Financial technology: Blockchain and securities settlement

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ABSTRACT

Financial technology (FinTech) is becoming more popular in Japan (as well as globally), and financial institutions are increasingly seeking to collaborate with the firms providing such technology. Among FinTech, blockchain (distributed ledger) technology is attracting particular attention because of the possibilities it offers, most notably as a powerful new tool for facilitating transactions. This paper provides an overview of this new technology, including its potential contribution to the infrastructure of the securities market, and provides an introduction to the role of blockchain in financial transactions. This technology is innovative and improving very rapidly. Nevertheless, any enterprise looking to adopt blockchain technology will need to update their business processes and maintain ongoing discussion with stakeholders. The author suggests that only 20 per cent of the barriers to adoption are technology based, the other 80 per cent being attributable to current business processes and business models. It is necessary to take the time to utilise and apply blockchain technology in financial markets. It will take more than a couple of years for blockchain technology to be fully deployed within the financial infrastructure, but it should take less than a decade.

Keywords: FinTech, blockchain, Japan, financial markets, financial infrastructure

INTRODUCTION

Financial technology (FinTech) is rapidly gaining popularity in Japan (and indeed the world), and financial institutions are increasingly seeking to collaborate with the firms providing such technology. For example, a group of Japanese mega banks has formed a FinTech innovation laboratory — the Japan Exchange Group — which is trying to set up two blockchain

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prototypes with different vendors.[1] Within the area of virtual currency, blockchain (distributed ledger) technology is attracting particular attention because of the possibilities it offers, most notably as a powerful new tool for facilitating transactions between financial institutions, as well as for foreign exchanges and stock exchanges. This paper provides an overview of this new technology, including its potential contribution to the infrastructure of the securities market, how it operates under existing regulation and market practices, its role as a central counterparty (CCP) in handling trades, practical operational procedures with respect to cross-border transactions and an introduction to the role of blockchain in financial transactions. This technology is innovative and improving very rapidly. Nevertheless, any enterprise looking to adopt blockchain technology will need to update their business processes and maintain ongoing discussions with stakeholders.

CONCEPT AND OUTLINE

Each trading partner possesses a copy of the distributed ledger, known as a node, and all transactions are registered on each ledger. To ensure all individual nodes are updated accurately, it is impossible to amend the ledger without consensus approval from all parties. Blockchain offers a number of advantages:

- *Near real-time settlement:* Distributed ledgers are updated in near real time. Compared with some remittance systems, this represents a time-saving of days. Although this reduction in friction reduces risk, it also limits the ability to charge back, but smart contracts have been developed to address this issue.
- *Low cost:* Transactions proceed via nodes, which are credentialed to approve transactions, thus avoiding the need for a hub computer at the centre of the framework.
- *Traceability:* Every transaction is recorded on multiple nodes, leaving a clear audit trail.
- *Encryption:* Blockchain technology requires cryptographic proof instead of trust, so parties can transact directly with each other without the need for a trusted third party. Work has been completed in crypto economics to ensure the blockchain continues pumping out new blocks and that blocks are not reverted or altered.
- *Accuracy:* All participants must agree the transaction before it is made, thus preventing double spending, fraud, abuse and the manipulation of transactions.
- *Distributed ledger:* The distributed ledger generates computational proof of the chronological order of transactions. The peer-to-peer distributed network records a public history of transactions that quickly becomes computationally impossible for an attacker to change. Blockchain does not typically preserve the identities of either party or the transaction data — only the proof.
- *Reliability:* Because of the distributed nature of the system, the overall mechanism can continue to function even if one party suffers a system failure. This has positive implications for business continuity planning.

In short, the status quo, which has operated for decades, is about to change substantially. The traditional role of the third party in the financial infrastructure of the capital market is likely to come to an end and the book will close on today's business model. A new service — a business process with a new business structure and technology — will stand in its place. To look at the situation another way, there is an established pattern of great leaps in technical innovation happening every 20 years.

In the 1970s, the personal computer permanently changed the way of doing business. In the 1990s, people around the world started to embrace the internet in great numbers, connecting globally and improving efficiency in leaps and bounds. Now, 20 years on, blockchain is set to reform business processes. According to the World Economic Forum, 'emerging innovations are streamlining or eliminating traditional institutions' role as intermediaries, and offering lower prices and/or higher returns to customers'.[2] Meanwhile, Santander suggests that it is possible to reduce financial infrastructure costs by as much as US$20bn a year until 2022.[3]

RECENT GLOBAL TRENDS IN BLOCKCHAIN

Recently, organisations such as R3CEV and the Linux Foundation have formed a consortium to develop blockchain projects in the financial area.[4] Prototypes are also under development in Japan. The International Monetary Fund (IMF) and UK government published an informative white paper about blockchain technology.[5] This white paper, which had a particular focus on the infrastructure of the securities market, included comments from organisations such as Euroclear, Depository Trust & Clearing Company (DTCC) and Deutsche Bank. According to DTCC, it is presently difficult to deploy blockchain technology in the securities market. By way of contrast, in March 2016, a trial that sought to combine smart contracts with the use of blockchain technology to automate repurchase agreement (repo) transactions was published.[6] Meanwhile, a trial with firms such as JPMorgan and Citi to process the settlement of credit default swaps, again with smart contracts, was reported to have ended in success.[7]

The Australia Stock Exchange (ASX) has joined a group of international investors, including JPMorgan and Santander InnoVentures, in a $50m investment in blockchain start-up Digital Asset Holdings, in January 2016.[8] ASX is planning to begin the project, which utilises blockchain for the post-trade settlement process, in around July 2016.

In the area of remittance, Ripples offers a blockchain service, while the Monetary Authority of Singapore (MAS), the central bank of Singapore, has voiced its support for the use of blockchain for trade finance.[9] Standard Chartered Bank and DBS are also conducting research into blockchain technology.[10]

The European Securities and Markets Authority (ESMA) has suggested that a distributed ledger has the potential to reduce counterparty risk, operational risk, legal risk and risk of cyber-attack during the post-trade period, which is of particular interest to the financial regulation authorities.[11] The Commodity Futures Trading Commission (CFTC) has drawn attention to the benefits of distributed ledgers for transparency and maintaining all of the trade records. The CTFC has even gone so far as to suggest that the Lehman Brothers crisis could have been avoided with distributed ledger use. It states:

> 'records powered by distributed ledger technology and held by trading counterparties (and available to regulators) would have accurately shown Lehman's open positions across asset classes. Imagine if, instead of requiring countless legal actions spanning eight years, we could have known all of Lehman's exposures within minutes of its bankruptcy filing.'[12]

In its report of February 2016, the Central Bank of the Netherlands makes reference to a study into the viability of a prototype

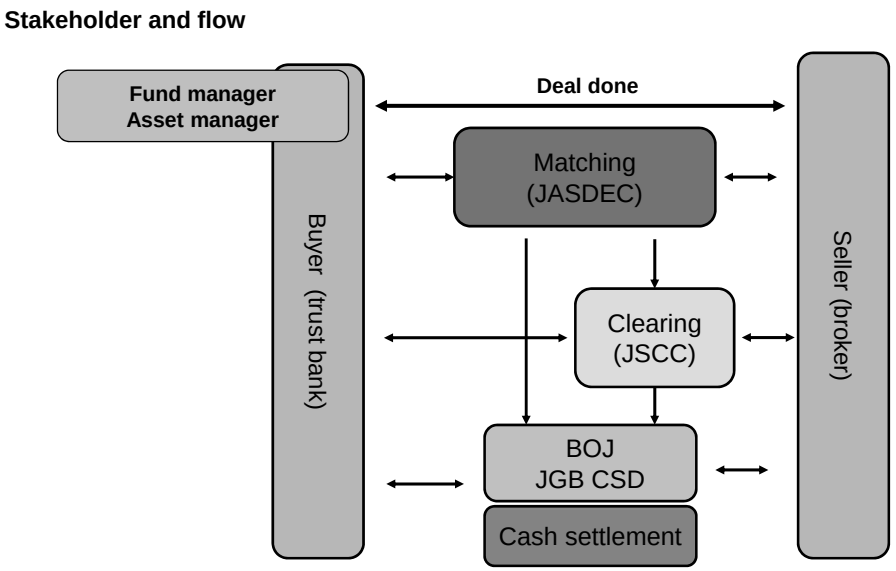

Figure 1 The current flow of securities post-trade
Source: © Deloitte Touche Tohmatsu LLC

coin (ie digital currency) supported by blockchain technology.[13] The Bank of England,[14] Central Bank of Australia[15] and the People's Bank of China[16] are also investigating and studying the potentiality of a digital currency. The International Organization of Securities Commissions (IOSCO) is planning to establish the use of FinTech and blockchain and will publish its report by the end of 2016, according to the author's source.

ISSUES REGARDING THE DEPLOYMENT OF BLOCKCHAIN IN SECURITIES SETTLEMENT INFRASTRUCTURES

In Japan, the buyers (in the case of investment managers and mutual funds, the investor side often outsources its operations to trust banks) and sellers (mainly brokerage firms) of Japanese government bonds (JGBs) presently conduct their post-trade transactions using the Japan Securities Depository Company's (JASDEC's) pre-settlement matching system. Subsequently, some transactions are referred to the netting service of the CCP — in this case, the Japan Securities Clearing Corporation — while others are processed by the Bank of Japan's (BOJ's) securities settlement system (BOJ-NET). A delivery versus payment (DVP) settlement with funds from the BOJ is performed and the settlement is completed (Figure 1).

In Japan, the Order for Enforcement of the Act on Book-Entry of Company Bonds, Shares, etc 2001 (the Act) stipulates the framework and finality of the settlement of securities, with the law about transferring stocks and bonds etc establishing their important role in the financial market. One of the essential parts of the general mechanism of this law is its multi-layered structure, which supports the stable transfer of securities (Figure 2). Securities settlement systems like BOJ-NET and JASDEC play a central role in managing this framework. Account management institutions (AMIs) are financial institutions licensed by the Act as account

Figure 2 Ledger structure stipulated by the Act on Book-Entry of Company Bonds, Shares, etc 2001
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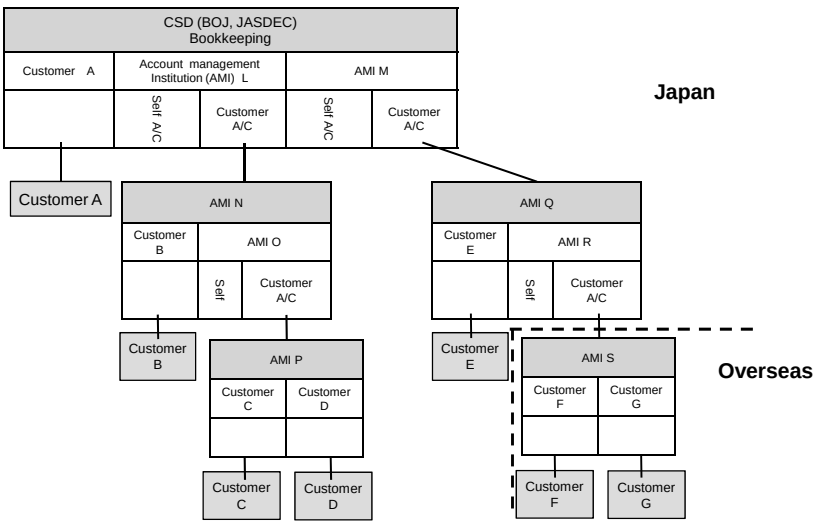
Complicated ledger structure

Image of multi-tier structure for account management institutions (AMIs)



administration facilities tied directly to the securities settlement system. Moreover, another financial institution is tied to the direct AMI as an indirect AMI, while an overseas AMI is connected as a foreign indirect participant, and cross-border trades also become possible. When an overseas financial institution becomes an AMI, it is necessary to get approval from the BOJ, JASDEC and Japanese Financial Services Agency (J-FSA, the regulator). One of the special features is that an upper AMI manages only the balance of the asset of the lower AMI; it has no access to data such as the names of the investors or the asset balance of each investor in the lower AMI. Only in the event of coupon payments or other corporate actions will the lower AMI have access to the names of the investors and the balance of the asset held by the upper AMI; this is in order to apply the correct tax rate for investors. Normally, the upper AMI does not know what kind of investor exists in the lower AMI. Therefore, with the exception of coupon payments or other corporate actions, even the securities settlement system does not know what kind of investor exists in this framework. (For equity, by contrast, the list of shareholders must be available for every — almost quarterly — accounting period. This means the securities settlement system and the issuing company usually can check the name of the investor and the balance of shares during the relevant accounting period.)

Deals with foreign investors have recently become more common in the JGB market, with over 10 per cent of JGBs now held overseas. When deals with foreigners are considered, the trade is contracted overseas and sent to a foreign custodian with transaction information from the overseas investor. The instruction is sent to the local custodian in Japan, which is a domestic financial institution and, after that, using the JASDEC pre-

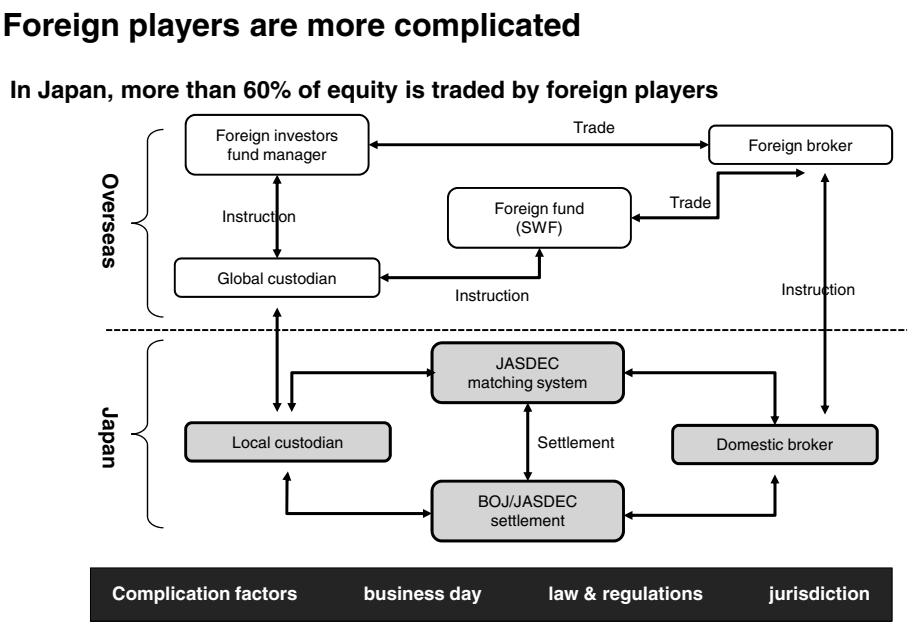


Figure 3 Additional complications introduced by adding foreign players to the trade
Source: © Deloitte Touche Tohmatsu LLC

matching system, a settlement will be performed by BOJ-NET; this procedure is very complicated (Figure 3).

Having described the flow of transactions and the associated mechanism, the paper next will consider the issues and tasks pertaining to the application of blockchain technology in this framework.

Legal framework and market practice

One of the most important parts of the financial transaction process is the finality of settlements. This finality is secured through transfer to the AMI or securities settlement system, as currently stipulated in Japan by the Act. In the blockchain world, there is nothing to define this finality in the event that investors settle directly without using an AMI. Therefore, substantial changes in the law would play a vital part in the adoption of blockchain for securities settlement.

A distributed ledger framework supports neither a ledger system with a multi-layered structure nor the role of the AMI. So, how does a distributed ledger treat participants? It is necessary to consider a new legal structure. Distributed ledger systems also need to adopt new modes of investor protection to balance know-your-customer demands with the protection offered via AMI. In practice, the market allows for a fail rule. In principle, however, fails in real-time trading and settlement do not occur in blockchain technology, so how is this rule considered? There is a special fail rule for non-residents in Japan, which means a fund shortage is regarded as a default but is admitted in the Japanese market for non-residents only; however, this special fail rule for non-residents is due to be reviewed.

About trading methods

The handling of short transactions provides an excellent example. The short selling of stocks accounts for about 40 per cent of the transactions of the Japan

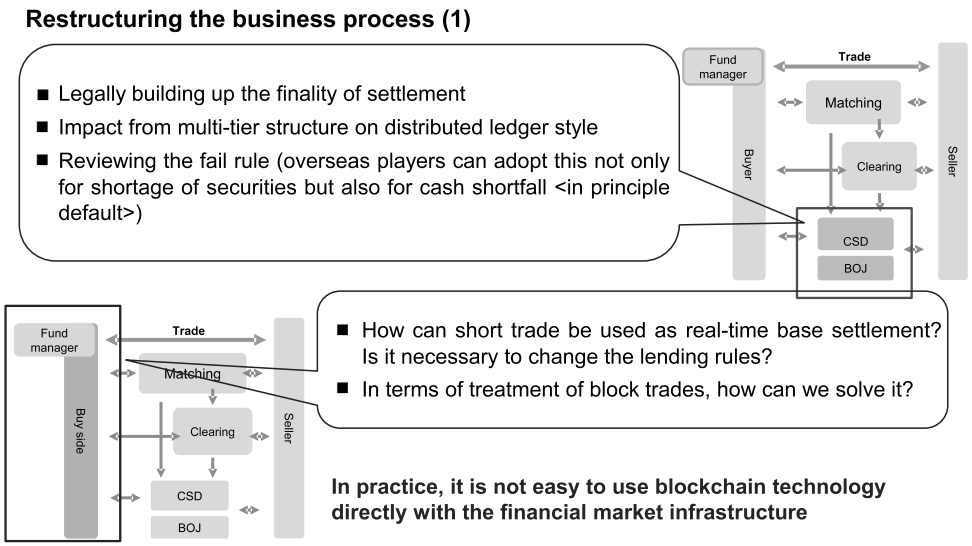


Figure 4 The challenge in domestic models (1) Source: © Deloitte Touche Tohmatsu LLC

Exchange Group.[17] One of the strong points of blockchain technology is real-time settlement. With short selling, however, the covering transaction is currently completed after the following business day. The adoption of real-time settlement therefore would require a change in the procedure for lending and borrowing securities. Likewise, with block trades conducted outside of open markets, the allocation processing is performed after the trade. Again, it is essential to create a new procedure for real-time settlement and allocation processing (Figure 4).

The central counterparty

With a distributed ledger system, in principle, there is no need for a CCP as the blockchain framework obviates the need to deliver collateral to the CCP. In the absence of CCPs, every transaction is settled immediately, so one must consider the efficiency of processing settlements without a netting facility (ie when multiple transactions are reduced to one or a few settlements). For example, greater liquidity may be required for transactions and, in some cases, pre-funding may be necessary. Regarding capital charges under the Basel Accord, if using a CCP, the capital charge is 2 per cent; without a CCP, however, 100 per cent of the capital is required. This implies additional up-front settlement costs for long-term repo trades that might currently offer settlement periods of, say, one month. There are similar issues with the settlement of loop securities transactions. In a world without CCPs, settlement efficiency may reduce dramatically.

Practical operational points

When settling securities, there are a lot of items to be matched, such as name of the share, amount, price, accrual etc. Without a matching function, it is very hard to settle such transactions smoothly. So, how can an alternative matching function be established? It is also necessary to consider the queue function, which is the transaction waiting operation to make the settlement run smoothly. With the current settlement framework (with the exception of overseas

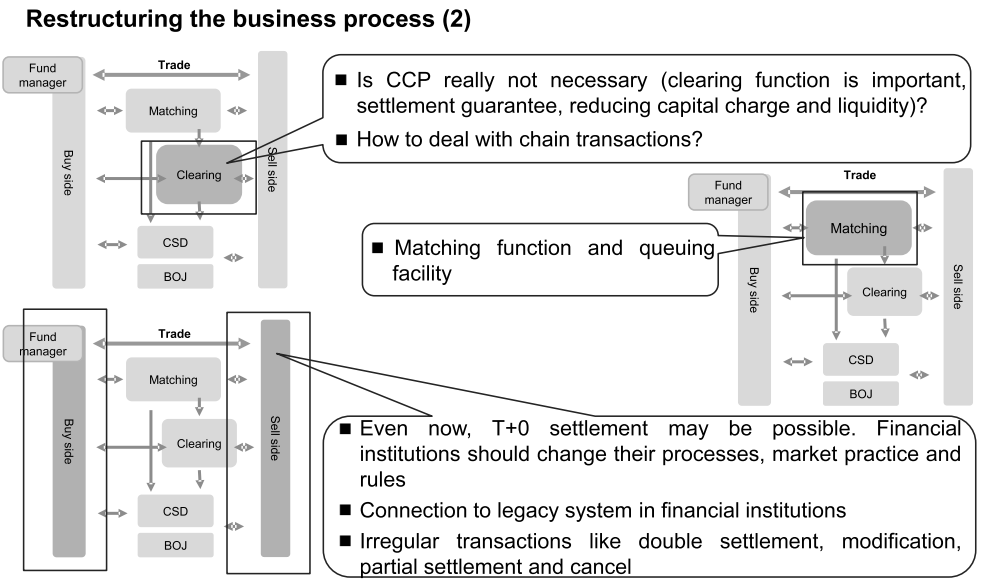


Figure 5 The challenge in domestic models (2) Source: © Deloitte Touche Tohmatsu LLC

transactions), the matching procedure is done within the trade date. The reality, however, is that the buying and selling process is not finalised due to less efficient IT systems and incomplete operational procedures within the trade date. For example, JGB trades move to T+1 from T+2 and equity trades move to T+2 from T+3. These trades are very hard to complete. It is necessary to change existing practice with respect to the marketing and renewal of IT systems and new operational procedures in financial institutions. A further challenge is the connection between the blockchain technology and current IT systems, such as accounting in financial institutions. Each firm has multiple dealers. In a global financial institution with multiple trading sites, many similar trades, in terms of both volume and price, will be conducted every day. There is therefore ample scope for double processing, and errors with securities names, codes and prices etc are common occurrences. When such errors occur, it is also necessary to correct them and cancel the original settlement. Even if a check is identical to the current state, a complicated practical business procedure is still necessary to secure the system's flexibility, which can even require additional manual processing later, because multi-trades are conducted and settlement is made with borrowing securities simultaneously (Figure 5).

Issues for cross-border transactions

When cross-border transactions are taken into consideration, the issue becomes yet more complicated. It is necessary to consider the existing regulations regarding transactions with foreign countries, such as the Act in Japan. When using the same distributed ledger across different territories, the ledger must be operational 24/7 due to the different business days in each country. Traders need to be aware of the different public holidays in the countries of their trading partners, as sometimes it can be impossible for them to settle on the same day. One must also take into account the bankruptcy law in the jurisdiction in which the trading partner is based, particularly with respect to institutions with international influence, as

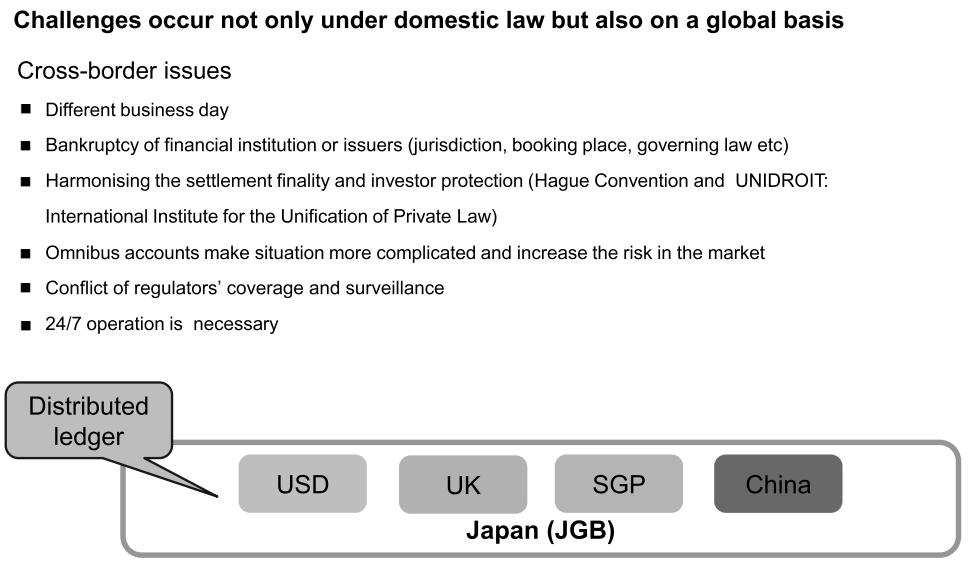


Figure 6 The challenge in global base models
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Lehman Brothers had before its collapse. One must also consider how to manage the settlement when there are multiple countries in the distributed ledger. For example, Japanese law and the US commercial code differ in their legal thinking with respect to the ownership of securities and the transfer or pledge of securities. In this regard, there is a clear need for international harmonisation; for example, the International Institute for the Unification of Private Law (UNIDROIT) and Hague Convention are working towards the international standardisation and harmonisation of the process to secure the ownership of securities and transfer or pledge securities in international securities transactions. The inspection rights and scope of supervision of a specific country regulator (which can control its own country but not other countries) for a distributed ledger (dictated by location of the server) need to be arranged, since the distributed ledger covers not only one country but also other countries (Figure 6).

AREAS FOR FURTHER IMPROVEMENT AND THE DEPLOYMENT OF BLOCKCHAIN

As ESMA has reported, presently it is not easy to retrofit blockchain to an existing system. Nevertheless, a rough estimate would suggest that only 20 per cent of the barriers to adoption are technology based, the other 80 per cent are attributable to current business processes. Even if a blockchain technology system could be retrofitted to existing technology, without substantial changes to existing business processes it is unlikely that it would be possible to leverage the full potential of the technology. Blockchain technology is very innovative; for example, progress with the improvement of the new technology, such as sidechain, which is patented by blockstream, has proceeded rapidly.[18] It is necessary to take the time to utilise and apply blockchain technology in financial markets. It will take more than a couple of years for blockchain technology to be fully deployed within the financial infrastructure, but it should take less than a decade.

Before this can happen, however, further ongoing investigation with stakeholders, including regulators and central banks, will be essential. NASDAQ has already deployed blockchain technology for the trade of unlisted stocks (only issuers and investors are members of this scheme).[19] In Australia, meanwhile, the ASX plans to commence a post-trade pilot scheme for blockchain in around July 2016.[20]

The transaction of securities is very complicated and stakeholders include central banks and financial services agencies (that is, the supervisory authorities that determine the guidelines and regulations), as well as financial institutions, issuing firms, exchanges, securities settlement systems, transfer agents and those parties trading on behalf of investors and brokers. These stakeholders must be included in any pilot study looking into changing both market practice and the law. Key to the successful deployment of blockchain within financial market infrastructures will be cooperation and collaboration between both public and private sectors to solve the many practical issues, change the business model and build up new laws, regulations and market practice.

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