



**Financial Market Infrastructures and Distributed Ledger
Technology**

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Executive summary

Financial Market Infrastructures (FMIs) across developed and emerging markets, and along various parts of the value chain are actively investigating the opportunities distributed ledger technology (DLT) presents. In most cases FMIs are focusing on applications which aim to create process efficiencies and cost savings, though some are also pursuing new service lines and revenue opportunities. Given the relatively nascent state of the technology – particularly as applied to capital markets – FMIs are uncertain about the extent to which the technology will live up to its promise. They also highlighted several risks that need to be addressed such as risks of maintaining security standards across a decentralised database, legal and regulatory uncertainty, and concerns around scalability. At this point, FMIs favour collaborative engagement with regulators as the technology and its applicability to the capital markets industry evolves.

Introduction

In July 2016, the World Federation of Exchanges (WFE)¹, in conjunction with the Affiliate Members Consultative Committee (AMCC) of the International Organisation of Securities Committees (IOSCO), surveyed exchanges and post-trade infrastructures (collectively, Financial Market Infrastructures) regarding their use of and perspectives on DLTs including blockchain. The survey questionnaire was developed in collaboration with IOSCO's Committee on Emerging Risk with the survey results also feeding into broader IOSCO research into financial technologies and their application in capital markets.²

Survey overview

The information contained in this report is based on responses from 24 FMIs (a combination of exchanges, central counterparties and central securities depositories) and where applicable, additional perspectives that emerged from an interview with another exchange.³ This report does not presume to represent the views of the entire industry or membership, but as the respondents include some of the more significant early-movers in the DLT capital markets space, we believe that there are certain themes and recommendations that are noteworthy.

We set out the remainder of this report as follows:

- DLT state of play and focus areas;
- Legal and regulatory perspectives;
- Risks, opportunities and visions of a post-DLT world.

We do not attribute views to specific respondents but the full list of respondents is set out in the Annex.

¹ The WFE is the leading global trade association for FMIs whose membership spans the full continuum of FMIs across asset class and size.

² This IOSCO report is due to be published towards the end of 2016

³ For the remainder of this report, the term 'respondent/s' and 'survey' includes all survey respondents as well as the interviewed exchange.

Summary of survey results

DLT state of play and focus areas

The overwhelming majority of FMI (21/25 respondents) indicated they were either investigating the applicability of DLT to their environment or actively pursuing DLT initiatives (to the point in one instance of already having deployed a DLT-based application). This is attributable to the fact that FMIs who were not engaged at all with DLT were less likely to respond to the survey. Perhaps more interestingly, of this set of positive respondents, seven replied they had gone as far as to allocate budget to their DLT initiatives. A further 13 FMIs who had not allocated budget as yet, said that they expected to do so in future.

In addition to working independently on their own initiatives, some respondents are also participating in various industry groups, specifically the Linux Foundation Hyperledger Project and the Post-Trade Distributed Ledger Group. The Hyperledger Project is a cross-industry initiative dedicated to creating a standardised DLT backbone, and its membership spans representatives from the financial industry to consultancies to technology firms (amongst others). The Post-Trade Distributed Ledger Group, consisting of banks and FMIs, is focused on understanding and agreeing common industry standards and regulatory policy as it relates to the post-trade environment. This level of industry cooperation suggests at least some participants believe that in order to realise the full benefits of DLT, certain core, standardised infrastructure (“public goods”) needs to be in place. How this standardisation will occur is however a different question with at least one FMI suggesting while standards were desirable, they would emerge through competition rather than upfront collaboration.

Hyperledger Project: (<https://www.hyperledger.org/>)

The mission of HLP is to:

- create an enterprise grade, open source distributed ledger framework and code base, upon which users can build and run robust, industry-specific applications, platforms and hardware systems to support business transactions;
- create an open source, technical community to benefit the ecosystem of HLP solution providers and users, focused on blockchain and shared ledger use cases that will work across a variety of industry solutions;
- promote participation of leading members of the ecosystem, including developers, service and solution providers and end users; and
- host the infrastructure for HLP, establishing a neutral home for community infrastructure, meetings, events and collaborative discussions, and providing structure around the business and technical governance of HLP.

Post-Trade Distributed Ledger Group (<http://www.ptdlgroup.org>)

The PTDL Group is a group of nearly 40 financial institutions and prominent market infrastructures players from all regions of the globe whose shared vision of the use of distributed ledger technology has brought them together.

The PTDL Group provides a trusted environment for key post-trade participants to collaborate and share information. The PTDL will undertake activities relating to how distributed ledger technologies will transform the post-trade landscape.

The PTDL connects practitioners, regulators and central banks on a global scale to identify and drive forward activities, and position specific recommendations that may leverage distributed ledger technologies' for the benefit of the post trade industry.

The PTDL will explore and identify regulatory and legal themes, and research and identify impacts and associated benefits for the wider industry, from the new distributed ledger technologies on the post-trade space.

Given the relatively nascent state of DLT development and the highly regulated nature of the core existing business they conduct, respondent FMIs are measured in their assessment of the extent of the opportunities presented by DLT. As part of this, FMIs are exploring a variety of potential use cases for DLT. These include:

- clearing and settlement (also the area which respondents believe DLT will have the greatest impact on the securities industry);
- trade matching and confirmation – not in traditional exchange-traded areas but rather in relatively lower volume assets such as fixed income, OTC derivatives, the repo market and the private securities market;
- corporate actions (voting rights and dividend payments);
- securities issuance particularly for private issuances;
- crowd-funding;
- proxy-voting;
- trade registration;
- regulatory reporting and transparency.

In the more bespoke category, respondents are also looking at using DLT to provide:

- national Know Your Client (KYC)/Anti-Money Laundering (AML) registries;
- trade finance facilities;
- asset registration facility (such as real estate);
- database on agricultural receivables;
- digital assets and associated products⁴.

These use cases are also the ones that respondents believe are most likely to materialise.

Broadly speaking, respondents highlighted cost savings (for the responding entity and the industry more broadly), efficiency enhancement and risk reduction as their main reasons for investigating the application of DLT to the use cases which are set out above. Respondents

⁴ CME CF Bitcoin Reference Rate and real time index with Crypto Facilities Ltd (publicly announced 2 May 2016)- <http://investor.cmegroup.com/investor-relations/releasedetail.cfm?ReleaseID=968356>

see these benefits as integral to the technology⁵ inasmuch as it allows for further automation and streamlining of processes; reduces the need for authentications and (manual) reconciliations; reduces the time needed to finalise transactions; and enables greater data integrity and system resilience. Specifically, in relation to clearing and settlement and collateral management, respondents believe these features will result in greater capital efficiency and with potentially reduced capital requirements for market participants. From an individual entity perspective, many respondents thought it was still too early to comment on the impact these initiatives would have on the firm specifically (other than the cost savings and operational efficiencies identified above). Some, however, noted the possible revenue opportunities their DLT investments could unlock through providing access to new product and service offerings, while others noted the resultant efficiencies could have an impact on organisational structure. As one respondent stated: *“Operational teams may become more integrated in nature. Certain non-digitized operational functions may cease to exist or significantly reduce in size.”*

Responding FMIs who had already identified potential DLT use-cases varied in their perceived time to roll out their DLT solutions. As mentioned, one FMI has already deployed a working blockchain application and is expecting to roll out another during the course of 2016; others are at proof-of-concept stage while others are still somewhere along the spectrum of evaluation, design and proof-of-technology. While the majority of respondents were not prepared to commit to a specific timeframe, 10 FMIs put their expected time to rollout at less than three years.

This timeframe should not, however, be read as a blanket endorsement of the viability of DLT for the use cases under investigation. As mentioned above, FMIs are still evaluating the extent to which DLT technology will live up to its promise, and identified concerns about security, scalability, throughput capacity, and the ability to ensure data privacy. One respondent was somewhat more sanguine, stating: *“We are undertaking efforts to identify, understand and address known technical constraints. To the extent that we have identified constraints, they have not raised any concerns.”* Yet another was less concerned about technical challenges and more concerned about integration with existing infrastructure and securing requisite ‘community-wide’ commitment to transitioning to a new solution.

Legal and regulatory perspectives

Respondents were clear on the need to ensure their DLT solutions aligned with relevant regulatory and legal frameworks, but they also highlighted several legal and regulatory issues that might need to be addressed or clarified to enable the implementation of the specific use-cases they are working on. These ranged from the general (data privacy laws, data governance considerations, conflict of laws issues, intellectual property laws, and investor protection laws) to more specific examples, which are set out below:

- One respondent noted that the use-cases they were examining integrated processes across trading, clearing, and settlement but that the legal and regulatory framework saw these in a discrete, silo-ed fashion.
- Another respondent stated that in relation to the use of DLT for collateral management it was important to have certainty regarding the legal status of digitised assets as means of

⁵ See the WFE Quarterly Regulatory Newsletter: An Overview of Approaches to Financial Technologies and Distributed Ledger Technologies, July 2016 for an overview of regulatory approaches to distributed ledger technology, in the members’ section of the WFE website

transferring and granting security over interests in such assets as well as treatment in insolvency, and applicability of insolvency protection.

- Several respondents suggested certain types of DLT implementations do not fall neatly into current regulatory frameworks dealing with, for example, recognition of ownership or settlement finality. One respondent highlighted, for example, that in fully decentralised DLT schemes, it was not clear who would define the relevant finality concepts under EU law (what constitutes a ‘transfer order’, moment of entry, moment of settlement, law governing the ‘system’, etc.) and suggested the extension of the legal protections provided under the Settlement Finality Directive (which are a precondition for legal certainty of settlement) to DLT schemes would require changes to the existing legal regimes.
- One respondent raised questions regarding smart contracts, and suggested it would be desirable to clarify how errors are identified and resolved, and in what circumstances ‘undoing’ a smart contract would be permitted.

Some respondents highlighted a lack of legal and regulatory clarity on some of these issues as amongst the largest risks associated with the adoption of DLT in the capital markets.

Regulators and respondents seem to largely agree that what is most important at this point is ensuring open dialogue regarding the evolution of the technology, and the sharing of information and best practice examples.⁶ Respondents stressed the importance of adopting a collaborative approach to a technology that was still evolving. In the longer-term respondents felt IOSCO may have a role to play in setting harmonised, global standards, and ensuring any technical or regulatory standards that are issued, are aligned/are not in conflict with other standards (for example, relating to data protection and cyber-security).

Risks, opportunities and visions of a post-DLT world

As mentioned above, respondents believed the application of DLT to clearing and settlement was likely to have the largest impact on the capital markets industry. This is primarily for the reasons already cited above relating to the potential for significant cost savings, efficiency enhancements and risk reduction. According to one respondent: *“Clearing and settlement is often a complex process involving a number of parties (including intermediaries) where several sets of rules and market practices from several jurisdictions may be applicable. There is therefore significant potential for simplification, standardisation and efficiency.”* Some respondents suggested the adoption of DLT would reduce the settlement cycle even further (suggesting, in some cases, instantaneous settlement) while others spoke of an “optimised” settlement speed.

A few respondents identified trade matching and confirmation as the area of largest possible impact for reasons similar to those for clearing and settlement (potential for efficiency enhancements and cost reductions). One respondent identified foreign exchange trading was the area of largest potential impact because of the possibility for disintermediation and the possible emergence of alternative currencies.

Despite agreement that DLT has enormous promise respondents noted there are several, not inconsequential, barriers to widespread adoption of DLT. These include regulatory and legal barriers, lack of technical skills, vested interests in the preservation of the existing system, and uncertainty about the technology itself. One respondent cited the Morgan Stanley article [“Global Insight: Blockchain in Banking: Disruptive Threat or Tool?”](#) which summarises the barriers for

⁶ See the WFE’s recent quarterly regulatory newsletter on “An Overview of Regulatory Approaches to Financial Technologies and Distributed Ledger Technologies”

DLT adoption (in the banking sector) as follows: “1) *is the use case cost/benefit compelling?*, 2) *cost mutualisation/who funds the overhaul of old systems?*, 3) *misaligned incentives*, 4) *evolving to the right standard*, 5) *scaleability/performance*, 6) *governance*, 7) *regulatory issues*, 8) *legal risks*, 9) *cryptology/security*, and 10) *simplicity/interoperability*”. Or in the words of another respondent: “*Unknown cost/benefits and understanding of whether or not it is compelling to make the switch from existing technology to DLT. Associated costs and risks with being a first mover and early adopter of a rapidly evolving and uncertain technology. Achieving interoperability across different ledgers and networks, addressing regulatory and legal risks such as data privacy and security, and competing priorities of financial firms in a highly regulated financial ecosystem.*”

In addition to barriers to adoption, respondents were also asked to identify potential risks of application of DLT to capital markets. Most responses speak to the immaturity of the solution (e.g. how to ensure cyber-security protection across distributed nodes, the ability of the technology to scale, lack of an IT governance framework) or uncertainty about the application of the technology to existing processes (e.g. how to handle events of theft/fraud, how to ensure transfers that happen outside the blockchain are reflected on the blockchain). However, one respondent, highlighted a potential risk stemming from the transformative nature of the technology, suggesting that as DLT had the potential to disintermediate current trusted parties this might result in reduced regulatory protection for users of the market.

The majority of respondents believed it was not only possible for non-financial players to take the lead in the development of DLT, but likely, given these firms would tend to be less regulated than financial services firms. This was not the same, however, as agreeing that non-financial firms would be in a position to rollout DLT solutions in capital markets without the participation of existing providers. Rather respondents felt this would likely happen in collaboration with market participants and existing service providers. Overall respondents disagreed as to whether or not the adoption of DLT in capital markets would fundamentally change the nature and structure of the industry. The nature of responses can be viewed along a continuum with some stating, “*We do not believe that the fundamental roles performed by financial market participants, custodians, exchanges, CCPs and regulators will change materially*” and others seeing fundamental change, including much more peer-to-peer activity and less central clearing. Similarly, respondents took different views on the impact of DLT adoption on the role of trusted parties and/or the emergence of new trusted parties. In relation to clearing and settlement specifically, one respondent noted the process might require fewer intermediaries than is currently the case but the need for trusted parties would remain. Other respondents suggested that as some of the use-cases required proof of identity and/or verification of possession of the assets, they could see the emergence of trusted third parties who would perform this verification function. This spectrum of responses is likely the result of the fact that while – in the words of one respondent – DLT can act as pure technology replacement, the capabilities inherent in the technology also mean that it has the potential to disrupt existing business models.

Conclusion

It is difficult at this early stage to make predictions about the full scope and scale of impact of DLT on financial markets and market intermediaries. However, the following is clear from the responses received:

- The number of FMIs that are investigating and deploying DLT proof-of-concepts and solutions will continue to increase.

- While some FMIs will approach DLT as a source of competitive advantage, the current collaborative approach is likely to persist as FMIs, technology innovators and market participants acknowledge that many of the more significant benefits of DLT will derive from standardisation and broad user-acceptance.
- This collaboration should also extend to policy-makers and regulators so as to both encourage the adoption of appropriate enabling regulation and to minimise unintended consequences of policy formation. Some regulators have adopted the concept of 'regulatory sandboxes' for the wider FinTech industry and these could be extended to DLT in order to ensure that appropriate collaboration and exchange of information occurs between industry (whether regulated, or not) and regulators.
- Where non-financial, unregulated entities lead in DLT development, regulators will need to ensure that equivalent regulatory standards and protections are maintained.
- To the extent that specific DLT regulatory standards are required, there is merit in organisations such as IOSCO taking the lead in developing harmonised, global standards.
- The set of potential use cases will evolve as FMIs and others start to look beyond current processes to new opportunities that the DLT presents.

As the global industry association for exchanges, CCPs and CSDs, the WFE will devote significant time and attention to forging consensus amongst its members on DLT-related issues, specifically formulating guidelines, codes of conducts and industry best practice as use cases and issues emerge. Further, the WFE will endeavour to facilitate an open dialogue between regulators and its membership regarding the evolution of the technology, and the sharing of information and best practice examples.

Annex 1: List of responding FMI and input providers

BM&FBOVESPA
CETIP
China Financial Future Exchange
China Securities Depository and Clearing Co., Ltd
CME Group
Depository Trust and Clearing Corporation
Group Deutsche Börse
Hong Kong Exchanges & Clearing Co. Ltd
Japan Exchange Group
Johannesburg Stock Exchange
Korea Exchange
LCH.Clearnet Limited
Moscow Exchange Group
Nasdaq
National Stock Exchange of India
Oslo Børs
Qatar Stock Exchange
Singapore Exchange
SIX Swiss Exchange
Stock Exchange of Mauritius Ltd
Tadawul - Saudi Stock Exchange
Taipei Exchange
The Bermuda Stock Exchange
The Stock Exchange of Thailand
TMX Group

Annex 2: Questionnaire

Survey on Distributed Ledger Technology (DLT) for Exchanges and Post-trade Infrastructures

Part I - Firm Specific Questions

1. What is the strategic direction of your senior management toward DLTs?

2. Has your company allocated specific budget to DLT?
 - a. If Yes, what is the budget in USD and as a percentage of global IT budget your company allocates to DLTs initiatives (excluding venture investment in DLT-related Fintech start-ups)?
 - b. Do you expect this budget allocation to increase over the next five years?
 - c. If you have not allocated budget to DLT, do you plan to allocate budget in the future?

3. Does your company invest in DLT start-ups as part of your DLT initiatives?
If Yes:
 - a. When were the investments made?
 - b. What is the size of the investments (in USD)?
 - c. Which use-cases are the focus of the investments?

4. Is your company part of any DLT-related industry consortium(s)?
If Yes, which one(s)?

5. Does your company partner with other financial institutions / exchanges / securities regulators / fintech start-ups / other entities for your DLT initiatives?
If Yes, with which one(s)?

6. What are the top THREE types of DLT use-cases your company is working on?

7. Where applicable, which collaborative effort mentioned in (4) and (5) do these THREE use-cases belong to?"

8. What goals does your company want to achieve with each of the THREE use-cases by using DLT?

9. What is the current status of DLT as the solution? What is the expected time to roll out?

10. What is the perceived impact of the DLT solutions for your company in the THREE use-cases above? In your response, please reference the following potential areas of impact namely:

a. Financial impact (e.g. impact on revenue, costs, capital requirements)

b. Operational impact (e.g. changing of business structure, headcount, divesture)

c. Strategic impact on business model

d. Impact in relation to regulatory compliance (e.g. reduction of data gap, comprehensiveness of data, transparency, risk reduction)?

e. Other (please specify)?

11. Have you considered technologies other than DLT to address the THREE use-cases above?

a. If yes, which technologies (e.g. central databases, industry utilities, etc.)?

b. If yes, are they being studied in parallel to your DLT initiatives?

12. Do you have any concerns about the technological constraints of the DLT?

If Yes, what are they?

13. For your responses to questions (14) and (15) please indicate which jurisdiction you are referring to.

14. Law related questions outside the remit of securities regulations (note these questions should be answered with specific reference to the jurisdiction(s) within which your firm operates):

a. What are the legal hurdles that must be overcome or which legal clarifications are needed for the THREE use-cases chosen by your company? For example, hurdle in relation to

contract law or data privacy law, etc.

b. Are your use-cases working under the premise that, even though DLTs are potentially global, national laws need to be able to be complied with (e.g. contract law or data privacy hurdles)?

If No, why not?

c. Are you presently working with law firms on such matters?

If Yes, which law firm(s)?

15. Securities regulation related questions (note these questions should be answered with specific reference to the jurisdiction(s) within which your firm operates):

a. What are the regulatory hurdles that need to be overcome/ which regulatory clarifications are needed for the THREE use-cases chosen by your company?

b. Are your use-cases working under the premise that even though DLTs are potentially global, national regulations need to be able to be complied with (e.g. traceability of data by local securities regulators)?

If no, why not?

c. Are you presently working with regulators on the matters set out in (a)?

If yes, please specify which regulators

d. Would you support the creation of global harmonization of regulatory standards in relation to DLT?

e. What role do you expect IOSCO and more generally regulators to play in regards to DLT?

Part II – Industry Wide Questions

16. What are in your view the main risks of DLT applied to capital markets?

17. What do you think are some of the barriers to the adoption of DLT?

18. Across various DLT initiatives in the industry, which use-case do you believe will have the greatest impact on the securities industry? Why?

19. Across various DLT initiatives in the industry which use-cases do you believe are most realistic? Why?

20. What do you think the time to market is of those use-cases referred to in questions 18 and 19 (e.g. 3, 5, 10, 20 years)? Please specify which use cases your answers refer to.

21. What are the major potential benefits for the capital market participants/ financial market infrastructures of these use-cases (e.g. bringing new asset classes to market, back office efficiency/cost reduction, etc.)?

22. What are the major potential benefits for the regulatory authorities of those use-cases (e.g. regulatory traceability, regulatory transparency, regulatory node, etc.)?

23. Who would be the users of such use cases (e.g. exchanges, banks, brokers, asset managers, etc.)?

24. Do you think non-financial players can lead the deployment of the DLT technology? If yes, how?

25. Vision of the future: will these use cases materially change the structure of the financial industry, including the roles, processes and business models of intermediaries, exchanges, central counterparties, and regulators? If yes, how (e.g. encryption, cloud, more/ less leverage, digital identity, smart contracts, more peer to peer/ less centrally cleared activity, regulatory nodes, etc.)?

26. Vision of the future: will these use cases lead to the emergence of, or need for designation of, new trusted parties or of new regulated utilities? If yes, how (e.g. issuers of digital settlement coins, KYC repositories, etc.)?