

# Blockchain and T2S: A potential disruptor

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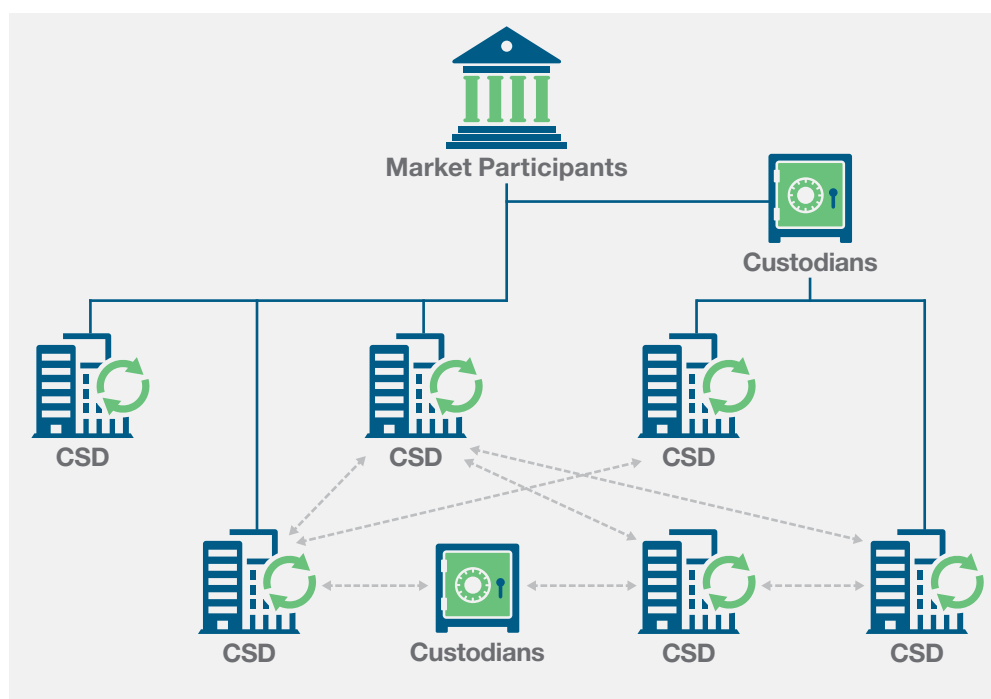
# Introduction

The concept of blockchain, a technological architecture facilitating a shared, distributed ledger, has gained enormous traction in the securities services industry over the last two years. Blockchain was historically associated with Bitcoin, a cryptocurrency, but its relevance and usage could potentially extend far beyond that. Blockchain, put simply, is a database holding unalterable transactional information supplied by financial institutions.

A number of financial institutions and market infrastructures have expressed interest in blockchain, pointing out it could replace manual and duplicative processes which can be highly inefficient, expensive and prone to operational error. This paper will explore whether blockchain could have a material role or impact on the European Central Bank's (ECB) Target2Securities (T2S) project, the long-standing and ambitious initiative launched in 2006. T2S is a pan-EU settlement platform designed to provide centralised delivery versus payment (DVP) trade settlement in central bank funds across the European securities market.

T2S aims to standardise European cross-border trade settlement by integrating securities and cash accounts onto a single IT platform. The T2S platform and Central Securities Depositories (CSDs) across Europe will therefore be interconnected through a single utility. This is known as the integrated model intended to enable cross-border real-time DVP settlement inside Europe. As the rules and standards governing T2S will be harmonised, this should help reduce some of the complexities and costs inherent in EU cross-border trade settlement.

## The current landscape of EU settlement



T2S has been subject to a number of delays over the last few years although deadlines are fast approaching. The ECB highlights migration of CSDs onto the T2S platform will occur in waves and has been doing so since June 2015. The final wave of CSDs located in countries including the Baltics, Finland and Spain will be migrated onto T2S on September 18, 2017. However, some hypothesise whether blockchain's evolution and implementation in the securities services industry could threaten or even replace T2S.

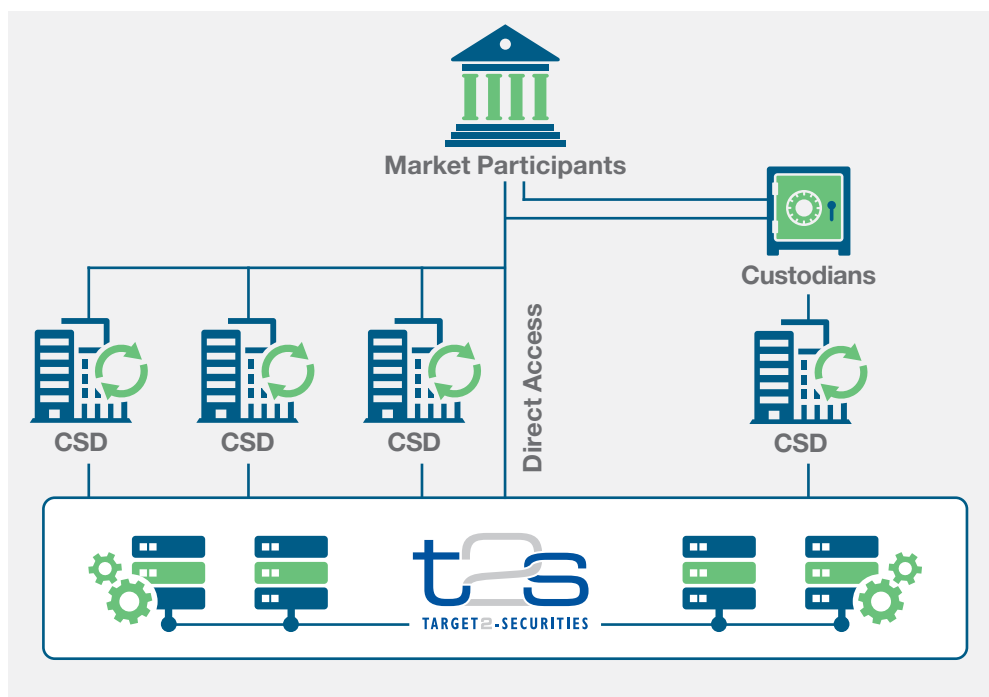
The first part of this white paper will explore the overarching implications blockchain could have on financial markets more broadly with a particular focus on securities services.

Part two of this paper will look at the practical implications blockchain could have on T2S and whether T2S could be a test case for the technology's usage. This will analyse whether T2S could be upgraded and amended to incorporate blockchain and the associated benefits this may bring. It will question the willingness of the T2S sponsor (effectively the ECB) to consider such a disruptive change in a system that is still in the process of launch.

Part three will explore some of the operational challenges of implementing blockchain onto T2S. Incorporating blockchain onto legacy systems that have been designed for T2S, both at the ECB and across users could be operationally difficult, expensive and risky. Attaining industry-wide agreement on blockchain's usage and standards is going to be a long-term project, and waiting for consensus on this will only delay T2S further.

Part four assesses some of the regulatory impediments which could inhibit blockchain's adoption into T2S. The ECB has invested enormous amounts into T2S's success. Simply replacing it with blockchain is not going to happen quickly. Furthermore, regulatory agencies including the International Organisation of Securities Commissions (IOSCO) and the UK's Financial Conduct Authority (FCA) have warned that Fin Tech could pose a systemic risk to capital markets. These regulators referenced distributed ledger technology as being one source of Fin Tech systemic risk.

### The future landscape with T2S



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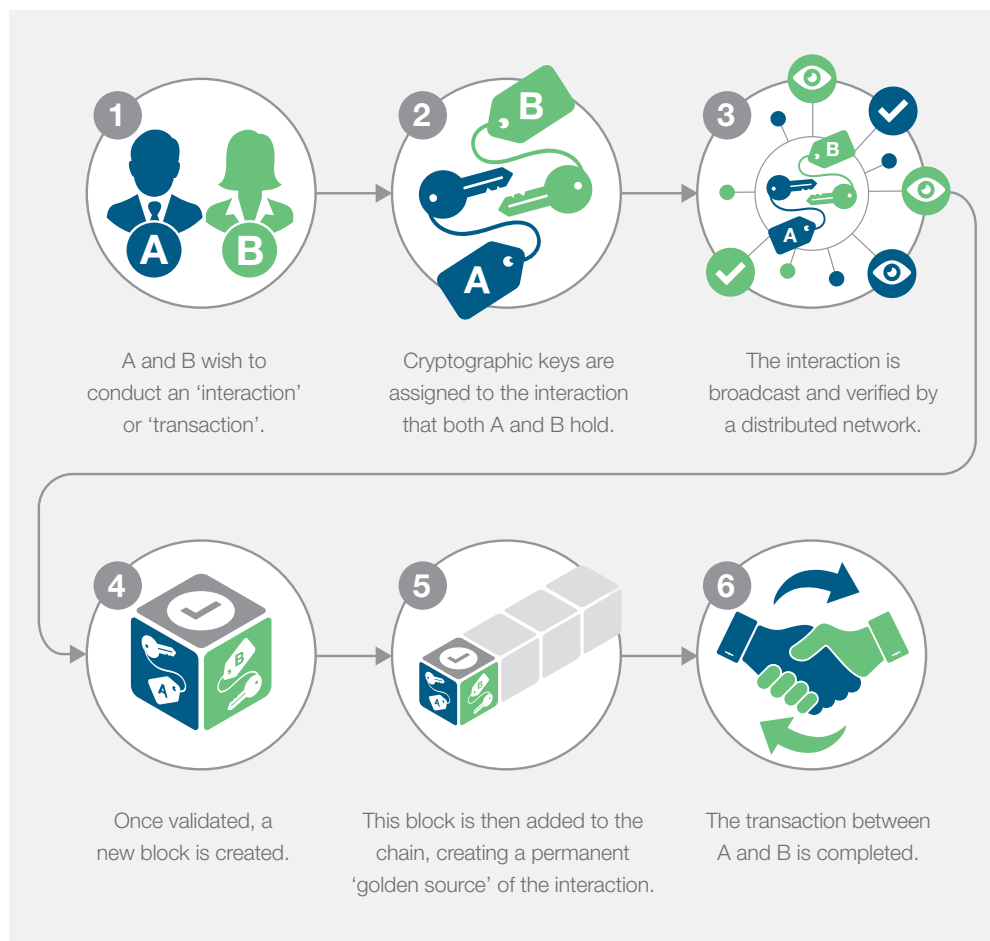
# The overarching potential of blockchain

The potential of blockchain has generated significant debate over the preceding two years. This is particularly true in the custody and securities settlement chain.

The potential of blockchain has generated significant debate over the preceding two years. This is particularly true in the custody and securities settlement chain. A prime example could be central counterparty clearing houses (CCPs) whose importance has been elevated following passage of the Dodd-Frank Act and European Market Infrastructure Regulation (EMIR), which have mandated a growing number of over-the-counter (OTC) derivative transactions be centrally cleared through these market infrastructures.

As blockchain operates on a real-time trade settlement time-frame and there is complete transparency that trading counterparties can meet their obligations at the point of settlement finality, some have questioned if it will remove the need for CCPs. This is overly simplistic. CCPs are likely to still have a role in a blockchain era for two fundamental reasons. First, they would add value in their clearing and netting function as that reduces settlement volumes and demand for settlement liquidity. Furthermore, they would have a role in terms of transaction collateral management, ranging from period transactions in derivative markets through to administrative demand for settlement in cash markets.

## The six steps in a blockchain transaction



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Others argue blockchain could infiltrate the securities settlement space dominated by CSDs. Again, while blockchain has the potential to disrupt a number of elements within the custody cycle such as corporate actions, there remains a school of thought that CSDs will have a part to play insofar as monitoring or overseeing this technology and ensuring that it adheres to industry-agreed standards and protocols.

The technology could gain interest in regulatory reporting as it would represent a golden source or single source of truth on all financial institutions' reporting. Financial institutions have to report enormous swathes of data to different regulators. Oftentimes, these reports may have a similar purpose (i.e. identifying customers and counterparties, risk exposures, details of trades) but could have different methodologies behind the calculations. Some of the reports may have different formats or definitions, which can occasionally lead to regulatory arbitrage and fragmentation.

This arbitrage can often lead to confusion. Even reporting Regulatory Assets under Management (RAUM) at fund managers is not necessarily consistent between US and EU regulators. Some regulatory bodies have tacitly encouraged an embrace of blockchain to help facilitate regulatory reporting. However, issues around a lack of standardisation and the ability of legacy technology systems to handle blockchain will need to be remedied before distributed ledger technologies can be properly adopted en masse.

## Which market segments could blockchain disrupt?

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-  Central Counterparty Clearing
  -  Trade Settlement
  -  Collateral Management
  -  Regulatory Reporting
  -  Corporate Actions
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At present, blockchain has been embraced by a small number of market participants. The Australian Securities Exchange (ASX) has been testing blockchain in equity trade settlement and clearing. Nonetheless, Australia's equity market is dematerialised and relatively small making blockchain adoption potentially more straightforward.

A number of financial institutions are participating in working groups as a means to further develop blockchain. An example of such a group is the R3 Consortium, which comprises a group of banks looking to develop blockchain technology across financial services.

Reports also indicate several high-profile asset managers are exploring blockchain as a mechanism to speed up transactions in illiquid assets. Others are seeking to modernise legacy platforms to attain compressed straight through processing (STP). Generally, it appears to be the major asset managers exploring the technology. "Asset management tends to be a conservative industry because of our fiduciary role managing peoples' life savings. As such, this can mean the industry can be slow to adapt to innovative technology. But we must be mindful of the risks of the technology before we embrace it given our fiduciary obligations," said one asset manager.

Blockchain's potential to disrupt capital markets should not be underestimated with Santander estimating it could incur savings of between \$15 billion and \$20 billion by 2022 through streamlining cross-border payments, securities trading and regulatory compliance. However, there are a number of challenges which must be overcome before this can be realised.

"Blockchain has the potential to impact markets globally including emerging economies, which are in the early stages of developing their market infrastructures. However, we must be mindful that change will not happen overnight. Distributed ledger technology – should it truly take off – will take years to come into fruition. It will require harmonised standards and regulation agreed by the industry, regulators and governments. The scale of this challenge should not be underestimated," said Alan Naughton, Head of Product Securities Services at Standard Chartered.



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**Alan Naughton**  
Head of Product Securities Services  
*Standard Chartered Bank*



# Could blockchain be incorporated into T2S or replace it?

Incorporating blockchain technology into T2S is a concept that is gaining interest. Some have hinted the technology could even develop at a rate faster than T2S's implementation. Both are hypothetical at the moment, although the ECB is certainly considering the impact blockchain could have on its T2S project.

In a consultative technical paper – “Eurosysteem’s vision for the future of Europe’s financial market infrastructure: RTGS Services”, the ECB recognised blockchain and distributed ledger technologies as a potential disruptor. The paper said there would be assessments around how these technologies could impact financial services.

The challenge around assessing blockchain’s likely impact on T2S is that the technology is still in its early stages and the markets/segments it is being experimented in are small. Its impact on an initiative as significant as T2S is purely speculative. One market infrastructure expert puts it succinctly. “To me, the fundamental question we must consider around distributed ledger technology is whether it is going to provide an additional benefit or value to an industry initiative like T2S or if it is going to completely reshape the industry as we know it. If it is the former, then T2S can adapt. If it is the latter, then we will have to question whether T2S is designed appropriately to adapt to this evolution,” said the expert.

Proponents of blockchain highlight it could facilitate a real-time environment within T2S in what would streamline the entire settlement process and theoretically reap cost savings. It could also reduce counterparty risk for those operating T2S as trades would be settled instantaneously. It would also help facilitate automation which could potentially reduce operational errors and duplication in what has historically been a highly manual process.



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One consultant is sceptical. “Just because the technology exists to do something does not mean you should necessarily do it. In theory, most markets could migrate to T+0. But real-time settlement has huge risks. These include FX risks, for example. Theoretically, the platform could move to the blockchain ideal market. However, this would need major platform re-engineering, a move to real time settlement from the chosen overnight batches, a careful study of the impact on liquidity of such an environment and comparable work at all participating CSDs and linked users. That is a long term project beyond five to ten years,” he said.

Blockchain could potentially replace T2S if the technology developed exponentially quickly. Blockchain is in an incubator phase at present and the technology could offer opportunities and cost savings around settlement and reconciliation. The big question for T2S is whether blockchain technology develops at such a fast rate that it could even replace T2S or result in an upgrade in T2S.

“Blockchain technology could potentially be used by T2S to improve efficiency and cost for its core delivery versus payment functionality. It could also assist across T2S users such as CSDs and custodian banks with their processing of transactions at T2S. I suspect if T2S was being created now, it would use blockchain technology in some shape or form. But it would take a long time to integrate into T2S today though,” said Alex Powell, independent consultant and advisor to Credits, a blockchain infrastructure provider.

“There is a possibility blockchain’s technology could develop or result in other advancements. If blockchain develops as its proponents say it will and it proves to be cheaper to implement and operate than the current infrastructure and negates all of the manual processes and demonstrates flexibility, it could bring major change. This would be something T2S would have to adapt to. I suspect such change would be a slow process as it would need to embrace all parties to the process. We must remember the T2S concept was launched more than 10 years ago yet we have still not completed migration from all participating CSDs. Conversely, markets can adopt to dramatic change in some instances. For example, when automation was introduced to UK settlement following the launch of the UK CSD in the early 1990s, there was a lot of resistance in the transfer agency industry, and now most of these opponents to change are no longer in business,” said Naughton from Standard Chartered.

## How could blockchain disrupt T2S?

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- ⚠ Real time trade settlement
- ⚠ Reduced counterparty risk
- ⚠ More efficient DVP
- ⚠ Enhanced automation

But this is all hypothetical at present

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# Operational issues to be considered

The scalability of blockchain is something that needs to be addressed. The T2S project comprises 24 CSDs across multiple markets. While blockchain's ability to handle Bitcoin transactions is not in dispute, the transactional volumes that will be occurring on T2S will be far higher, and many believe the technology is not mature enough to deal with this at the current stage.

## Scalability

The ECB estimates that daily T2S peak volumes will reach 4.7 million transactions with a value of approximately €10 trillion to €15 trillion. In contrast, daily transactional volumes in Bitcoin total around 250,000 with a value of US\$257 million. "Bitcoin had a limited scope, and blockchain has to demonstrate it is scalable before it can be considered for use alongside or within the T2S platform. I understand this is an issue proponents of the technology are trying to tackle, but until I see blockchain being deployed and working effectively on a massive scale, then I struggle to believe it will be incorporated onto T2S," said Virginie O'Shea, Research Director of Aite Group's Institutional Securities research practice.

Others agree. "Scalability is a challenge blockchain must overcome. The volume of Bitcoin transactions versus T2S will be very small. If blockchain is to truly evolve, it must prove itself beyond niche or small segments of the market. It needs to show that it can handle huge volumes of time-critical transactions in a highly regulated environment," said Naughton from Standard Chartered.

T2S will after all handle several thousands of different securities across multiple geographies over the course of each settlement day. Furthermore, one must be mindful that a securities transaction does not only comprise of a single, simple transfer of value. It may also include special ex dividends and special ex rights transactions. Transactions, unless the parties are made redundant by the new process, need to be matched or approved with all parties to the trade or settlement and maybe even the fund administrator for control purposes. Oftentimes, a single securities transaction may need to be allocated across multiple funds and beneficiaries. Nonetheless, proponents of blockchain believe the technology will be able to cope with the complexity and volume of securities transactions passing through T2S.



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## Standardisation

Perhaps the biggest impediment to blockchain's adoption or even replacement of T2S surrounds attaining an industry-wide consensus on the standards governing the technology. Industry-wide consensus on blockchain's adoption would have to be agreed between financial institutions, market infrastructures and regulators across a diverse array of geographies. "Today's distributed ledger landscape lacks standardisation at all levels – from technical protocols to ledger and transaction data formats, to smart contracts. Moreover, distributed ledger development is being completed entirely in isolation from existing business standards organisations such as ISO (International Organisation for Standardisation), ISDA (International Swaps and Derivatives Association) or FPL (FIX Protocol Ltd). The direct consequence of this lack of standardisation is that the various distributed ledgers are not interoperable and information stored on the ledger is not aligned to market standards and practices," reads a position paper published by SWIFT and Accenture.

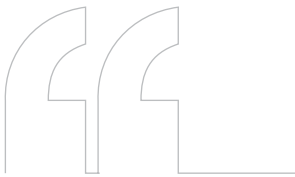
"It is essential that industry-wide standards are agreed on blockchain if it is to develop. This may include having a common language and adherence to uniform market practices around entitlements, record dates and registrations. Technical standards such as an agreed message format type to identify securities or markets and capture data would have to be decided upon. A failure to agree on standards governing blockchain will hinder interoperability between organisations. Blockchain for securities would need harmonised governance and community management and be able to interoperate on a global scale," said one expert.

A paper – "Blockchain in Capital Markets" – published by Euroclear in conjunction with Oliver Wyman said alignment would be needed in a number of areas including whether the systems are completely open or if access must be permissioned. Other issues which would need to be addressed might include the principles outlining suitability to use blockchain and safeguards against coding errors, added the paper. The pace of change in obtaining agreement in areas as sensitive as this could be slow.



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Technology upgrades and changes can be rife with operational risk and overheads. T2S has been in the mainstay for ten years and a number of financial institutions in Europe with global client bases have been building their internal architecture, at considerable cost, around T2S.

### Technology challenges

The T2S implementation programme has been in train for a decade. Market participants have been connecting to T2S through SWIFT's Value Added Network Solution or via SIA (Societa Interbancaria per l'Automazione) and COLT. A number of smaller financial institutions have connected to T2S via larger financial institutions. This has been a delicate and protracted process, which has overcome a number of technological and administrative impediments, not to mention legacy systems. Bolting on blockchain technology infrastructure to T2S could be operationally challenging, costly and even risky.

Given the systemic importance of T2S in the functioning of European securities settlement processes, any incorporation of new technology must be carefully considered. Suggestions to minimise the risk of technological error could be to run parallel infrastructures, a point made in the Euroclear and Oliver Wyman paper. Simply latching blockchain architecture onto T2S is certainly achievable but potentially costly and high-risk. However, running parallel structures would also be extremely expensive, particularly if the migration was delayed. Many of these IT systems will store huge swathes of data, and there are questions whether blockchain has the bandwidth to do this as well.

"Technology upgrades and changes can be rife with operational risk and overheads. T2S has been in the mainstay for ten years and a number of financial institutions in Europe with global client bases have been building their internal architecture, at considerable cost, around T2S. While blockchain is exciting, we must be mindful that implementing blockchain onto these proprietary technology systems is complex and risky, and could put businesses all over the world with European interests in a difficult position if there was an error," commented Naughton from Standard Chartered.

Others agree that any migration by T2S onto blockchain would be difficult. "The sheer risk of replacing these systems would be huge and there is no easy way around it. There is a reason why financial institutions do not often replace systems and back offices, which are not revenue generating. It is risky and costly and does not add to the bottom line. Furthermore, one must remember that when you replace one system, you have to make changes to every system connected to that replaced system. This can facilitate a number of problems," said O'Shea.

Should blockchain take off, its systemic importance cannot be dismissed. Having a select few blockchain providers servicing capital markets would turn those providers into systemically important entities. There are a number of blockchain providers coming to market. One market infrastructure expert highlights this presents a conundrum. "There are a number of innovations coming to market. The big issue would be if firms leverage a blockchain provider who does not become the dominant player in the space, or goes out of business. This could prove to be a costly error or worse," said the expert.

The asset manager acknowledged market participants are fully aware that technologies change rapidly and will have systems in place to deal with such disruption. "Technology in today's market is used to this problem. Digital technology is very mobile and market participants recognise that change is happening all of the time. Most firms implement technology with the view that it will have a three year life span. Reviews of the technology and its long-term prospects and viability within the business will be conducted within 18 months of its implementation usually," said the asset manager.

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Another challenge would be interoperability or lack of. If a number of blockchain providers emerge, it is crucial that their systems can co-exist and interact. “Blockchain providers need to be able to interoperate. It is crucial one blockchain can actually refer to information on another blockchain and cross-reference it,” said Powell.







If a single or multiple blockchain providers were to suffer a technological fault, hacking or default, the ramifications would be severe. A number of financial institutions have suffered cyber-attacks including information leaks or Distributed Denial of Service (DDoS) attacks by malicious parties. It is critical that any blockchain technology system has excellent cyber-protections in place. Cyber-crime is a concern for all market participants. The on-going fear of cyber-activities could be something which stymies adoption of blockchain in T2S. “Cyber-risks are a huge risk for market infrastructures. Awareness of cyber-security has increased but I do not feel blockchain proponents have done a huge amount to allay fears around this as yet,” said O’Shea. The asset manager highlighted blockchain would inevitably suffer a cyber-attack as malicious parties work out its encryption models and become increasingly sophisticated. “Dealing with cyber-crime will be a case of cat and mouse for blockchain providers, but it is something the industry should be thinking about continuously,” said the asset manager.

Mitigating this risk would require blockchain firms to have business continuity planning (BCP) in place, with technology infrastructure storing transactions in real-time on a separate server. “Cyber-crime and cyber-security is something international regulators are taking increasing note of. There have been a number of high-profile incidents. While proponents of blockchain highlight that it has excellent cyber-security, it has yet to be tested on a wider scale in a highly regulated environment. Exchanges, banks, broker-dealers and fund managers have all been impacted by cyber-crime and regulators require these financial institutions to ensure not only their own cyber-protections are fully robust but the cyber-protection measures at their service providers including technology vendors meet these standards,” said Naughton from Standard Chartered.

However, others point out blockchain has a strong cyber-security track record. “Blockchain has a robust cyber-security record so far and one could argue it is superior to existing systems. It has strong encryption and cryptography built in which protects data,” said Powell. While there were some high-profile Bitcoin hackings, this had nothing to do with the underlying blockchain technology, and this is something market participants ought to be cognisant of.

## Key operational challenges facing blockchain

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-  Scalability concerns
  -  Lack of standards
  -  Operational risk of incorporating blockchain onto legacy systems
  -  Costs of incorporating blockchain onto legacy systems
  -  Lack of interoperability between blockchain providers
  -  Cyber-security issues
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# Regulatory challenges facing blockchain and T2S

Regulators have embraced disruptive technologies as a means by which antiquated, manual, error-strewn processes could be modernised. Nothing illustrates this better than Project Innovate, an initiative jointly agreed between the UK FCA and the Australian Securities and Investments Commission (ASIC) whereby both regulators will support fintech projects in each other's market.

Despite this embrace, there is scepticism among market participants that the ECB will be as receptive to blockchain being incorporated onto T2S. "Huge amounts of money – millions of euros - and effort have been spent trying to get T2S operational at the ECB and among market participants. I believe the ECB would need to take some serious convincing around blockchain's role in T2S," said O'Shea.

Other regulatory challenges are more pronounced. Distributed ledger technology could pose major systemic risks in the event of a technical fault, cyber-attack or default. Such a scenario – and if blockchain were incorporated into T2S – would have a significant impact on securities settlement. The FCA has publicly commented on the systemic risks that could arise through blockchain. The Financial Stability Board (FSB) is exploring the issue too. IOSCO published its Securities Markets Risk Outlook 2016 report and this referenced distributed ledger technology as a phenomenon that needed to be carefully understood along with its associated risks.





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Some have warned that the shared nature of blockchain could make it difficult for regulators to impose sanctions against market participants for wrong-doing. However, this would require an entity – possibly a CSD – to assume management, trust and governance of the blockchain record. As such, this could potentially address this issue. “Blockchain must be subject to oversight, and market infrastructures and custodians are in an excellent position to assist. Organisations such as Standard Chartered are well-placed given its strength in emerging markets across APAC, MENA and Africa to assist local market participants in formulating systems to transpose blockchain onto their existing architecture and market practices,” said Naughton from Standard Chartered.

The legal challenges posed for regulators should not be underestimated. Should the technology truly take off, huge volumes of legislation will have to be rewritten or amended to take account of this. This will not be a quick process, particularly as adopting this technology is likely to have a global impact. Regulators across impacted jurisdictions would have to be involved in the process. The Euroclear paper highlights that rules around the legal definition of settlement finality would have to be revised. As such, finality in blockchain would have to be aligned with regulations such as the EU’s Finality Directive. One consultant highlighted the structure of blockchain’s records could create legal problems if regulators or laws demanded erroneous or illegal transactions be unwound.

Furthermore, outstanding issues around data security – a topic of growing prominence – would need to be resolved. There are a number of questions surrounding where the data is physically held, which could pose problems. “Regulators are always looking at where data is held, and this is something blockchain would have to address,” said the market infrastructure expert.

## Key regulatory issues facing blockchain

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- ⚠ Will the ECB be receptive to blockchain upending its T2S project?
  - ⚠ What would the implications be if regulators designated blockchain as systemically important?
  - ⚠ Lack of regulatory harmonisation
  - ⚠ Data security issues
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Huge amounts of money – millions of euros – and effort have been spent trying to get T2S operational at the ECB and among market participants. I believe the ECB would need to take some serious convincing around blockchain’s role in T2S.

**Virginie O’Shea**  
Research Director  
*Aite Group’s Institutional Securities*

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# Conclusion

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Blockchain has the potential to disrupt a number of processes including T2S and have a major impact on financial institutions globally. Nonetheless, many operational and regulatory challenges will need to be overcome before this materialises. This is likely to take several years, if not up to a decade. Standard Chartered is monitoring and reviewing the potential opportunities and challenges that blockchain may bring, and how it can be incorporated into its future business model. The bank has also begun working with clients across the globe to assess how blockchain can fit into their businesses and ecosystem.

## Key takeaways

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1 A number of financial institutions are interested in blockchain, but its adoption will not happen overnight. Rather, it could potentially take place over several years, across different aspects of financial services.



2 Blockchain offers a number of opportunities for T2S but hurdles must be overcome.



3 Blockchain must demonstrate scalability and the industry must agree on standards before it can be considered for T2S.



4 Blockchain's adoption and success is conditional on a smooth implementation and incorporation onto legacy technologies. The costs of getting this wrong could be high.



5 Blockchain must prove to the market it is secure from cyber-attacks, a phenomenon financial institutions increasingly have to deal with.



6 Regulators do encourage disruptive technologies to an extent. Blockchain, however, will face regulatory scrutiny if it becomes systemically important.

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# About the author

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Margaret Harwood-Jones is Managing Director and Head, Investors and Intermediaries for Transaction Banking at Standard Chartered Bank. Based in Singapore, Margaret joined the bank in January 2013 and is responsible for leading the business agenda for this strategic client segment on a worldwide basis, across cash management, securities services and trade finance.

Margaret has more than three decades of experience in financial services, almost 20 years of which has been within the securities services industry. Previously in senior management positions at BNP Paribas, and before that at HSBC, Margaret has undertaken roles in global sales management, relationship and service management, marketing, strategic development and business unit leadership for global custody and corporate trustee activity. Margaret is a Chartered Individual of the Securities and Investment Institute and an Associate of the Institute of Bankers. She was a founding Executive Director of the Depository and Trustee Association in the UK. Margaret holds a General Management Programme certificate granted by the European Centre for Continuing Education, INSEAD, France.

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