

# Distributed Ledger Technology in the Capital Markets

Game Changers – Future trends  
in Securities Services





# Contents

Executive summary	3
<hr/>	
Introduction	4
<hr/>	
Key areas of debate	5
1. <b>What, why and how?     A snapshot of DLT today</b>	6
2. <b>What are the most compelling use cases for     DLT in the capital markets?</b>	7
3. <b>What key developments have shaped DLT     over the past 2-3 years?</b>	9
4. <b>What are the most important success     factors for DLT?</b>	10
5. <b>How will DLT evolve over     the next 2-3 years?</b>	11
6. <b>How might DLT reshape capital markets –     and how can participants respond?</b>	13
<hr/>	
Conclusion	14

# Executive summary

Following several years of development, applications for Distributed Ledger Technology (DLT) in capital markets are multiplying fast and moving rapidly towards implementation.

It is becoming apparent that DLT not only has the potential to reduce costs and risks in the investment industry: in time it could re-order existing value chains, ushering in profound changes to capital market processes and structures.

This paper aims to take a pragmatic look at the future evolution of DLT, identifying realistic possibilities – and likely obstacles. It reviews six key areas of debate and, in brief, concludes that:

- ◆ DLT represents a varied, adaptive group of consensus-based technologies with unique features and benefits. It is ideally suited to performing a range of capital markets functions.
- ◆ Practical uses for DLT are multiplying. The post-trade space presents great opportunities, but is only one of many potential applications. In time, DLT could even facilitate trading.
- ◆ A huge range of organisations are debating and investing in DLT. Private ledgers hosted by specialists or consortia are capturing the bulk of capital, but other investment models remain in play.
- ◆ Adoption holds the key to DLT's ability to achieve financial benefits and operational improvements in capital markets. Continuing momentum will depend on a number of critical success factors.
- ◆ The next few years will see development accelerate, with commercial imperatives helping to overcome potential obstacles. Engagement and a range of partners will become ever more vital.
- ◆ DLT will begin to redistribute value between market participants within 2-3 years. That will pose a growing challenge for many organisations, and means that active engagement with DLT is essential.

To reach its potential, DLT still needs to overcome significant barriers. Progress will be gradual and there will be setbacks. Nonetheless, we believe DLT is at a tipping point. It is an increasingly viable tool and, from here on, will be largely judged against commercial criteria. As adoption of DLT grows, it will change the shape of technology spending – not only by attracting investment, but by encouraging collaboration and in the process, it will exert growing influence over the way that markets function.

At a minimum, every firm in every sector of the capital markets should keep a close eye on the evolution of DLT. In many cases, a more active stance will be justified. For those that want a stake in the development of DLT, now is the time to get involved.

# Introduction

Welcome to the latest paper in our **Game Changers** series, looking at the impact of technology on the investment industry.

Following our last paper on Artificial Intelligence we now turn to a different and maturing theme: Distributed Ledger Technology (DLT).

DLT is an entirely new way to construct highly secure, highly capable and widely distributed databases. Because development often calls for extensive co-operation, it can be relatively slow to implement. But the ability of DLT to provide new kinds of connections could create an alternative to existing frameworks, ushering in transformative change.

After several years of effort, proofs of concept are rapidly evolving into customer facing platforms and DLT is moving closer to achieving implementation at scale.

This paper aims to provide a capital markets focused snapshot of DLT and its implications. In six key areas of debate it recaps the rationale for DLT; considers its most appealing applications; reviews its evolution to date; identifies critical success factors; makes predictions for the future; and assesses how it could reshape the capital markets industry.

We hope this paper will provide clients and other readers with food for thought, helping them to gauge the implications of DLT – and their own responses.

**Stephen Bayly,**

CTO, HSBC Securities Services



# Key areas of debate



# 1. What, why and how? A snapshot of DLT today

Distributed Ledger Technology (DLT) can achieve simultaneous consensus across a database that is distributed to multiple users. DLT has advanced and branched quickly in recent years, moving far beyond its infancy – the blockchain that supports Bitcoin. Within the capital markets the DLT category now includes many variations, most of which have little or no connection with cryptocurrencies.

Non-specialists do not need to master every nuance of DLT. But to grasp its ability to perform a wide range of capital markets functions, we believe they should understand four key points.

First, distributed ledgers are not always preferable to centralised singular databases, but they do offer a range of significant benefits. The most important are:

- ◆ **Consensus** – DLT establishes a ‘single version of the truth’ shared by all users, however diverse;
- ◆ **Efficiency** – DLT reduces the number, duration and complexity of reconciliations, manual interventions and other data processing steps;
- ◆ **Resilience** – DLT avoids reliance on centralised infrastructure and guards against corruption;
- ◆ **Trust** – DLT commands trust independent of an individual users’ reputations.

Second, DLT is itself a combination of technologies. Many – such as peer-to-peer networking, distributed consensus algorithms and cryptography – are far from new. These can be combined in a mix of ways proprietary and open sourced, to create specific capabilities.

Third, like any database, every distributed ledger requires several complementary elements. At a minimum, these include:

- ◆ **Infrastructure** – the processing power and storage;
- ◆ **Protocols** – the rules that achieve consensus and security;
- ◆ **Services** – the functions or applications;
- ◆ **Interfaces** – the mechanisms, such as APIs<sup>1</sup>, that allow interaction with other technologies.

Fourth, variations in DLT design can have a material effect on its commercial applicability. We see three factors as being especially important.

- ◆ **Access to the ledger**  
‘Public’ or wholly decentralised ledgers require high innate security. This is often achieved by using cryptography to record transactions in an immutable chain. In contrast, ‘private’ or ‘permissioned’ ledgers are restricted to a defined user group. This lessens the need for encryption, increases processing capacity and provides centralised oversight and accountability.
- ◆ **Use of tokens**  
Public ledgers need to compensate users for the processing power that maintains accuracy. This is achieved by issuing ‘protocol tokens’ – better known as cryptocurrencies. Private ledgers don’t require this economic mechanism, so can operate without tokens. However, some private ledgers use tokens to carry messages or to represent ‘off-chain’ assets (see Key Debate 2).
- ◆ **Other technology within the ledger**  
DLT can incorporate a range of additional capabilities. Most notably, smart contracts enable ledgers to update themselves automatically using pre-defined logic in response to dates and times, transactions or other information.

## In summary

DLT represents a combination of technologies and offers unique benefits in terms of consensus, efficiency and security. The DLT umbrella now includes a wide variety of approaches and structures. Many are ideally suited to performing a range of connective functions within the capital markets.

<sup>1</sup> Application Programming Interfaces – see <https://www.gbm.hsbc.com/insights/securities-services/apis-joining-the-dots>

## 2. What are the most compelling use cases for DLT in the capital markets?

DLT's ability to establish a 'single version of the truth' allows it to cut across corporate boundaries and existing market structures. One of the most obvious applications for DLT is as a single asset register for an asset manager or broker-dealer. This 'golden source' would eliminate internal reconciliations, enhance capital efficiency and give clients or regulators controlled access to real-time data.

Extending this logic across multiple market participants opens up vast potential benefits in the post-trade arena. For exchange traded assets this scope is illustrated by the ASX's decision to move its cash equities clearing and settlement onto Digital Asset's proprietary ledger by 2021<sup>2</sup>.

Even more ambitiously, mutually-operated ledgers could transform clearing, settlement and reporting for OTC securities and derivatives markets. That is the aim of Corda, an adaptable DLT platform created by the R3 consortium, of which HSBC was an early member<sup>3</sup>. As well as transforming operational efficiency, such a ledger would release huge amounts of capital by reducing settlement periods and giving users a single view of the location and eligibility of collateral assets. It would need to be able to support fiat currencies - a possibility being investigated by central banks including the Bank of Japan, the Bank of Canada, the Bank of England and the Monetary Authority of Singapore.

In theory, tokenisation – using tokens to represent legal title of financial assets – could enable DLT to act as a trading venue, not just a settlement venue. To encourage FinTechs with new services France is one country that now allows the use of DLT to trade unlisted securities<sup>4</sup>. On-ledger trade execution would further reduce operational and capital costs. Trading on a distributed ledger could also generate liquidity by connecting more issuers and investors. And the divisibility of tokens could allow fractional ownership of securities, funds or property.

Away from securities, some other compelling applications for DLT in the capital markets include:

- ◆ **Payments** – DLT can streamline end-to-end value transfers, reducing costs, operational risks and settlement periods. For example, Ripple's XRP ledger provides real-time cross-border settlements, using tokens that represent central bank currencies<sup>5</sup>. In foreign exchange, HSBC's FX Everywhere tool processed more than 3m inter-company FX transactions worth \$250bn in its first year<sup>6</sup>.
- ◆ **Bank finance** – Syndicating lending, trade finance and other forms of bank finance still rely on paper documents and manual processes. DLT could transform this by providing a shared record of shipments, ownership, financing and insurance. The we.trade platform, built by 20 European banks including HSBC and hosted on IBM's Blockchain, conducted its first open account trades in July 2018<sup>7</sup>.
- ◆ **Fund administration** – A distributed ledger recording the creation, redemption and transfer of fund units would eliminate many of the current complexities of fund administration. It could unify cross-border sales, processing and transfer agency. Calastone<sup>8</sup> and Fundsquare<sup>9</sup>, two large platform providers, are both developing new 'distributed market infrastructures' based on blockchain.
- ◆ **Customer identification** – An industry-wide distributed ledger could host a shared record of beneficial owners. Such a utility would give appropriate, permissioned access to market participants allowing immediate KYC and AML checks, assisting with client on-boarding and enhancing tax reporting.

<sup>2</sup> <https://www.asx.com.au/services/chess-replacement.htm>

<sup>3</sup> <https://www.r3.com/>

<sup>4</sup> <https://uk.reuters.com/article/us-france-finance/france-to-allow-blockchain-for-trading-unlisted-securities-idUKKBN1E220A>

<sup>5</sup> <https://ripple.com/>

<sup>6</sup> Financial Times, 'HSBC banks on blockchain to finesse forex trades', 14.01.19

<sup>7</sup> <https://we-trade.com/>

<sup>8</sup> Financial Times, 'Blockchain could save asset managers \$2.7bn a year', 22.02.18

<sup>9</sup> <https://www.fundsdlr.net/>

This list is just a snapshot of use cases under development or already in use. As DLT adapts and evolves, interoperability between ledgers will lead to the creation of hybrid services and other applications. Just as digitisation has transformed many industries, DLT will re-order processes, relationships and functions in the investment value chain. Ultimately, it has the potential to create more direct capital markets.

**In summary**

DLT can deliver many potentially transformative applications in the capital markets. In our view, the post-trade arena offers the most compelling opportunities. DLT could also reshape practice in other areas of the markets, especially as interoperability between ledgers starts to take shape.



### 3. What key developments have shaped DLT over the past 2-3 years?

DLT-driven proofs of concept have captured many headlines over the past few years. Some high profile examples from 2018 include:

- ◆ HSBC completing a commercially viable trade finance transaction – a shipment of soya beans<sup>10</sup>;
- ◆ Project Jasper, a Canadian public-private consortium, demonstrating instantaneous securities clearing and settlement<sup>11</sup>;
- ◆ Santander launching a cross-border payment app for customers<sup>12</sup>; and
- ◆ The Bank of Canada, Bank of England and Monetary Authority of Singapore assessing the use of DLT for cross-border settlements, a project supported by a group of financial institutions led by HSBC<sup>13</sup>.

But these are just a few examples in a diverse and highly adaptive field. What are the underlying trends shaping DLT in the capital markets? We see the following as among the most important themes.

#### Growing investment

FinTechs, venture capitalists and specialist consultancies were among the first commercial investors in DLT. They were followed by banks, broker-dealers, exchanges and clearing houses. More recently, large asset managers such as Schroders have joined major DLT projects now<sup>14</sup>. It is hard to separate global levels of investment in DLT from cryptocurrency-related spending, but a recent study quantified annual DLT spending in financial services at over \$1bn in 2017, with an estimated annual figure of \$1.7bn going forward<sup>15</sup>. The fact that such a wide range of firms are now investing in DLT is perhaps the clearest sign of its potential impact on the capital markets.

#### Preference for privacy

Permissioned ledgers now attract the bulk of investment from established capital markets firms. These allow a known group to transact with each other, and can grant visibility to stakeholders such as clients, regulators or analytics providers. And since they typically permit faster and higher volume processing than encrypted public ledgers, they are better suited to capital markets functions. Private ledgers can be proprietary or controlled in partnership (see below).

#### Ownership and governance

The past few years have seen three core models of ledger ownership emerge.

- ◆ **Proprietary** – hosting a distributed ledger within a single corporate framework. This includes owner-users such as banks, and DLT vendors such as Digital Asset. Proprietary ledgers are relatively straightforward to develop and use. Set against that, wholly in-house ledgers can deliver limited benefits from decentralisation but risk becoming a costly solution to needs that can be met by conventional technology.
- ◆ **Partnership** – Distributed ledgers controlled by a consortium of partner organisations – such as R3 or Hyperledger – offer a range of potential benefits. These include the sharing of costs and risks; the pooling of expertise; the potential for widespread adoption; and the scope to transform processes across the value chain. However, they can also pose development challenges (see Key Debate 4).
- ◆ **Public** – As mentioned, most capital market applications for DLT are based on private ledgers. But some developers see potential in launching ‘decentralised applications’ on public ledgers. For instance the Ethereum Enterprise Alliance<sup>16</sup>, which aims to connect established businesses with smaller Ethereum specialists, includes a number of large financial institutions.

#### In summary

Growing investment from a range of actors is pushing a range of applications into the market and provoking discussion about the potential of DLT. Private ledgers – whether developed by specialists or via DLT partnerships – are dominant but other models remain in use, especially among small developers.

<sup>10</sup> Financial Times, ‘HSBC claims first trade-finance deal with blockchain’, 13.05.18

<sup>11</sup> <https://www.bankofcanada.ca/research/digital-currencies-and-fintech/fintech-experiments-and-projects/>

<sup>12</sup> Financial Times, ‘Ripple and Swift slug it out over cross-border payments’ 06.06.18

<sup>13</sup> <http://www.mas.gov.sg/News-and-Publications/Media-Releases/2018/Assessment-on-emerging-opportunities-for-digital-transformation-in-cross-border-payments.aspx>

<sup>14</sup> <https://www.hyperledger.org/announcements/2017/05/22/hyperledger-welcomes-8-new-members-ahead-of-consensus-2017>

<sup>15</sup> <https://www.greenwich.com/equities/blockchain-adoption-capital-markets-2018>

<sup>16</sup> <https://entethalliance.org/members-2/>

## 4. What are the most important success factors for DLT?

The ultimate measure of success for DLT lies in its ability to realise efficiencies and enhance or transform existing capital markets mechanisms. Like any connective innovation – from shipping containers to social media – that success will depend on levels of adoption and the agreement to standards. The more users a DL has, the greater its value, the more new users it attracts and so on (the network effect). In our view, the most important drivers of initial and continuing adoption are:

- ◆ **Commercial value** – We see this is a function of an application’s ability to create new connections and its ability to deliver tangible improvements in efficiency, risk or revenues (see Key Debate 5).
- ◆ **Legacy systems** – Weaknesses in existing technology with high replacement costs can encourage bolder thinking and generate support for DLT<sup>17</sup>. The ASX’s decision to substitute its existing equities platform with DLT is a case in point – helped by its ability to mandate change to users.
- ◆ **Flexibility and interoperability** – Retaining flexibility is vital to achieving lasting success. That includes the ability to build scale without increasing complexity; to incorporate future innovations; and to enhance interoperability with other ledgers and platforms.
- ◆ **Overcoming resistance** – Adoption is not just about technical merits. Cultural factors and adaptability are also crucial to firms’ ability to grasp the upside of DLT. At a minimum, creativity and innovation are vital to identifying and developing new applications, while flexibility and openness are key to successful co-operation. Talented teams and committed leadership are also required.
- ◆ **Economic alignment** – The economic costs and benefits of developing and using a distributed ledger need to be shared appropriately. For example, a ledger capable of accelerating securities clearing and settlement is unlikely to succeed if users feel that a core group is capturing all the resulting value.
- ◆ **Balancing convenience with security** – The protocols of every ledger and application need to strike a balance that meets the needs of different users. In each case there is a trade-off to be made between interoperability and performance on one hand, and security on the other.

These success factors illustrate a core paradox of DLT development. On one hand, the importance of early user adoption means that a large group of partners has the best chance of developing applications at scale. Set against that, agreeing protocols and standards becomes harder as consortia grow larger.

### In summary

The ultimate measure of success for DLT will not be technological, but commercial. Widespread adoption depends on achieving continuing, valuable improvements to existing processes. We see cost savings, risk reduction, interoperability, the status of existing platforms and culture as some of the key drivers for success.

<sup>17</sup> <https://www.asx.com.au/services/chess-replacement.htm>

## 5. How will DLT evolve over the next 2-3 years?

Based on developments to date and the critical success factors outlined above, we expect the evolution of DLT in the capital markets to accelerate over the next few years. The most important driver will be developers' strengthening focus on delivering commercial benefits. This will become easier as adoption grows and DLT provides:

- ◆ **Cost savings** – By streamlining processing and eliminating intermediate steps, DLT should deliver significant savings across the operations, technology and finance operations of buy side and sell side firms alike. Shorter settlement times and more efficient use of collateral could also reduce capital costs, especially on the sell side. The potential annual savings have been estimated in the billions of dollars<sup>18</sup>. For individual firms, a tiny fraction of such gains would be extremely valuable.
- ◆ **Risk reductions** – Simplifying capital markets processes should not only eliminate costs, but achieve material reductions in risk. At the institutional level, the unique features of DLT can lower credit risk, settlement risk, operational risk and cyber risk. Distributed ledgers could also reduce systemic risks during periods of market disruption.
- ◆ **Revenue opportunities** – DLT offers relatively few direct revenue opportunities in the short term. But in the long term its potential to facilitate tokenisation and create liquidity could encourage the emergence of new investment strategies and income streams.

Set against these positive drivers, the evolution of DLT is also likely to face a number of obstacles over the next few years. These include:

- ◆ Insufficient skills and knowledge for firms to develop, operate and oversee DLT effectively;
- ◆ Excessive hype over the potential of DLT, and its potential to trigger wasteful investment;
- ◆ The difficulty of establishing common standards and interoperability;
- ◆ Unsuitable applications for DLT – fixing what isn't broken, or failing to identify optimal use cases; and
- ◆ The challenges of taking the 'quantum leap' from trials and testing to real-world implementation.



However, these factors need not be viewed in a completely negative light. For example, the industry should expect growing regulatory attention on DLT, and it remains unclear how supervisors might apply existing regimes such as MiFID II, EMIR or GDPR to the technology. But the fact that regulators and central banks in markets including Australia, France, Hong Kong, Japan, Singapore and the UK are studying DLT and allowing trials to take place could act as a spur for further private sector investment.

The need to overcome potential obstacles will also encourage greater collaboration and partnership over the next few years. At the firm level, organisations seeking to develop DLT capabilities will work with a range of partners including technology vendors, DLT specialists, service providers – and each other. The three dominant investment approaches will be:

- ◆ **Build** – develop a new ledger with help from specialist DLT providers or FinTechs.
- ◆ **Buy** – use a proprietary ledger operated by an external vendor such as DAH, R3 or IBM to build or launch applications.
- ◆ **Partner** – join a development consortium such as R3 or Hyperledger.

At the industry level, partnering with academic and industry bodies or participating in cross-industry forums such as the Post-Trade Distributed Ledger Working Group<sup>19</sup> could provide a valuable catalyst for co-operation.

#### In summary

We believe the next few years will see DLT developments accelerate. As adoption grows, more firms will view it as a mainstream commercial proposition instead of a technical curiosity. Engagement with regulators, developers and other partners will become ever more important to overcoming potential obstacles.

<sup>18</sup> <https://www.finextra.com/newsarticle/28955/blockchain-tech-could-save-cash-equities-market-6bn-a-year---goldman-sachs>

<sup>19</sup> <http://www.ptdlgroup.org/>



## 6. How might DLT reshape capital markets – and how can participants respond?

So far, we have focused on tangible applications for DLT that are already gaining traction in the capital markets. Within two to three years we expect these applications to begin circumventing existing processes and structures, with the possibility of re-arranging the investment value chain. In the process, they could start to redistribute value between participants.

Looking further ahead, we expect DLT to achieve adoption at scale in the capital markets within five years, and to be running alongside and even replacing core market infrastructure within ten. For now, a theoretical scenario of totally decentralised global markets is harder to foresee.

Whether or not these predictions are proved accurate, DLT's ability to create highly capable connective networks seems certain to have a fundamental impact on the capital markets. As adoption grows, DLT will affect:

- ◆ How data is stored and shared;
- ◆ How transactions are recorded;
- ◆ How ownership is represented; and
- ◆ How trust is established.

In the process, DLT will force the organisations that make up today's investment industry to question their role in the value chain. That in turn could force asset managers, broker dealers, banks, service providers, exchanges and clearing houses to change strategies, structures and operating models.

We can't yet predict the extent of those changes, but it seems clear that organisations involved in DLT development will have more influence over the process than their less enthusiastic counterparts. So in our view, it is unwise for any institution to totally ignore the evolution of DLT. A completely passive approach carries the risk that firms will become 'product takers'.

Of course, not every organisation has the resources to take an active role in developing DLT. But, depending on their appetite for innovation and investment, we believe that most firms should consider taking some of the following actions:

- ◆ Understanding DLT and actively monitoring its development.
- ◆ Joining or contributing to industry-wide working groups and forums.
- ◆ Identifying potential value-adding applications for DLT within the business.
- ◆ Engaging with potential DLT vendors, service providers or specialist suppliers.
- ◆ Advocating specific desired outcomes to external vendors or partners.
- ◆ Developing internal working groups, innovation labs or centres of excellence to test DLT.
- ◆ Becoming actively involved in development, perhaps by joining an existing DLT consortium.

Ultimately, the rationale for DLT in the capital markets is not to replicate existing processes; it's to improve upon or replace them. It's up to individual organisations to ensure that they can make an active contribution to this process.

### In summary

We expect DLT to begin restructuring capital markets value chains within the next two to three years. That will pose fundamental questions for the roles of existing incumbents. A considered, engaged strategy is essential for firms hoping to shape DLT, rather than be shaped by it.

# Conclusion

The capital markets exist to provide connections between the providers and users of finance. At a minimum, DLT has the potential to make those connections faster, cheaper and more reliable – improvements that will benefit every firm, not to mention investors and issuers.

But efficiency is only the beginning. DLT could have a more far-reaching impact by changing today's processes entirely. In time we believe it could restructure value chains, bringing the providers and users of capital closer together. The result – more direct capital markets – would deliver huge benefits to the wider economy. This potential could be accelerated by the shift of economic power from West to East, where innovative changes to infrastructure may be easier to achieve.

Of course, DLT is not going to replace current capital markets platforms overnight. Many practical hurdles to widespread adoption still remain to be overcome, as significant and healthy scepticism persists – a natural response to DLT's technical complexities.

Even so, we expect the next two years to see more and more organisations derive growing benefits from a range of DLT applications. DLT will become an increasingly viable option in many firms' technology toolkits. As adoption grows, more and more organisations will begin judging DLT on its commercial merits, rather than as a theoretical concept.

In our view, every investment firm should take an active interest in DLT, even if they don't wish – for now – to take an active role in development. That will enable them to monitor developments, identify opportunities and avoid being caught out by DLT's potential to redistribute economic value.

A good understanding of DLT will also allow firms to appreciate the importance of collaboration to many of DLT's most compelling applications. The need for collective efforts – and the appeal of collective benefits – could bring about a significant change in patterns of infrastructure investment. Instead of 'winner takes all', 'winning takes all' might become the new paradigm.

In short, DLT provides a unique opportunity to enhance and reorder the infrastructure of capital markets. It may be unfamiliar, but that shouldn't prevent firms from taking advantage of its potential on behalf of their clients. Institutions of all types and sizes should act now to give themselves a stake in the future of DLT.

