs may well be slightly different. There is never going to be one unified way of doing it.'

'Ultimately, many systems will use ledgers, and the technology for each of these DLTs may well be slightly different. There is never going to be one unified way of doing it.'

Blockchain platforms

Implementation is more complex if a bank decides to build its blockchain framework and network, therefore banks tend not to opt for this approach.

Several blockchain platforms offer benefits in terms of infrastructure, network, solution and services. The three main providers are R3's Corda, IBM's Hyperledger Fabric and Ethereum-based Quorum. They sit on the protocol layer of the blockchain tech stack (which consists of application, service, protocol and infrastructure) and define essential rules of permission, consensus and framework.

Working on standards and protocols

Standardisation is still in its early stage. The International Standards Organisation is working on a series of blockchain and DLT standards, ISO/TC 307, which aim to address architecture, taxonomy and ontology. The ISO plans to develop a terminology standard in 2020. However, due to lack of definitions for some critical aspects, these don't yet have timeframes. These include security, privacy, identity and interoperability. PingAn, a Chinese insurance, banking and financial services company, publishes technical standards for cross-border trade. Other entities such as the Institute of Electrical and Electronics Engineers Standards and the China Electronic Standardisation Institute have published standards and protocols relating to blockchain.

R3 and Hyperledger are leading private efforts to establish standards. However, Ethereum organisations such as the Enterprise Ethereum Alliance and the ISO argue for more global and public standardisation methods, to maximise interoperability and take full advantage of networking effects.

Working groups aim to identify blockchain standards and build code bases and proofs of concepts, and are a useful way to pinpoint new issues. However, outcomes vary between groups.

Joining a large working group is valuable for establishing standards in the long run, but processes can be slow. Smaller groups allow players to reach a consensus faster, but risk becoming obsolete if a more widely adopted standard emerges. Banks usually mitigate this risk by joining multiple groups, large and small. That is what BNP Paribas did, for example, in addition to investing in fintech firms. The bank's objective was to define standards and develop a proposal for a specific blockchain application.

Banks typically need to see clarity in the models, goals and use cases of a particular consortium before agreeing to participate. As one respondent notes, 'while fewer is definitely better,' there are 'going to be many ecosystems'. As such, many banks surveyed agree, there is a need for clear terms and conditions across networks. For example, there are clear intellectual property considerations between different consortia blockchains. Hyperledger has an explicit IP clause, while it is unclear where R3's lies. If there are layers of applications built on top of existing blockchains, there will also be different layers of intellectual property. Such instances require more detailed clarifications.

Fig 1.10 Comparing blockchain platforms
Each platform presents different benefits

	R3 Corda	Quorum	Hyperledger Fabric
Industry focus	Financial services	Cross-industry	Cross-industry
Governance	R3 Consortium	Ethereum developers and JP Morgan Chase	Linux foundation
Ledger type	Isolated and multi-tenant by design	Permissioned	Permissioned
Multi-tenancy	Isolated and multi-tenant by design	Not available	Supported using side-channels
Smart contract functionality and programming language	Yes, built with Kotlin (Java)	Yes, built with Solidity	Yes, built with Golang (Java)
Consensus	Pluggable framework, parties to a transaction are involved in decision-making	Pluggable framework, Raft consensus, and Istanbul byzantine fault tolerant consensus	Pluggable framework, but not necessary for all nodes to participate
Throughput	Approximately 550 transactions per second	Approximately 600 transactions per second	More than 2,000 transactions per second

Regulation

'The future of the bank depends on the bank meeting all the regulatory approvals and requirements with regards to KYC and AML.'

DLT-based cross-border payments could offer banks considerable cost-savings and efficiency gains, but this area is rife with competition from nascent fintech firms. These challengers face a smaller regulatory burden than well-established, systemically important banks, granting them greater flexibility in devising effective cross-border solutions. One respondent suggests that fulfilling DLT's potential in financial services revolves around regulation: 'The future of the bank depends on the bank meeting all the regulatory approvals and requirements with regards to KYC and AML.' These regulatory requirements are a key part of the payments playing field. The most important obstacle to date is a lack of harmonisation across jurisdictions and the absence of global standards.

US banks for example, as depository institutions, require a banking license and are subject to regulations from the Federal Reserve, Office of the Comptroller of the Currency and federal states in which they operate. Payments service providers and money service businesses are regulated by the US Treasury's FinCEN unit. Any novel operation will have to fit into existing regulatory frameworks. Fintech firms are technology solution providers, and therefore are not formally regulated. However, any solution they develop for banks must comply with regulations.

The industry's regulatory predicament

'The future is to align towards regulatory requirements, so getting regulators on board with every step that we take with regards to DLT should be our top priority. There is a need to comply with the rules and gain approval from all the different central banks. There will be the 80-20 rule – when showing central banks a blockchain platform, they will agree on most things, but will inevitably deviate on the details.'

Some of the key features of DLT are at odds with existing regulatory approaches in competition, intellectual property and consumer law. According to the International Telecommunications Union, there are five main issues: distribution, autonomy, tamper evidence, incentive mechanisms, and transparency.

First, given the decentralised nature of distributed ledgers, it is difficult to apply existing regulatory approaches to blockchain technologies. For one, legal systems are largely national, and may struggle to adequately regulate nodes across different jurisdictions. It is unclear how legal responsibility would be attributed in this context. Furthermore, DLTs may pose challenges related to cross-border data sharing and data localisation, which may fall under disjointed regulatory authorities. Multi-party enterprise blockchains are subject to legal ambiguities over territoriality and liability.

Second, automated, autonomous processes are a key attribute of blockchain networks, with features such as smart contracts used to automate contract execution on-chain, for example. While automated decision-making on DLTs is generally transparent, there are still questions around legal liability in the case of these processes, though this is less of an issue on permissioned networks where there is a 'central' administrator.

Third, ledger permanence is another key feature of blockchain ecosystems, which explicitly use cryptography to ensure that distributed records are tamper-proof. This is an essential feature of decentralised networks and one which clashes with several existing environments, including the European Union's General Data Protection Regulation. The right to be forgotten and the right to rectification are key elements of the GDPR which conflict with the immutability of a DLT system.

Fourth, maintaining and participating in blockchain governance requires an incentive mechanism. Cryptocurrencies usually provide this incentive quantitatively, for example by deriving additional coins as a form of payment. However, in permissioned blockchain systems, non-financial qualitative incentives for member participation are derived from the alignment of participants' common objective, such as the ability to transact near-costless across borders.

Finally, decentralised networks owe much of their appeal to their privacy and anonymity features, which are incompatible with anti-money laundering and KYC rules, among others. One respondent shares that systematically shifting to a new payments infrastructure using DLT could prove difficult as 'banks have built up their compliance checks, in AML, KYC and reporting requirements for supervisors around the nostro-vostro system'. For instance, one valued-added regulatory and compliance service that Swift provides to banks – and recently corporate entities – is a KYC registry.

These issues play out largely at the domestic level. For respondents, the main problem is the fragmentation of regulation across different borders and jurisdictions, a crucial quandary given the central use case of cross-border payments. Except for the EU's GDPR, there is little by way of supranational or international regulation of DLTs. The Bank for International Settlements' Principles for Financial Market Infrastructures seek to cover the global payments landscape.

However, it would be difficult to apply these as a regulatory framework for enterprise cross-border payments solutions. The BIS has produced an analytical framework through which to examine

blockchain design in the context of the PFMI, but in doing so has mostly sketched trade-offs and important considerations vis-à-vis existing financial market infrastructures. It has not provided concrete legal guidance or explicit guidelines. For instance, on the question of settlement finality, the BIS writes, 'For DLT arrangements, settlement finality may not be as clear. In arrangements that rely on a consensus algorithm to effect settlement finality, there may not necessarily be a single point of settlement finality. Further, the applicable legal framework may not expressly support finality in such cases.' Banks we surveyed agree that the BIS's PFMI provide guidance but no clear global standards. Nevertheless, they still expect to abide by the principles: 'New market infrastructures are likely to be expected to comply with the Committee on Payments and Market Infrastructures and International Organisation of Securities Commissions PFMI standards, and the legislation in local jurisdictions which implement these standards.' That being said, one technology provider admits, 'A lot of work needs to go into aspects such as data standardisation to prevent fragmenting the market. This, by itself, is tedious and contentious – the implementation of ISO20022, for example, is still dragging'.

Slow progress in solving regulatory divergence

Market participants we spoke to suggest that international bodies may have to take the lead in developing these blockchain regulatory standards. National central banks, such as the Bank of England, frequently rely on these fora to shape and inform their approach. One respondent compares regulation of DLT to post-crisis swaps regulation produced by the G20, yet notes that even then, interpretation and implementation of the international standards resulted in 'massive divergence'.

'There needs to be coordination beyond that… in order to get into the detail and address some of the interpretive issues to make sure parties are aligned not only on the outcomes, but also on the interpretive issues in order to reduce the friction that emerges through implementation and execution'.

As a result, it is necessary to use international organisations not only to develop detailed guidelines but also to ensure parties are aligned on interpretive and implementation issues, to reduce longer-term frictions. At the same time, several respondents are optimistic about the prospects for interoperability and cross-border regulatory harmonisation, with one noting that 'it's going very well,' and that global member banks in their enterprise blockchain solution are 'very excited about what we can do on this.'

While cross-jurisdictional ambiguities and incompatibilities will remain a common element in blockchain regulation, the trend towards formal consortia is reducing this ambiguity. Internal blockchain governance within a consortium

US regulatory considerations

The US agencies working on cryptocurrency regulations are the Securities and Exchange Commission, the Federal Trade Commission, and the Department of the Treasury, through both the Internal Revenue Service and the Federal Crimes Enforcement Network.

There are no formal regulations at the Federal level. Approaches are mixed at the state level. Some states have passed favourable regulations which exempt cryptocurrencies from state securities laws, monetary transmission statutes and other regulatory requirements. These include Wyoming, Colorado, Georgia, Arizona and Ohio. Other states such as New York have passed more restrictive laws, prompting a number of cryptocurrency-based companies to exit the market.

The sale of a cryptocurrency is regulated if it constitutes the sale of a security under state or federal law, or money transmission under state law. The sale falls under FinCEN regulations if done as part of a money services business under federal law.

If the token or cryptocurrency is deemed to be a security, it falls under the securities regulation of the SEC. Similarly, under the Bank Secrecy Act, FinCEN regulates money service businesses. According to FinCEN, 'An administrator or exchanger that (i) accepts and transmits a convertible virtual currency or (ii) buys or sells convertible virtual currency for any reason is a money transmitter under FinCEN's regulations, unless a limitation to or exemption from the definition applies in person'.

According to Global Legal Insights, MSBs that are monetary transmitters under FinCEN regulations will have to develop, implement and maintain a written programme that is reasonably designed to prevent the MSB from being used to facilitate money laundering or terrorist financing. Specifically, the company must incorporate written policies, procedures and internal controls reasonably designed to assure ongoing compliance; designate an individual compliance officer responsible for assuring day-today compliance with the programme and Bank Secrecy Act requirements; provide appropriate training for personnel, which includes training in the detection of suspicious transactions; and provide independent review to monitor and maintain an adequate programme.

With a stablecoin, similar considerations must be taken. The SEC notes that labelling a digital asset a 'stablecoin' does not affect its regulatory status. Instead, it depends on a facts-and-circumstances analysis of the economic reality, meaning securities regulation could apply. If a stablecoin exhibits the properties of a deposit (e.g. if it is issued in exchange for $1 and is redeemable for $1), this will trigger bank regulatory licensing requirements. Stablecoins are also likely to constitute spot commodities, subject to the anti-fraud and anti-manipulation authority of the Commodity Futures Trading Commission. Lastly, an administrator or exchanger of convertible virtual currencies (either has an equivalent value in real currency or acts as a substitute for real currency) must register with FinCEN as an MSB. At the state level, a stablecoin issuer or exchange may be required to obtain a money transmitter license in the states in which it operates.

'There needs to be coordination to get into the detail and address some of the interpretive issues to make sure parties are aligned not only on the outcomes, but also on the interpretive issues in order to reduce the friction that emerges through implementation and execution'.

can allocate liability and stipulate the governing laws, jurisdiction and agreed dispute resolution mechanism to some degree. In addition, the creation of ecosystems consisting of multiple consortia has alleviated the problem of interoperability, with ecosystems serving as so-called super-connectors. However, the problem of regulatory divergence remains. One bank is resigned to the prospect of this remaining the case in the long term, and is simply complying with relevant sets of national regulation and bearing the costs this entails.

Achieving substantive regulatory consensus is difficult at best. The most successful attempts to streamline cross-border innovation for financial services occurs on an ad-hoc, bilateral basis between specific regulators. For instance, fintech firms in Australia and Singapore benefit from pre-existing reciprocal agreements between the Australian Securities and Investments Commission and the Monetary Authority of Singapore. Initiatives such as the Global Financial Innovation Network are the first steps towards expanding this regulatory convergence. First founded in January 2019 by the UK's Financial Conduct Authority and like-minded financial regulators, the GFIN's primary goal is to help regulators share experience of innovation in their respective markets, including emerging technologies and business models. It also aims to provide accessible regulatory contact information for firms.

However, there is not yet enough regulatory coordination for the GFIN to fulfil its overarching ambition of functioning as 'a full multilateral sandbox that allows concurrent testing and launch across multiple jurisdictions'. The lack of existing global standards, and uncertainty around who will be developing them in the future, makes off-chain policy issues harder to navigate. US authorities have been too fragmented in their domestic approach to develop an adequate, internationally applicable framework. The EU's growing role as global rule-maker means that it may take on the mantle of shaping blockchain regulation. It has successfully exported GDPR and the Markets in Financial Instruments Directive, for example, as part of trade deals, simplifying cross-border data sharing through harmonisation.

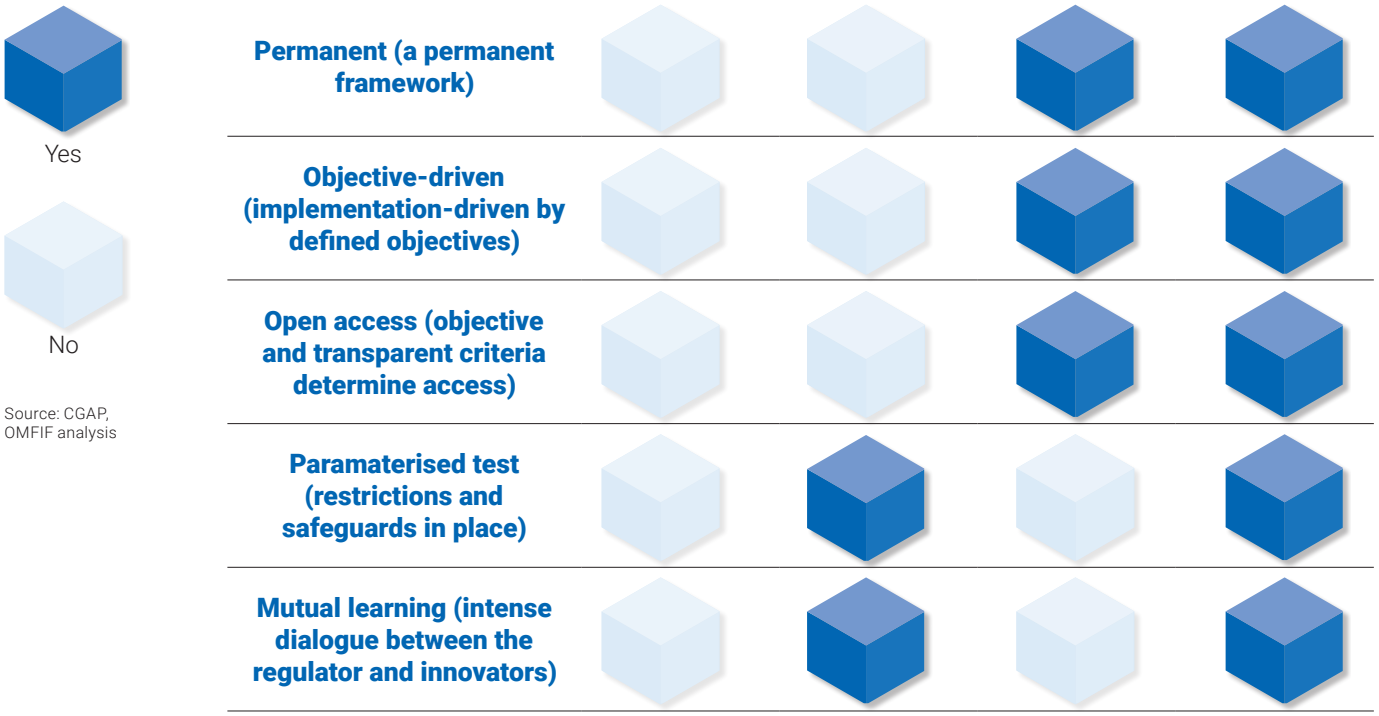
Sandbox dynamics and key regulatory mechanisms

Regulatory approaches to DLT in financial services vary significantly, depending on the relevant authorities' risk tolerance and efforts. 'Wait and see' approaches involve regulators taking a step back to allow nascent technologies to evolve naturally. 'Test-and-learn' strategies, such as that pioneered by the Philippines in the early 2000s, are bespoke, private solutions devised through a dialogue between innovators and regulators, see Fig 1.11.

Regulatory sandboxes, the most common type of fintech regulatory strategy, combine and build on several of these elements. A sandbox allows

Fig 1.11 Regulatory sandbox offers multiple benefits

Approaches to regulations



Source: CGAP, OMFIF analysis

innovators to test their product in a small-scale, live environment controlled by the authority, in which they are exempt from certain regulations for a set period of time. They are more transparent and standardised in nature than other approaches, with publicised acceptance criteria and clear eligibility requirements. This framework permits regulatory agility and creates a controlled space for financial innovation.

Crucially, sandboxes allow for the delicate blend of standardisation and openness, and are often combined with an 'innovation hub', adding to their permanence and objective-oriented nature.

From a regulator's perspective, promoting innovation is not the only purpose of a sandbox. An innovation-focused sandbox dedicated to testing business practices and products is one possible option. They may instead select a more policy-oriented design, with the aim of critically analysing a given regulatory framework. This allows for the testing of, for example, regulatory rule changes, to ensure that they strike the best balance between innovation and consumer safety, and do not excessively hamstring small start-up innovators.

Despite the disparate policy purposes of these sandboxes, there are underlying, universal considerations for regulators to bear in mind. The banks we spoke to emphasised three key areas.

The first is clarity of purpose. Regulators should decide from the outset whether their focus is examining the effect of potential regulation, fostering innovation, or otherwise. Other potential policy rationale may include promoting financial inclusion, for instance. Second, clear eligibility and evaluation criteria are required. Third, risk management processes and reporting should be clear and aimed towards safeguarding consumer protection. These processes may include dispute resolution mechanisms and redress procedures depending on the type of transaction.

A further consideration concerns entry and exit mechanisms. Setting parameters early – such as whether admission to the sandbox is rolling or occurs on fixed dates – is important to maximise benefits. Similarly, determining the appropriate criteria for sandbox 'success' is one of the most pivotal tasks for the regulator, to ensure smooth integration into the market post-testing.

There are key risks that legislators and regulators must heed. For one, a sandbox is neither indicative of a permanent license to operate nor does it represent a regulator's stamp of approval for a

'For smaller companies, the sandbox is ideal. It levels the playing field slightly with large incumbents and they can use the sandbox to test products, and work with regulators in a structured way to obtain the licenses and approval to move on to the production phase.'

certain company. In the past, innovators have used their participation in a sandbox not as a trialling phase, but as an additional investor pitch to secure funding. Sandboxes should explicitly not be used as a way of attracting new customers or investment, as this undermines their purpose as a safe testing environment.

Given the cross-border nature of many DLT use cases, it may be sensible for policy-makers to employ multi-jurisdictional or regional sandboxes. The establishment of a multi-authority sandbox could promote regional, cross-border regulatory harmonisation. Similarly, it would enable innovators to rapidly test their product in different regulatory environments and thus scale far more rapidly than they would otherwise. At the intersection of these two justifications, these regional sandboxes could minimise the medium-term risk of regulatory arbitrage by innovators.

This may be particularly useful for countries lacking the resources to set up a well-designed and -regulated sandbox independently. They could pool resources with authorities in other jurisdictions, possibly by setting up a joint institution or sharing cross-sectoral expertise. However, regulatory overlap may cause redundancies and confusion among the participating innovators. Therefore, clear communication on goals and guidelines is particularly important.

There are two types of regional sandboxes: private industry sandboxes to hone products, and public regulatory sandboxes to test a regulatory framework. The most prominent example of the former is the Association of Southeast Asian Nations' Asian Financial Innovation Network, which seeks to promote collaboration between regional banks, non-bank finance, and emerging fintech companies with a focus on financial inclusion. Banks in developing countries frequently lack the resources to devote their full attention to financial inclusion efforts. Industry sandboxes allow them to reap the benefits of scaling their endeavour. Brussels may soon establish an EU-wide regulatory sandbox, a compelling project given the level of regulatory harmonisation across countries, in part to facilitate the completion of capital markets union.

Bank respondents speak of overwhelmingly positive experiences with sandboxes, pointing to a handful of improvements that could be made on the moving-to-market side. As one puts it, sandboxes are 'great for testing,' especially doing so in a 'low-risk environment.' Participation can be a way to 'get the central bank on board,' which is key to the success of the consortium and its innovation product. Banks praise these areas – regulatory dialogue and low-risk testing – as the main success points of sandboxing. Continued use of these tools will be critical to creating successful and safe blockchain solutions. The next section will discuss some of the improvements that can be made to regulatory engagement strategies, as well as the broader outlook for DLT applications in financial services.

Section 2:
Outlook

Many new features of blockchain have emerged over the years, and the technology will continue to evolve rapidly. Payments solutions are set to become the dominant use case, though banks still face regulatory and scalability issues.

Future trends for blockchain in banking

'The industry finally understands the power and benefits of using blockchain technology.'

The introduction of enterprise-grade blockchain has encouraged large-scale investment into a variety of evolving protocols that meet payments systems' threshold for privacy and permissions. In this section, we highlight the most probable future use cases outside of cross-border payments, obstacles that need to be overcome, and potential changes in regulation in the long term. Nearly all bank respondents are prioritising payments solutions in the next 12 months. They say DLT's features are most complementary to the processes involved in running a payments system. That use case is likely to offer the highest return to investment in the long run.

In the near term, there will be greater adoption of stablecoins, largely fiat-backed. This will be driven by Facebook's Libra, and projects such as Fnality and JPMorgan's stablecoin. Central bank digital currencies will be become a reality, with the PBoC set to be the first issuer later this year. Interoperability across blockchain platforms will improve. The differences between the major blockchain protocols remain significant, but there is an open dialogue for collaboration and research into how assets on different chains can co-exist. Last year saw the deployment of multi-cloud blockchain, which is likely to result in successful cross-blockchains pilots in the coming months.

Regulators will become more innovative in their approach to managing fintech innovations from new, small companies and incumbent financial institutions. They may, in a sense, start forming their own 'consortia'. There are some early-stage efforts to set common principles for cross-border convergence in financial innovation, including the GFIN.

Opportunity in trade finance

Most banks interviewed state that almost all options are open for the industry. They identify trade finance in particular as an area in which they expect blockchain to make significant strides within five years. As mentioned on page 6, DLT offers significant benefits of speed, transparency and the freeing up of capital.

Several notable use cases in which bank consortia have developed capabilities in this area include We.Trade, a blockchain-based platform that was developed in 2017 by nine banks (Deutsche Bank, HSBC, KBC, Natixis, Nordea, Rabobank, Santander, Société Générale and UniCredit) to simplify cross-border trades. A similar platform, Batavia, was developed from a proof of concept initiated by UBS and IBM in 2016, and brought onboard the Bank of Montreal, CaixaBank and Commerzbank as additional partners. We.Trade and Batavia were both built on the Hyperledger Fabric platform and merged their trade finance blockchain platforms in 2018. Other trade finance blockchain initiatives include Marco Polo and Voltron, which use R3 Corda's framework, and komgo, which is based on Quorum.

Yet problems persist in the trade finance application. One respondent notes that if they were to build a system, 'it would only work if [we were] on both sides of the international trade and both clients agreed to use it, which does not always work.' There are also issues of scale, with 'smaller third parties'

80

In 2018, the World Bank issued bond-i. This two-year blockchain bond was managed by the Commonwealth Bank of Australia, raising $80m in its first issuance.

warded off by the prospect of centralised, scaled international trade. As a result, trade finance is not as close a prospective application as cross-border payments, but one on which banks are working intensively.

Primary security issuance

Blockchain systems could facilitate the issuance of primary securities such as corporate bonds. Currently, issuance and payment of cashflows is largely tracked and performed on a manual basis. The immutable nature of blockchain transactions can help automate certain procedures in the bond life cycle via pre-determined smart contracts. For instance, issuance of bond proceeds can be done on a parametric basis, which is instantaneously activated once specific trigger conditions are met. In 2018, the World Bank issued bond-i, the first public bond created and managed via DLT. This two-year blockchain bond was managed by the Commonwealth Bank of Australia, raising $80m in its first issuance. There is likely to be similar issuance in the future.

Steady increase in asset tokenisation

Thanks to technology, there is now an ecosystem for regulated digital shares of any asset in any asset class to be issued and traded on the open market by an accredited individual or legal entity.

This tokenisation of securities will help banks significantly reduce global trade costs. A tokenised economy offers the potential for a more efficient system where frictions are removed in the creation, buying and selling of tokens. One bank finds that 'tokenisation could make the financial industry more accessible, cheaper, faster and easier, thereby possibly unlocking trillions of euros in currently illiquid assets, and vastly increasing the volumes of trades.'

In the coming years, traditional players will have the opportunity to meet the demands of a token economy by providing a platform for storing tokens, or assuming the role of a trusted intermediary if a decentralised solution is not enough. In the near term, there is a need for appropriate regulation, and for it to be aligned across jurisdictions.

In 2019, significant technological advances in the security tokenisation industry improved speed, security, transparency and the immutability of records. One respondent believes the industry may take time to mature, saying, 'Going to blockchain 10.0, you will see more token-based solutions, greater issuance of tokens and passing of tokens between different blockchains. However, I think we are a long way off from that.'

'Going to blockchain 10.0, you will see more token-based solutions, greater issuance of tokens and passing of tokens between different blockchains. However, I think we are a long way off from that.'

DLT will improve clearing and settlement

Banks see clearing and settlement as another important use case. A shared ledger could expedite the clearing and settlement of assets where large and complex multiparty transactions occur regularly. Stock exchanges and other financial institutions dealing in frequent, high-volume exchanges of securities and derivatives have experimented with blockchain platforms in their settlement process. In 2017, Goldman Sachs was granted a patent for SETLcoin, a transaction settlement system based on blockchain. The Nasdaq stock exchange successfully completed the first blockchain-based securities transaction platform via Linq in 2015.

According to one respondent, industry groups are taking 'precursor steps' towards 'continuous 24-hour settlement,' in other words, the establishment of a genuine 'global settlement day.' Current real-time gross settlement systems have limited operation hours. Continuous-Linked Settlement, a platform operating as an international multi-currency clearing system on a payment-versus-payment settlement mechanism, is limited by the fact that transactions can only occur in specific time windows, such as when two countries' central bank RTGS systems are running concurrently.

Using DLT would allow for continuous PvP and delivery-versus-payment settlement globally. However, respondents caution that this is still in the early stages, and that there are 'a whole series of policy issues on the back of' the idea of 24-hour settlement. 'This application of DLT would massively de-risk payment settlement', comments one bank, although it would probably create pressures in other places, such as liquidity management. This is one other area in which banks expect significant progress over the next five years, conditional on productive engagement with regulators and other policy-makers. One respondent elaborates on the systemic benefits of moving away from a 'regional settlement day' to a 'global settlement day'. 'Any of obligations I have, can actually settle across that 24-hour window… it helps us do payment v. payment and allows us to coordinate good delivery versus payment on a cross-border basis. This allows us to massively de-risk the system effectively'.

Know-Your-Customer and identity

Blockchain can bring greater transparency and efficiency in complying with KYC obligations. Verifying consumer identities is a ubiquitous requirement across financial service providers to prevent funding of criminal activities, anti-money laundering and illicit flows of funds. As it stands though, KYC checks across institutions and jurisdictions are burdened by effort duplication. The unique digital identity of each participant in a blockchain network can help streamline authentication processes across a shared KYC infrastructure. This can create opportunities for implementing tamper checks, proof of origination and designated acknowledgement in business-to-business processes.

Dominant institutions will lead blockchain production

Some respondents point to more specific trends in blockchain in the short to medium term. A technology provider expects that at national level, one or two strategically important financial

'The transition phase will take a long time, because the old world and new world will need to work in parallel for many years to come.'

institutions would drive significant blockchain production over the next two to three years. One bank respondent states that in the short term, use cases will be conditional on the bank's expertise and confines. Some corporates will create their own ecosystem, including moving money cross-border, bringing suppliers and buyers on to the chain. In the bank's view, this will be the fastest case for implementation. On the other hand, the bank says that 'consortia that have multiple parties including possibly regulators, customs or government officials, such as the letters of credit or certainly in the logistics industry, will take longer to gain momentum and traction'.

DLT will integrate with other technologies

One bank respondent says 'the challenge will be to link the DLT to other technologies like advanced analytics and data analytics. DLT is not the only technology that offers potential and so to derive the added value of DLT systems, it needs to work in a holistic manner.' At the same time, banks perceive that the disruption from DLT should not be overly drastic or rapid. The practicality and scalability of use cases will depend on linking new systems in some way to legacy infrastructures, databases and technologies as seamlessly as possible. A bank respondent shares, 'To transition from the current infrastructure towards a new level… we're doing double costs, because building this is not only building this [DLT] ecosystem one step at a time, one financial transaction at a time, one platform at a time, but also getting all the players on board and making sure that in the next five to 10 years, you will still need to work with the old system. Not everybody is going to be reachable via DLT.'

'This is a big investment and a leap of faith towards the future that in the end, all parties will take part in this, all banks, but also all end-users and clients. From that point of view, we're very much aware this transition phase will take a lot of time because you will need to work in parallel, the old world and the new world for many years to come.'

When institutions look to blockchain solutions, they view the technology as a component of the solution, and not the solution itself. DLT can be better leveraged in combination with other technologies, and the industry is looking at employing DLT solutions which can work jointly with the internet of things and artificial intelligence. A survey by Gartner, a US-based research company, found that 75% of organisations that are implementing IoT technologies have already implemented blockchain or plan to do so by the end of 2020.

Success will drive wider adoption

The success of one use case is likely to drive the adoption of others across industry. One respondent says that as more of the industry 'understand[s] what the core components are around consensus and mutability and what that single version of the truth enables or a golden ticket and how that golden ticket can then be used for other use cases, whether it's credit, regulatory reporting, cross-border payments or trade finance … then there are many additional services you can add to that.' Therefore, as adoption increases, the maturing technology can help solve challenges of cross-platform interoperability.

Technology considerations for future implementation

The progression of blockchain as a technology is an evolutionary process. Since 2008, there has been a significant jump in the number of features that blockchain can support, especially the introduction of complex smart contracts, the ability to scale and the possibility to integrate with other developing technologies. Blockchain's capacities will expand in the coming years, see Fig 2.1.

Banks and fintech firms are still addressing technological issues. Many blockchain and DLT experiments in their current state fall short in terms of scalability and transaction capacity. The complex, encryption-based and distributed nature of blockchain transactions can be lengthy to process vis-à-vis traditional payment systems, and therefore requires more advances in engineering and processing speeds. Vitalik Buterin, Ethereum's founder, has coined this challenge the 'scalability trilemma', in which only two of three attributes can be attained: decentralisation, security and scalability.

A core technological challenge for these users will be one of scalability. The resources to quickly and cheaply process information exchanges across an international network are lacking. While public blockchains like bitcoin have prioritised decentralisation and security over scalability – leading to low transaction capacities – appropriate enterprise grade blockchains for payments will need to perform similarly, if not better, than their incumbents. How various enterprise blockchain and DLT mitigate or overcome these trade-offs will be an important consideration influencing their wider adoption in the financial industry. One bank says their decision for blockchain adoption was 'business case driven, it was less so about the technology, as we look at the different outcomes it would provide the business for adopting that sort of technology.'

Still, businesses will be keen to improve scalability and speed without compromising on the inherent privacy provided by decentralised ledger keeping. Enterprise blockchain consortia must balance these two concerns. As one respondent notes, blockchain solutions need to 'prove that you can have a privacy solution which is on the one hand, bulletproof, so that other parties on the forum definitely can observe the effects of these transactions that other parties are doing, and that this does not have an impact on the performance on the scalability and speed.' Consortia working in financial services are likely to select scalability and security, foregoing some of the decentralisation in favour of having central nodes responsible for oversight to implement KYC and AML. Yet honing the best solution through which to achieve this is a work in progress, which one respondent dubs the 'holy grail.' One possible solution is zero-knowledge

Fig 2.1 Technology must demonstrate it can add value to current methods

The evolution of blockchain

2018

Blockchain 1.0 (Present, from 2008)

- Cryptocurrency
- Payments
- Remittance
- Private stock trading
- Simple smart contracts
- Digital certification

2020

Blockchain 2.0 (Next two years)

- Digital identity management
- T+2 – T+0 settlement
- Complex smart contracts
- Asset ownership
- IoT management
- Complex exchange management
- Electronic health record management
- Publicly issued digital currencies (CBDC)

2022

Blockchain 3.0 (Beyond)

- Complex, advanced financial instruments
- Decentralised management and governance (decentralised autonomous organisations)
- Liquidation of physical assets
- Cross-system integration (Working with other technologies such as AI and automated machinery)

Source: OMFIF analysis, CCBU

proof cryptography, which could address privacy and security concerns while allowing for verifiability of transactions.

Aside from implementation, another important issue is whether cost reductions from adopting blockchain technology can outweigh its operating costs. For instance, the energy cost required to power blockchain computations and the storage costs for nodes could be significant depending on the protocols and consensus mechanisms powering the platform. Eschewing computationally intensive processes such as mining and proof-of-work in favour of cost and energy-conscious protocols will be essential in scaling up blockchain and DLT to handle frequent, large-scale transactions.

As it stands, developing, implementing and maintaining a blockchain-based system will require a careful cost-benefit analysis of the advantages and trade-offs which a specific blockchain platform delivers to a well-defined use case. When selecting potential blockchain-related solutions, banks have several options, with both incumbents and new players developing new technological services that employ blockchain and DLT. Some, such as JP Morgan Chase and Goldman Sachs, are opting to develop in-house capabilities.

Resolving these trade-offs is an essential step towards genuine widespread adoption of DLT.

Regulatory and governance challenges remain

'We start by determining what we want to do, what our clients want, and whether the technology will help them. We are not set on the technology. We just try and find the best way to solve a specific problem.'

Regulatory approaches to blockchain in financial services are incomplete, and significant upgrades are required, both at global and domestic level. One technology provider says, 'Would the governance or network operator [of a DLT platform] be outsourced to a technology company, or would for example a structurally and strategically important institute such as an exchange, central securities depository or regulator operate the network? This has several ramifications from a business and political perspective.'

Respondents identify several concrete ways in which regulatory processes can become more efficient and conducive for productive innovation.

For one, banks suggest that regulatory sandboxes need to do a better job of 'productionalising' successful sandbox participants. As one respondent explains, firms in a sandbox tend to be ring-fenced and isolated, which makes it hard to transition elements of the sandbox out into a production environment. Some sandboxes do not necessarily have this final aim in mind – the goal of any participant is to get out of the sandbox and into the market, and regulators must make this easier and 'more fluid.' Clarifying pathways to production needs to be high on the regulatory improvement agenda.

This ties in to a second necessary, medium-term improvement, which is that once innovations are brought into production, it should be easier to move along to other parts of the value chain after entry. Innovators and bank consortia primarily use sandboxes as an entry point – once they identify a concrete case where blockchain can add value, they establish an ecosystem with critical mass to apply to this case. In the words of one respondent, the central challenge is to 'destroy that entry point' through value creation. Once that has been achieved, however, moving up the value chain into areas like servicing is difficult, and more should be done to make preparing for this transition part of a sandbox.

Developing global standards and achieving further clarity in key regulatory areas is also a much sought-after step. As one bank notes, the evolution of the industry is unclear and some clarity on regulations would help define the space. For example, with safekeeping of crypto-assets, the method for storing, controlling, and handling of private keys is an important question that would clarify the definition of digital custodial services.'

Consortia will have to consider important trade-offs to improve their functioning and appeal as a governance mechanism for enterprise DLT solutions. One of these has to do with the question of size. While large numbers of banks collaborating are essential to create a shared infrastructure network, there are downsides to large membership. In the early stages of blockchain and DLT development, the merits of membership must be weighed alongside the pace of collaboration and the balance of decision-making power. While consortium size is a necessary factor, excessively large membership at an early stage could prove cumbersome for implementation.

'Getting all parties together is important in the end stage [of blockchain implementation]. But you can only be successful and gain interest from all the different parts if you start with sufficient core coverage. So that is why you need to participate in a consortium, one that is not too big, and has the geographical scope.'

Maintaining interest and focus among consortium members – who are also natural competitors – is essential. Should projects seem less relevant or slow for their preferences, members may feel compelled to look elsewhere to newer consortia, bringing with them experience and information. For instance, Morgan Stanley, Santander, Goldman Sachs and JP Morgan have all left R3 to embark on different blockchain projects. One respondent acknowledges

this motivation: 'We still continue to monitor other initiatives because we don't want to be like a donkey or like a mule and looking only at the consortium that we chose'. Banks' interest in consortia is focused on their utility to drive fresh ideas and co-operation between members. One respondent states, 'If for example, we have new blockchain initiatives, then we can use the network [consortium] to create a nucleus for a new DLT project, or prototypes that we would like to develop'.

Use cases that are relatively simple to design and implement, and which are combined with already tested technological solutions such as cryptocurrencies, are likely to find early adoption (for example, adding a digital currency payment option for wallets and cross-border payments). Intra-organisational projects intended to reduce organisational complexity and reconcile multiple databases would be another possibility.

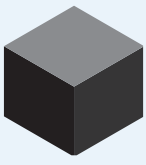
Financial services firms are extending this kind of collaboration to trusted counterparties to reduce costs through private blockchains. Truly disruptive blockchain solutions that depart from existing business practices carry high potential for future growth, but their heightened complexity and need for stakeholder collaboration (such as elaborate financial instruments and smart contracts) will probably delay their adoption. There remains considerable regulatory uncertainty around blockchain and DLT. As such, consortium-based approaches are likely to persist as a means for enterprises to overcome perceived 'first-mover' risks.

Activity-based regulatory approach

Blockchain and DLT are providing the impetus for a broad array of economic activities to shift from centralised to de-centralised market structures. However, while different applications might make use of similar underlying technologies, the precise regulation and legal risks that blockchain and DLT might encounter vary depending on the nature of the use cases. Some, such as anonymous blockchain platforms like Silk Road to sell illegal goods and services, fall into the unambiguous 'dark box' meriting strict regulation and oversight. Other use cases may not generate significant regulatory risks due to their uncontroversial nature where existing laws and regulations are sufficient and can be 'recycled'. However, many enterprise blockchain and DLT use cases fall in the middle of this regulatory risk continuum. This is salient in the case of regulations governing banking and financial activities. Although a swath of enhanced regulation to that effect has emerged since the 2008 financial crisis, blockchain and DLT-based financial services may not always meet existing standards. In general, the regulation often strives to conform to the widely accepted principle of 'same activity, same regulation', to limit the scope of regulatory arbitrage.

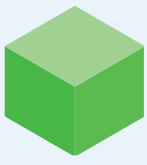
Fig 2.2 Contrasting regulatory approaches

Dark Box



Use cases are intended for illicit objectives that contravene established laws. Examples include the use of privacy focused cryptocurrencies like Zcash to buy goods on the dark web.

Recycle Box



Use cases are applied to uncontroversial goals to greatly increase their speed and transparency. Existing legal frameworks can be 'recycled' to accommodate these changes with minor adaptations. An example where a recycle box has been used is Ripple's interbank settlement system, the Ripple network.

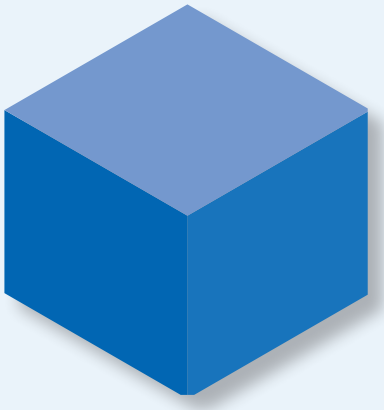
Sandbox

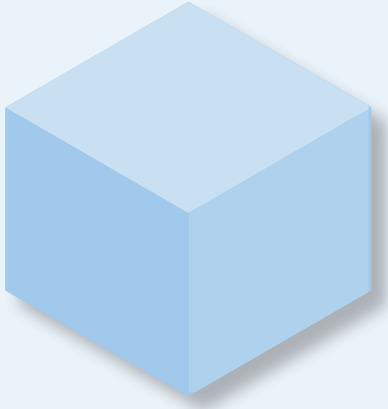
Use cases pursue permissible objectives, but also pose some risks. Existing regulatory regimes may not fully account for the unprecedented nature of use cases and must be reconfigured. One example is DACX, which facilitates cross-border transactions of multicurrency payments through the FCA's Global Financial Innovation Network.

Source: Maupin, OMFIF analysis

Conclusion

Blockchain offers the greatest promise for cross-border payments, in terms of return on investment, efficiency gains and the mitigation of pain points. That is the use case banks will prioritise in their blockchain strategies over the next five years. The following are considerations for large global banks as they look to employ DLT:





Building a business case

Prior to building a proof of concept or an implementation strategy, banks must consider the appropriateness of blockchain for their specific use case. Incumbents cannot afford a 'wait and see' approach delaying their decisions to invest in digital transformation. Three interrelated trends underlie the need for digital transformation: profitability, customer centricity and competition. These relate to the development of a sound business case before a bank considers overhauling or replacing its systems. Building a business case will garner greater internal support from within the institution.

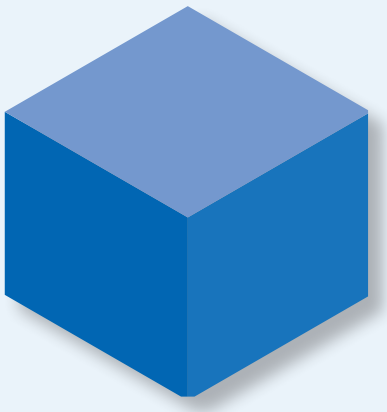
Joining a consortium

Most major banks focused on enterprise blockchain development are participating in consortia to follow the three tenets of ecosystem building, integration and industry advocation. Banks surveyed are mixed on the benefits of joining a consortium. A distributed ledger system would benefit from network effects, and a permissioned consortium could allow banks to better leverage this network utility for cross-border payments.

In practice, banks must consider their own specific objectives when joining a consortium and whether it is the optimal fit for them. A bank may use membership as an opportunity to learn and see how to approach the technology, and structure projects from a resourcing perspective. But as one bank respondent suggests, the core of the use cases in their respective consortium were European and UK focused, far from the bank's regional priority, meaning there was little opportunity to participate in many of the consortium's projects. In some circumstances, membership fees could be used to access different research portals or resource a bank's internal teams to develop their own expertise.

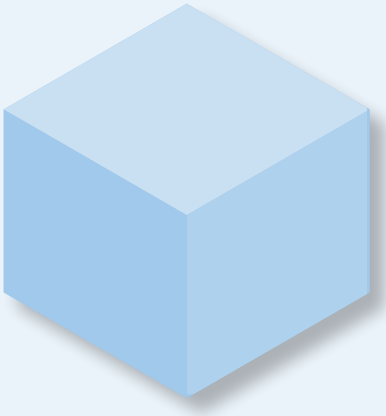
Appropriate underlying technology and implementation

There are frameworks and technical structures in place to help with decision-making on the blockchain technology, but bank respondents have differing views. The key set of criteria varies by the intended operation, the bank's structure and rules, and the regulations that these activities need to comply with. There seems to be no one-size-fits all solution. Arguably, the challenge remains for the bank and technology provider(s) to construct a convincing permissioned payments system that can be properly benchmarked, in terms of speed, scalability, security and resilience, against existing systems and meets high standards for security, robustness, efficiency and speed.



Growing the ecosystem requires ‘co-opetition’

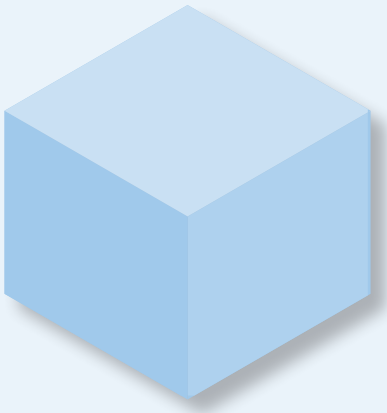
Consortia offer various benefits. Through its network effects, an ecosystem has a greater opportunity to grow and become more dominant in the long run. Therefore, the incentives are geared towards ‘co-opetition’ rather than competition. The growth in consortia and the wider blockchain ecosystem will create a wealth of opportunities for joiners and current members. Given the positive externalities of being part of a growing ecosystem, traditionally more competitive members are changing their behaviour within consortia and ecosystems.

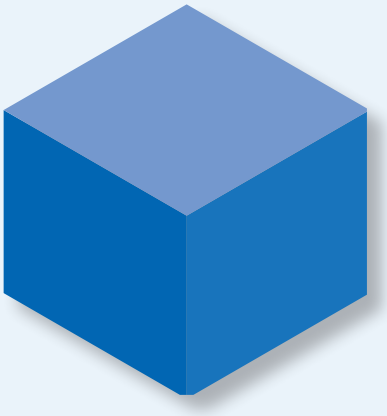


Meeting regulatory compliance

Banks and fintech firms should seek to understand each other’s capabilities and needs by attending industry forums and roundtables that bring traditional banks and fintech firms together. They should stay abreast of regulatory developments related to fintech firms and partnership arrangements, constantly looking for ways to enhance their services by partnering or possibly merging.

Regulatory divergence must be considered. Banks should take a prudent approach to regulation. Each jurisdiction has its own rules and regulatory regimes, which is why all bank respondents have adopted a ‘one-country, one policy’ approach. When implementing an intra or interbank payment network, the regulator in each member’s region or country must be consulted and provide approval.





Appendix

R3 Corda

Corda is a distributed ledger technology platform developed by enterprise software company R3. It was initially designed to meet the specific needs of the financial services industry; it has expanded its reach to include support for central banks in their digital currency and DLT endeavours. R3's framework includes more than 300 partners including financial institutions, software companies and systems integrators.

R3's successes include a first live securities-lending transaction on the Corda platform between Credit Suisse and ING in March 2018. The company continues to partner with a number of banks including Bank of America Merrill Lynch, Credit Suisse. Membership of the network has fluctuated over time – JPMorgan Chase, for instance, joined early but left the network in April 2017 to develop its own blockchain-based technology, Quorum.

How Corda is different:

- Only users with a legitimate interest can participate in the network which prevents unauthorised access to the database.
- Experience and well-known for managing complex financial situations and ease of integration with legacy systems.
- Uses notaries (centralised or distributed) in the network to address privacy concerns, eliminating the need for expensive consensus algorithms – which could affect speed and running cost.

Hyperledger

Hyperledger is an open source distributed ledger technology platform designed for enterprises. It uses a permissioned distributed ledger and is the first to allow smart contracts to be written in general programming languages like Java, Google go and Node JS. Therefore, no additional training is required for learning domain specific languages. The main difference between this and other platforms is the support of pluggable consensus, which allows it to be more efficient for a particular use case.

Started as a Linux Foundation project in 2016, it aims to create an open-source cross-industry standard platform for distributed ledgers. Hyperledger Fabric is an implementation of a distributed ledger platform for running smart contracts, leveraging familiar and proven technologies, with a modular architecture allowing pluggable implementations of various functions.

How Hyperledger Fabric is different:

- Privacy is achieved by encrypting the transactions which can be modified by only those authorised. This solves the problem with Ethereum which offers transparency irrespective of privacy.
- Built on the modular approach, it requires fewer levels of verification and therefore improves the performance of the entire software.
- Data partitions on the blockchain allow enterprises to protect highly sensitive data, by allowing access to the parties concerned.

Quorum

Developed by JP Morgan, it is the first step taken towards implementing blockchain in financial sector. This permissioned blockchain, which is specifically designed for financial use cases, is built off Go Ethereum. It aims to provide confidentiality of records, the main concern for financial institutions.

Quorum is an enterprise-focused version of Ethereum. Quorum is a private blockchain enterprise-ready distributed ledger and smart contract platform. It is well-suited to applications requiring high speed and high- throughput for the processing of private transactions within a permissioned group of known participants (for example, a group of investment banks).

Quorum allows participants to perform both private and public smart contracts, and so the ledger is differentiated into a private state and a public state database. All nodes can view the public states of the ledger, however only participating nodes can view private ledger states.

How Quorum is different:

- As a permissioned network, it offers complete data security and ease of accessibility.
- The speed of processing transactions is higher compared to Ethereum, the result of its simple consensus mechanism.
- Most of the updates in Ethereum can be easily integrated with Quorum as it is an extension of the Ethereum platform.

Blockchain cross-border solutions case studies

On 11 September 2019, R3 and Mastercard announced a partnership to build and pilot cross-border payments solution on Corda. Mastercard's objective is to develop a cross-border B2B payments solution by improving worldwide connectivity in account-to-account transactions. The first stage of the pilot focuses on connecting global faster payments infrastructures, including the different payment schemes and banks that use a clearing and settlement network operated by Mastercard. Mastercard's blockchain-based cross-border network will potentially expand as it has purchased Transfast, a global payments company.

The merits of this partnership lie in its combination of R3's expertise with Mastercard's payments system assets, brand and distribution. Mastercard says that through this consortium, it can provide innovative, value-added services for customers. It can also address issues such as high costs in processing transactions, liquidity management and the lack of standardisation and technical processes between banks and domestic clearing systems.

Wells Fargo's settlement coin

On 17 September 2019, Wells Fargo & Company announced their plan to pilot an internal settlement service, Wells Fargo Digital Cash. The pilot will use a tokenised dollar to settle internal cross-border payments across its global network, including the ability of its international locations to move funds between each other. The bank says technology can meet growing demands to reduce friction in traditional cross-border payments.

Corda underpins the network. It will allow Wells Fargo to move money in near real-time and without impacting the underlying account, transaction postings or reconcilement infrastructure. The bank believes that thanks to Wells Fargo Digital Cash, it could remove barriers to real-time financial interactions across multiple accounts in marketplaces around the world.

Incumbents innovate

Although blockchain has rapidly emerged as a solution for the shortcomings in the global payments infrastructure, this has also prompted responses from major incumbents in the payments industry. Rather than compete with technologies that require complete and costly overhauls of front-to-back office infrastructure, organisations could take a middle ground, instead revising their existing technological systems and business processes to keep pace with the disruptive potential of blockchain. For instance, since 2015,

Swift has enhanced its traditional messaging system through the global payment innovation programme. This uses alternative technologies and processes to blockchain and DLT to accomplish similar objectives. While receptive to its potential to enrich their efforts, Swift has stated its belief that blockchain and DLT is 'not yet mature enough' for practical, large-scale usage for cross-border payments.

Keeping the overall structural features of the nostro-vostro banking model intact, Swift gpi instead uses new technologies and procedures to reduce friction and promote collaboration and transparency among member institutions. The technologies underpinning Swift gpi are cloud-based computing and APIs that enable the real-time tracking of payments, giving end-to-end visibility for transactions to institutions and clients. These services are underpinned by new service level agreements that financial institutions which have signed up to Swift gpi mutually agree upon. One of the requirements in the gpi SLA is that payments are to be processed on the same day, thus leading to radically shorter transaction and settlement times.

As of 2019, Swift has stated that more than $300bn is exchanged daily over Swift gpi with more than 50% of payments credited to end beneficiaries within 30 minutes, 75% within six hours and nearly 100% of payments within 24 hours. Three sub-systems facilitate these improvements: an end-to-end payments tracking system (gpi Tracker), a data monitor of banks adherence to the SLA rules (gpi Observer) and a complete list of all gpi members and their details (gpi Directory).

Swift bank-to-bank transfers

In March 2018, Swift reported a successful pilot with IBM's hyperledger to help with nostro account reconciliation. The cross-border payments solution test was in conjunction with more than 50 global banks, including BNP Paribas, BNY Mellon, and JPMorgan Chase.

PoC results showed that DLT could provide the functions needed for Nostro account reconciliation, including 'real-time event handling, transaction status updates, full audit trails, visibility of expected and available balances, real-time simplified account entries confirmation, the identification of pending entries and potential related issues, and [...] the data required to support regulatory reporting.'

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On December 17th 2018, China Construction Bank announced the establishment of CCB University ("CCBU"), a corporate university that fosters new finance and new ecosystem for a new era. The mission of CCB University is to serve the society by providing financial solutions, serve corporate strategy by promoting steady and innovative development, and serve employees by improving their professional capabilities. Following a philosophy that features specialization, sharing, technology and internationalization, CCB University strives to facilitate industry-education integration, keep empowering the society and has become a new platform to explore the method for cultivating new financial talents and the development model of modern vocational education.

At present, CCB University has 10 regional campuses, 10 specialized campuses and 37 provincial-level campuses led by CCB tier-one branches. CCBU New York Academy is one of three CCBU's overseas regional campuses located in New York, London and Hong Kong.