



European Securities and
Markets Authority

Report

The Distributed Ledger Technology Applied to Securities Markets



Table of Contents

1	Executive Summary	2
2	Introduction to DLT	4
3	Possible benefits of DLT applied to securities markets	5
3.1	More efficient post-trade processes.....	5
3.2	Enhanced reporting and oversight.....	6
3.3	Greater resilience and availability.....	6
3.4	Reduced counterparty risk and enhanced collateral management.....	7
3.5	Reduced costs	7
4	Key challenges and constraints	7
4.1	Network effect, interoperability and standardisation.....	8
4.2	Other technology related issues	8
4.3	Governance and privacy issues.....	9
5	Key risks	10
6	Interaction between the existing EU-level regulatory regime and the application of DLT to securities markets	12
6.1	Clearing activities	13
6.2	Settlement activities	14
6.3	Safekeeping and record-keeping of ownership of securities and rights attached to securities (including asset servicing).....	16
6.4	Regulatory reporting activities	17
6.5	Other possible regulatory issues	18
6.6	ESMA's way forward	18
	Appendix – Summary of the Responses to ESMA's DLT Discussion Paper	20

1 Executive Summary

The distributed ledger technology ('DLT') has quickly caught the attention of many in finance for its potential to streamline financial processes and to save costs. Many market participants are experimenting with the technology and we expect that a number of targeted applications could come to market in 2017. ESMA wants to understand both the benefits and the risks that DLT may introduce to securities¹ markets, and how it maps to existing EU regulation. In turn, our aim is to assess whether there is a need for regulatory action to facilitate the emergence of the benefits or to mitigate risks that may arise.

With the results of our April 2015 call for evidence on investments using virtual currencies or DLT, ESMA in June 2016 published a Discussion Paper ('DP') to seek feedback from the market on the technology.^{2,3} Building on the responses to the DP, the present report reflects ESMA's analysis of the key benefits and risks of DLT applied to securities markets. It then looks at how DLT interacts with the existing EU regulatory framework. The responses to the DP are summarised in Appendix.

ESMA believes that DLT could bring a number of benefits to securities markets, notably more efficient post-trade processes, enhanced reporting and data management capabilities and reduced costs. However, a number of challenges will need to be addressed before these benefits may materialise. These challenges include interoperability and the use of common standards, access to central bank money, governance and privacy issues and scalability. Importantly, despite a number of interesting proofs of concept, DLT is still at an early stage and it remains unclear if the technology will overcome all of these challenges. Also, ESMA realises that DLT may create or exacerbate some risks, although it is premature to assess the exact nature and level of those risks.

ESMA anticipates that the early applications of DLT focus on optimising processes under the current market structure. Less automated processes in low volume market segments and with minimum dependency on the existing legal framework are likely to be first targets. Meanwhile, over time, DLT may allow for the reconsideration of suboptimal aspects in the existing market structure. ESMA's role is to ensure that the regulatory framework provides relevant safeguards to investor protection, financial stability and orderly markets.

Supporters and developers of the technology should be aware of the existing rules when designing DLT solutions. Indeed, the presence of DLT does not liberate users from complying with the existing regulatory framework, which provides important safeguards for the well-functioning of financial markets. Importantly, ESMA sees as unlikely for DLT to eliminate the need for financial market infrastructures, such as Central Counterparties ('CCPs') and Central Securities Depositories ('CSDs'). Yet, ESMA realises that DLT may render some processes redundant or change the role of certain intermediaries through time. On the one hand, some regulatory requirements could become less relevant, while, on the other hand, additional requirements may be needed to mitigate emerging risks.

At this stage, ESMA believes that it is premature to fully appreciate the changes that the technology could bring and the regulatory response that may be needed, given that the technology is still evolving and practical applications are limited both in number and scope. In the responses to our DP, ESMA has not identified major impediments in the EU regulatory framework that would prevent the emergence of DLT in the short term. Meanwhile, a number of concepts or principles, e.g., the legal certainty attached to DLT records or settlement finality, may require clarification. Also, ESMA realises that beyond pure financial regulation, broader legal issues, such as corporate law, contract law, insolvency law or competition law, may impact on the deployment of DLT.

ESMA will continue to monitor market developments around DLT to assess whether a regulatory response may be needed. Active engagement from regulators and coordination at EU and international level are paramount in ESMA's view to ensure both that DLT does not create unintended risks and that its benefits are not hindered by undue obstacles. Meanwhile, ESMA believes that the industry should work towards solutions to address the challenges posed by the technology.

¹ The term 'securities' is used as a synonym for financial instruments in this report

² As a reminder, ESMA began analysing virtual currencies in 2013. It was public knowledge that a number of investment products using virtual currencies as underlying assets were launched into the market. The phenomenon was marginal at that time but ESMA believed it should be monitored as it had the potential to become more widespread and to create new risks to investors. ESMA was also aware that attention was shifting from virtual currencies to the technology underpinning them. In April 2015, ESMA published a [call for evidence on investments using virtual currencies or the distributed ledger technology \('DLT'\)](#). The results of the call for evidence showed that investments using virtual currencies as underlying remained marginal. However, the underlying technology had the potential to be used by financial markets outside the space of virtual currencies with possible disruptive effects. Hence, ESMA decided to analyse the possible impact of the application of DLT to securities markets.

³ [ESMA Discussion Paper on DLT applied to securities markets, June 2016](#)

2 Introduction to DLT

1. Distributed ledgers - sometimes known as 'Blockchains' - are essentially records, or ledgers, of electronic transactions, very similar to accounting ledgers. Their uniqueness lies in the fact that they are maintained by a shared or 'distributed' network of participants (so-called 'nodes') and not by a centralized entity, meaning that there is no central validation system. Another important feature of distributed ledgers is the extensive use of cryptography, i.e. computer-based encryption techniques such as public/private keys and hash functions, to store assets and validate transactions.
2. Until today the most widely known application of DLT is the public ledger of transactions for virtual currencies, such as Bitcoins. More recently, the idea has spread that the use of distributed ledgers could be extended to traditional financial services. Some market participants and market infrastructures have publicly commenced working on initiatives to leverage this technology.
3. Importantly, ESMA understands that the DLT that would be used for financial services would differ from the Blockchain designed for Bitcoins in a number of ways. In particular, while the Bitcoin Blockchain is an open system where all can contribute to the validation process ('permissionless' system), the DLT that is likely to be used in financial markets would be a permissioned system with authorised participants only. Permissioned DLTs have a number of advantages compared to permissionless systems when it comes to governance issues, scale or the risk of illicit activities, which makes them more suitable for securities markets. Yet, some of the benefits attached to permissionless frameworks, e.g. 'openness', may be lost in a permissioned framework. In line with current market initiatives in securities markets, the rest of the report deliberately focuses on permissioned DLT.
4. ESMA assumes that the readers of this report are familiar with the concepts underlying DLT. More information on DLT and its functioning is available in the ECB Occasional Paper 'DLTs in securities post-trading: revolution or evolution'.⁵ Also, ESMA realises that several variations of permissioned DLT exist. For ease of reference, ESMA uses the term DLT in singular in the rest of the document.
5. Finally, although ESMA is aware of the payment risks raised by virtual currencies such as Bitcoin, our focus, as a securities regulator, is on the application of the technology to securities markets.

⁴ ESMA recognises that there are currently two terminologies used interchangeably to qualify the type of DLT networks: permissioned or restricted networks and permissionless or unrestricted networks. ESMA uses 'permissioned' and 'permissionless' in this report.

⁵ [ECB occasional paper 'DLTs in securities post-trading: revolution or evolution'](#), April 2016

3 Possible benefits of DLT applied to securities markets

6. ESMA believes that DLT could bring a number of benefits to securities markets. Meanwhile, those benefits come with a number of conditions. This section of the report sets out our analysis of the potential benefits of DLT, which can be grouped into four categories, namely (i) more efficient post-trade processes, (ii) enhanced reporting and supervisory functions, (iii) greater security and availability and (iv) reduced counterparty risk and enhanced collateral management. A fifth benefit, which would follow on from the former, are reduced costs for providers of financial services and ultimately their users. We discuss the conditions that will need to be met for those benefits to materialise in the following section.
7. Importantly, our analysis reflects our current understanding of the technology which may evolve over time as the technology matures. Also, one should not assume from the analysis below that these benefits are unique to DLT, as certain existing technologies or technological developments may bring similar benefits.

3.1 More efficient post-trade processes

8. ESMA believes that DLT could accelerate the clearing and settlement of certain securities transactions. It may also facilitate the safekeeping and the record-keeping of ownership of certain assets by providing a single 'golden record' that would be shared across market participants. These enhancements would be particularly useful for those assets for which post-trade processes are very cumbersome today.
9. In theory, clearing and settlement could become almost instantaneous with DLT, as trade confirmation, affirmation, allocation and settlement could be combined into a single step and reconciliations would become virtually superfluous. This would in turn have a number of benefits, including reduced counterparty risk (see below), and potentially reduced settlement failures and penalties. Yet, various factors beyond technology, e.g., the time needed to perform compliance checks or to fund positions may impact on settlement timeframes. Moving from the current T+2 standard to (almost) instantaneous settlement would require a number of changes to existing market practices, which may increase costs and risks. In turn, the expected benefits of real-time settlement would need to be balanced against the possible downside risks and costs. Flexible settlement timeframes may be preferable to mandatory real-time settlement for all securities transactions.
10. DLT may facilitate the recording of ownership of a variety of securities and the safekeeping of certain assets. It may enhance the traceability of transactions and make ultimate ownership transparent throughout the security life cycle. As an example, ESMA is aware that some companies have started to use DLT to issue private shares and keep shareholders' records.

11. The use of so called 'smart' contracts, i.e., self-executing pieces of codes translating contractual terms into computational material, could enhance the enforcement of contract terms and the automation of back office processes, e.g., the processing of some corporate actions. This could in turn reduce errors and legal disputes. The concept of smart contract existed before DLT but ESMA believes that the technology could accelerate its development. There does appear to exist successful non-financial markets applications of smart contracts that leverage on DLT.

3.2 Enhanced reporting and oversight

12. ESMA believes that DLT could enhance reporting and supervision functions at firms and regulators, by facilitating the collection, consolidation and sharing of data for reporting and risk management purposes. With a DLT record application, multiple market participants may access a single accurate and verifiable ledger source in real time. As far as regulators are concerned, they could be granted special access rights to consult or retrieve data stored on DLT ledgers, e.g., details on transactions made by some market participants or their risk exposure levels.
13. Yet, because DLT was not originally designed for reporting or risk management purposes, ESMA believes that it may lack some of the features of traditional reporting and risk management tools. Its use for reporting or risk management purposes may be more resource intensive and complex than anticipated. Also, the potential benefits for regulators of having direct access to the data would need to be carefully weighed against the potential reputational risks, e.g., it might lead to a sharing of responsibility between firms and regulators. Furthermore, the mentioned benefits need to be squared with the decentralised supervision of the different nodes which might be less effective than the supervision of a central market infrastructure.
14. Know Your Customer and Anti-Money Laundering processes could also leverage on the technology, e.g., to store or share information on customers. Another expected advantage of DLT is that it may increase the traceability of transactions. Potential privacy issues would need to be carefully managed though, as we discuss below.

3.3 Greater resilience and availability

15. DLT might have certain advantages relative to current systems when it comes to security and resilience to a cyber-attack or a system breakdown. The distributed and shared nature of the system could facilitate the recovery of both data and processes in the case of an attack (assuming that not all the nodes are corrupted simultaneously). This could reduce the need for costly recovery plans. Sophisticated encryption techniques could also provide an additional layer of protection to pools of information stored on DLT compared to existing systems. Nonetheless, ESMA believes that the risk of a cyber-attack would still need to be considered seriously in a DLT context as discussed below.

16. Several features of DLT, including its global nature and heightened automation, support the case for a high degree of accessibility. Yet, ESMA believes that the complexity of a system running on a continuous basis should not be underestimated. Also, the resilience and availability of DLT remains to be tested, including when large volumes are involved.

3.4 Reduced counterparty risk and enhanced collateral management

17. Shorter settlement cycles should reduce counterparty credit risk for spot trades, as risk exposure to the transaction settlement time span is reduced. In turn, there may be reduced need to mitigate counterparty risk through central clearing and collateral posting.
18. For term transactions that require the posting of collateral to cover counterparty risk, DLT could facilitate reconciliations and accelerate collateral movements. This could ultimately lead to more collateral being available in the market. Market liquidity may improve as a result, although the need to have funds or assets immediately available may exacerbate the strain on liquidity in times of stress.

3.5 Reduced costs

19. The above benefits could lead to a reduction in costs for post-trade processes, including clearing, settlement, custody, registrar and notary services in the medium to long term, once investment and transitional costs have been amortized. Reporting, compliance and risk monitoring costs may decrease as well.

4 Key challenges and constraints

20. Although ESMA believes that DLT may bring benefits to securities markets as discussed above, we accept that those benefits are conditional on a number of elements. Firstly, most of the DLT expected benefits assume that it will be broadly adopted by market participants – even if this adoption only concerns targeted market products or segments in the first stage – which raises a number of questions around a possible ‘network effect’, interoperability and standardisation, not to mention more specific technology issues.
21. Secondly, supporters of the technology will need to agree on a governance framework that provides relevant safeguards to the users of the technology and their clients. The management of potential privacy issues is an important consideration. Finally, regulatory and legal issues need careful consideration. These challenges and constraints are discussed in greater detail below. We discuss regulatory and legal issues separately in section 6.

4.1 Network effect, interoperability and standardisation

22. It seems unlikely that DLT will be deployed across the securities markets at once. A more likely scenario, assuming that a number of challenges are addressed, is a gradual deployment. Yet, an application that would be limited to a specific market segment would still require that a critical mass of the market participants in that segment embrace the technology to reap its benefits. This 'network effect' implies that stakeholders are convinced that there is an interest, from a business and economic perspective, to move from the existing systems to DLT. This will not happen without concrete and compelling business cases. Noteworthy, those market segments where a network effect could be triggered more easily, e.g., those with fewer stakeholders, might see the first applications.
23. If DLT deployment is gradual while several DLT networks co-exist, DLT-based systems will need to be able to interoperate with each other and with legacy systems. This will require harmonised technology standards and possibly the use of a universal standard for reference data. Importantly, the use of a universal standard for reference data will also be paramount for many of the benefits of DLT to materialise, e.g., to reduce reconciliation needs and establish a single source of truth. Efforts to establish technology standards are underway with some market initiatives but it remains to be seen whether they will be successful. As far as reference data are concerned, the industry currently maintains various identifiers and the adoption of a universal standard remains a challenge.
24. Another related challenge that may determine the adoption of the technology is the ability to provide Delivery versus Payment (DvP) settlement, in particular in central bank money. Indeed, a reduction of counterparty risk would be conditional on having settlement in central bank money on or connected to the ledger. ESMA is aware that market participants are analysing different solutions for that purpose, including the use of so-called settlement coins. Those solutions will require support from central banks to varying degrees. However, in the absence of central bank money settlement, it is important to stress that the technology could still provide some benefits, e.g., in case where solutions using commercial bank money exist.

4.2 Other technology related issues

25. The capacity of DLT to handle large volumes of transactions remains largely untested in ESMA's view, even if we understand that scale will be less of an issue for permissioned DLT compared to the original permissionless Bitcoin blockchain. The degree to which scalability might be a challenge will of course depend on the applications. Indeed, relatively low volume market segments, e.g., private shares or bank loan securities would represent less of a challenge. Meanwhile, scalability would be critical for products such as listed securities where volumes processed are high.

26. The DLT that was originally designed for Bitcoin created immutable records, meaning that transactions once validated cannot be modified, cancelled or revoked. While this immutability had clear benefits in a permissionless DLT framework, it appears ill-suited to securities markets, e.g., operational errors may necessitate the cancellation of some transactions. ESMA is aware that some progress is being made on designing recourse mechanisms for DLT applied to securities markets. Importantly, beyond technology, ESMA underlines the need for these recourse mechanisms to be carefully designed from a governance perspective, in order to avoid issues such as the ones recently highlighted by the DAO case⁶.
27. Additional functionalities, such as netting, would also be needed, if DLT were truly aimed at replacing the sophisticated systems currently in use in the post-trade industry, e.g., clearing or collateral management systems. For example, in the case of centrally cleared OTC transactions, position margins and collateral requirements are computed and settled on a net basis. Also, margin finance currently allows market participants to transact with assets financed externally. Based on the feedback received to our DP, stakeholders seem confident that technical solutions will be developed to take these constraints into account.

4.3 Governance and privacy issues

Governance issues

28. Securities markets are organised around networks of trusted parties with robust governance frameworks. These governance frameworks are either prescribed by regulation or are the result of agreements between participants. They are meant to support trust by establishing the obligations, the liabilities and rights of the participants.
29. ESMA stresses that market participants should put in place appropriate governance frameworks if they want to employ DLT in securities markets. For example, we expect those governance frameworks to include provisions on the liability of the respective parties, rules to approve/reject authorised participants, correction mechanisms, applicable law in case of disputes etc. Also, they would have to be tailored to the features and functions of DLT. Noteworthy, whenever applicable the existing regulation provides a number of requirements already, as we discuss in section 6.

Privacy issues

30. Another characteristic of securities markets is the privacy of some information. For example, the identity of a party to a transaction is, in most instances, not public unless legal provisions require the disclosure of this information. Therefore, it is of utmost

⁶ <http://qz.com/730004/everything-you-need-to-know-about-the-ethereum-hard-fork/>

importance that DLT networks are designed in a way that protects privacy when necessary.

31. ESMA understands that some solutions to potential privacy issues are being developed. For example, the use of specific encryption identifiers (i.e., private keys) would allow that only the two parties to a given transaction have access to the full details of the transaction. Yet, we are unsure as to how this would interface with the need to have some form of publicity with other market participants in order to validate the transaction. Importantly, the operation of those private keys would need to be carefully designed and controlled to prevent a series of risks, e.g., the risk of illicit activities as we discuss later. Also, while the use of private keys and encryption could help address some of the issues, they might not suffice to guarantee the privacy that would be needed, e.g., we could imagine a situation where the identity of a market participant, although technically unknown, is inferred from its trading patterns recorded in the system.

5 Key risks

32. While ESMA believes that DLT could bring benefits under certain conditions, we also believe that it may give rise to new types of risks or exacerbate existing risks. The section below analyses the key risks that deserve close monitoring in a DLT environment, based on our understanding of the technology. Importantly, we realise that the level and scope of the risks will vary depending on the type of activities, asset classes or volumes involved and the features of the DLT solutions that are deployed, e.g., requirements applicable to authorised participants. Other risks may emerge as DLT expands.
33. Given the novelty of the technology and the anonymity supposedly attached to the use of encryption, cyber risk and the risk of fraudulent activities are often cited as priorities to be considered with DLT. While ESMA acknowledges the importance of those risks, we also believe that other risks, such as operational risks, should not be underestimated in a DLT context. Risk to fair competition and orderly markets will deserve close attention, although a robust governance framework may provide some useful mitigants. Risk to financial stability, through increased market volatility or interconnectedness, appears relatively remote today, considering that DLT's applications are likely to remain limited in scope in the short term but will deserve monitoring as DLT develops. Supporters of the technology should be mindful of those risks when designing and applying DLT solutions. ESMA will monitor DLT developments to assess whether they create risks that may be left unaddressed by the current EU regulatory framework.

Cyber risk

34. ESMA realises that DLT has a number of interesting features from a cyber security standpoint, as discussed above. Yet, we remain cautious as to the capacity of DLT to significantly reduce cyber risk. First, the technology is at an early development stage and largely untested. Second, the 'cracking' of the encryption algorithms, although it is

considered unlikely today, remains possible. In addition, technical evolutions, e.g., quantum computing, may render the security schemes inherent to current DLT systems irrelevant through time. Also, the security of the entire network remains dependent on its 'weakest link', e.g., an attacker could step into the breach created by one single unsecured node.

Risk of fraudulent activities and money laundering

35. ESMA expects that in a permissioned DLT framework authorised participants would be required to have risk mitigation techniques similar to those applied by market participants today to prevent the risk of fraud or anti-money laundering. In that case, ESMA anticipates that those risks would not materially increase with DLT. DLT might even facilitate KYC and AML checks by enhancing the traceability of transactions. That being said, in the absence of relevant controls, those risks would be exacerbated as cryptography could be used to conceal identities and undertake fraudulent activities. Importantly, ESMA sees the security of private keys as paramount in a DLT context, as lost or stolen keys might easily be used for illicit purposes.

Operational risks

36. DLT could in principle help mitigating operational risks, due to a greater standardisation and automation of post-trade services. However, ESMA believes that DLT might facilitate the dissemination of errors, unless a number of checks are implemented. If left unnoticed, a mistake in the coding of smart contracts or reference data might affect a greater number of participants, not to forget the additional time that might be needed to correct a mistake once identified. Similarly, a glitch or failure might have wide consequences with DLT as many parties would share the same tools.

Risk to fair competition and orderly markets

37. ESMA anticipates a number of potential fair competition issues with DLT, although some of these issues may not be unique to DLT. Early participants might refuse or impose conditions on new members that make it unduly difficult or costly for them to join the DLT network. The governance that would apply to the network, including the requirements imposed on authorised participants, will be crucial. Also, it may become increasingly difficult to develop competing systems through time for cost or technical reasons, e.g., patents that would protect certain components of the technology or the need to ensure interoperability with existing systems. This could drive some firms out of the market and lead to a monopoly-like situation with negative consequences on the cost and quality of the services.
38. The shared and public features of DLT could facilitate market manipulation and other unfair practices. In the absence of proper safeguards, some could unduly exploit the information recorded in DLT, e.g., recent trades or inventories levels of other participants, to front-run competitors or manipulate prices. The need to have some level of transparency – transparency underpins the trust in DLT – and the need to protect

potentially sensitive information through privacy rules needs to be carefully balanced. Here again the governance framework has a key role to mitigate risks.

Systemic risk - Market volatility, interconnectedness and liquidity risk

39. Under certain market circumstances, ESMA believes that DLT may contribute to increase market volatility. Smart contracts in particular, because of their embedded automated triggers, might exacerbate one-directional market reaction in times of stress. DLT could also increase interconnectedness between market participants. Shorter settlement timeframes might have unintended consequences on liquidity. ESMA anticipates that these risks may be relatively low in the short term when DLT applications are limited in scope, but could increase as the technology develops.
40. Another risk that ESMA sees is the risk that DLT's applications are targeted to those market segments and asset classes that are less regulated. This risk will deserve close monitoring to prevent the emergence of systemic risk.

Other risks

41. Another concern is that DLT may increase complexity rather than simplify financial services and processes in the short term. Indeed, it is likely that DLT would be deployed gradually, meaning that it would co-exist with current systems. This could increase operational risks and market fragmentation. Also, the use of sophisticated encryption techniques could effectively render risk monitoring at firms and supervision by competent authorities more complex, at least in a first stage. The fact that DLT-related knowledge and skills are currently concentrated in the hands of a small number of people is another potential source of concern.
42. Finally, ESMA realises that the use of DLT could in some cases raise privacy risks in relation to client data.

6 Interaction between the existing EU-level regulatory regime and the application of DLT to securities markets

43. In this section, ESMA sets out its analysis of how DLT would map to the existing EU regulatory framework depending on its applications to securities markets. Our objective here is to draw stakeholders' attention on the key requirements likely to apply. Indeed, market participants willing to use DLT in securities markets should be mindful of the existing EU regulatory framework, even if the current rules were not designed with this innovation in mind.
44. Considering that DLT is likely to be used primarily for post-trading activities, i.e., clearing, settlement and securities servicing, at least in the first stage, our focus is on the main EU pieces of legislation on post-trading activities, namely the European Market

Infrastructure Regulation (EMIR)⁷, the Settlement Finality Directive (SFD)⁸, the Central Securities Depositories Regulation (CSDR)⁹. Other pieces of legislation such as the Markets in Financial Instruments Directive (MiFID II)¹⁰, the Markets in Financial Instruments Regulation (MiFIR)¹¹, the UCITS Directive¹² and the Alternative Investment Fund Managers Directive (AIFMD)¹³ for the record-keeping of ownership are also discussed. Other pieces of legislation such as the Securities Financing Transaction Regulation (SFTR)¹⁴, the Directive on Financial Collateral Arrangements (FCD)¹⁵, the Market Abuse Regulation¹⁶, the Anti-Money Laundering Directive¹⁷ or the Short Selling Regulation¹⁸ could be relevant as well but are not discussed in this report. Notwithstanding the binding regulatory requirements likely to apply, some global standards, like the CPMI-IOSCO Principles for Financial Market Infrastructures¹⁹, may also provide useful guidance on the requirements that would need to be applied to DLT.

45. Importantly, this analysis does not pretend to be exhaustive, considering that the technology is still at an early stage. Equally important, ESMA's purpose in this report is not to make any recommendations on possible ways to address the regulatory challenges that DLT could raise at this stage.

46. ESMA's understanding is that the current EU regulatory framework does not represent an obstacle to the emergence of DLT in the short term. Meanwhile, some existing requirements may become less relevant through time. New requirements might on the contrary be needed to address emerging risks. Also, a number of concepts or principles, e.g., the legal certainty attached to DLT records or settlement finality, may require clarification as DLT develops.

6.1 Clearing activities

47. In the EU, clearing activities are governed by EMIR and MiFIR. EMIR provides that certain classes of over-the-counter (OTC) derivative transactions have to be cleared through Central Counterparties (CCPs) and that risk mitigation techniques need to be applied for other types of OTC transactions. MiFIR extends the clearing obligation by CCPs to regulated markets for exchanged-traded derivatives. In addition, clearing may be used for other types of transactions (e.g., transactions of shares or bonds),

⁷ Regulation (EU) No 648/2012.

⁸ Directive 2009/44/EC

⁹ Regulation (EU) No 909/2014

¹⁰ Directive 2014/65/EU

¹¹ Regulation (EU) No 600/2014

¹² Directive 2009/64/EC

¹³ Directive 2011/61/EU

¹⁴ Regulation (EU) No 2015/2365

¹⁵ Directive 2002/47/EC

¹⁶ Regulation (EU) No 596/2014

¹⁷ Directive 2005/60/EC

¹⁸ Regulation (EU) No 236/2012

¹⁹ See <http://www.bis.org/cpmi/publ/d101a.pdf>

depending on market practice. In the latter case, clearing may be done through CCPs or other entities.

48. From the responses to our DP, ESMA understands that the various scenarios presented in the DP may possibly materialise. However, their likelihood and expected implementation timeframe may vary.
49. The clearing of some spot transactions with DLT as the underlying seems the more likely near term scenario. Spot transactions are not in scope of the clearing obligation under EMIR and MiFIR and any initiatives seeking to combine the clearing and the settlement steps would not be affected by these regulations. If these assets are cleared by entities other than CCPs, there is no rule at EU level on the form that these entities must take and their governance. For the time being, this type of entity is not common and most regulated markets have chosen to use CCPs not only for derivatives but also for spot transactions. It is important to recall that CCPs are subject to EMIR requirements for all their activity, i.e. for all the products cleared.
50. With respect to the clearing of OTC derivative transactions it is important to make the distinction between OTC derivative transactions subject to the clearing obligation by CCPs and OTC derivative transactions not subject to the clearing obligations by CCPs. For the former type of OTC derivative transactions, if market participants were to set up a DLT network to clear these transactions, the DLT network would need to comply with requirements set by EMIR. In particular, this means that a CCP would still be needed, i.e., the network would need to meet the definition of a CCP under EMIR and obtain a CCP authorisation or an existing CCP would need to join the network.²⁰ From a business perspective, this would be consistent in our view with the need to mitigate counterparty risk (indeed, even in a DLT context with instantaneous settlement, the need to mitigate counterparty risk would remain for derivatives instruments because of their term structure).
51. For non-centrally cleared OTC derivative transactions, the bilateral exchange of margin could possibly be accommodated via DLT. Indeed, for OTC derivative transactions not cleared by a CCP, EMIR requires a range of risk mitigation techniques but does not prescribe the type of technology to be used for these mitigation techniques. That being said, this implies that DLT would have the capacity to accommodate those risk mitigation techniques.

6.2 Settlement activities

52. Settlement activities are mainly governed by CSDR and SFD. The aim of CSDR is to harmonise certain aspects of the settlement cycle, settlement discipline and provide a set of common requirements for Central Securities Depositories (CSDs) operating

²⁰ the same requirements apply for the clearing of exchange-traded derivatives for which Article 29 of MiFIR extends the clearing obligation by CCPs to these types of financial derivatives.

securities settlement systems within the EU. CSDR plays a pivotal role for post-trade harmonisation efforts in Europe, as it enhances the regulatory and operational conditions for cross-border settlement in the EU. It applies to the settlement of transactions in all financial instruments as defined by MiFID II and activities of CSDs, unless specified otherwise in a given provision of CSDR.

53. SFD aims at reducing the systemic risk associated with participation in payment, clearing and securities settlement systems, and in particular the risks linked to the insolvency of a participant in such a system. SFD applies to systems duly notified as well as any participant in such a system, and to collateral security provided in connection with the participation in a system, or operations of the central banks of the Member States in their functions as central banks. In line with ESMA's remit, we focus on the SFD applied to securities settlement systems, and not payment systems.
54. ESMA is aware that some market participants are testing the technology for settlement purposes. Also, the vast majority of the respondents to our DP confirmed that settlement was a key potential application for DLT, and that all three scenarios described by ESMA in the DP could materialise. Yet, based on the feedback to our DP, we feel that it is premature to form a view on the exact form and scope that DLT applications could take in the settlement space.
55. Some market participants could in theory set up a DLT-enabled settlement platform that would rest outside the scope of SFD and CSDR, e.g., because it would not be designated as a securities settlement system under the SFD (and therefore it could not be a CSD as defined in the CSDR), and it would not act as a settlement internaliser as defined in the CSDR either. Yet, its scope of activities would be limited to the settlement of transactions of securities that fall outside of CSDR, i.e., it would not cover the settlement of transactions in transferable securities admitted to trading on EU trading venues or transferable securities transferred following a financial collateral arrangement as defined in the Financial Collateral Directive (FCD).
56. The scenario under which the DLT network acts a settlement internaliser as defined in the CSDR is also possible. This would require that the DLT network has direct access (as a CSD participant) or intermediated access to a CSD. In such a case, the DLT network would need to comply with the internalised settlement reporting requirements under CSDR.
57. It is important to highlight that, in the two scenarios mentioned above, the risk mitigants provided by SFD and CSDR, e.g., the obligations to settle on the intended settlement date, to monitor and resolve settlement fails, protection mechanisms in case of insolvency, etc., would not apply, which would create potential risks for the users of the DLT network and the market more broadly. A robust governance framework, including rules that would frame the obligations and liabilities of participants could help address certain risks.

58. ESMA will monitor market developments to see whether such scenarios arise. In any case, ESMA would expect DLT settlement platforms to be designated as securities settlement systems by Member States, as soon as the risks involved become material.
59. A third scenario where DLT might materialise, would be the case where market participants were willing to use DLT to settle securities transactions in the scope of CSDR. In this case, an authorised CSD would need to be involved i.e., the network would need to obtain a CSD licence or an existing CSD would need to start using DLT. Importantly, this would imply that the technology allows compliance with all of the regulatory obligations and standards under CSDR and the CPMI-IOSCO principles, including the provision of Delivery versus Payment (DvP), settlement finality, operational resilience and cyber resilience.
60. An important aspect that will need to be assessed is how settlement finality is ensured in a DLT environment both from an operational perspective and from a legal perspective.
61. As most CSDs offer settlement in central bank money, which is a practice encouraged by the CSDR, the provision of DVP settlement in central bank money in a DLT environment is an important aspect that would need to be considered. ESMA is aware that several firms are exploring alternative solutions including so-called 'settlement coins' or the issuance of central bank money directly on DLT. ESMA will continue to monitor market developments to assess the strengths and weaknesses of the proposed solutions.

6.3 Safekeeping and record-keeping of ownership of securities and rights attached to securities (including asset servicing)

62. There is no harmonised definition of safekeeping and record-keeping of ownership of securities at EU-level and this task is performed by a wide range of entities such as custodian banks, registrars, notaries, depositaries or CSDs. The rules also depend on whether the record-keeping applies at the issuer level (notary function) or investor level (custody/safekeeping function).
63. At the issuer level, the rules are dependent on each national corporate law.²¹ At the investor level, depending on the type of investor, the rules will vary across several sectorial legislations such as MiFID II, the UCITS V Directive or the AIFM Directive. Moreover, the rules will also vary according to the national legislation applicable to securities and the rights attached to securities, which is not harmonised at EU level.
64. ESMA believes that DLT could potentially facilitate the safekeeping of assets and recording of ownership, provided a number of pre-requisites are met, as discussed below. This is also consistent with the views expressed by the respondents to our DP

²¹ Pursuant to Article 49(1) of CSDR, Member States shall communicate to ESMA a list of the key relevant provisions of their corporate or similar laws and ESMA shall publish this list. The list is available at: https://www.esma.europa.eu/sites/default/files/library/provisionsofmemberstateslaws_art_49csdr.pdf.

and also the fact that at least one market participant has already launched a DLT platform to track and record the ownership of securities. Yet, ESMA foresees a number of potential regulatory challenges mainly in relation to national rules and the lack of harmonisation across jurisdictions of security ownership, company and insolvency laws.

65. Firstly, national rules may provide that some securities may not be fully dematerialised. For example, in Germany, issuers have to create a physical certificate for the issuance of securities in accordance with civil law requirements. Although DLT may be used to record title to those securities the need to maintain the physical certificates would remain. In those circumstances, whether DLT records would be considered as evidence of ownership in case of a dispute remains uncertain.
66. Secondly, the onus to confirm legal title to securities may fall on different financial intermediaries, e.g., custodians, registrars, notaries or CSDs, depending on national law. In the same way that authorised CSDs would be needed for certain types of settlement activities (see above), certain types of authorised intermediaries might therefore be needed for safekeeping and recording of ownership purposes in a DLT context. Those authorised intermediaries would need incentives to move to DLT from a business perspective. They would also need to ensure that the technology allows them to fulfil their regulatory obligations. Importantly, the type of authorised intermediaries that would be required by law may vary across countries.

6.4 Regulatory reporting activities

67. Several legislations such as MiFID, EMIR and SFTR have introduced reporting obligations for a wide range of stakeholders, including market participants, national competent authorities or market infrastructures.
68. Under EMIR, information on OTC derivative transactions and exchange traded derivative transactions, whether cleared or not, has to be reported to trade repositories. Under SFTR, a similar reporting obligation covers securities financing transactions.
69. Trade repositories are registered legal entities supervised by ESMA. They have to comply with a wide set of rules provided by EMIR and SFTR. In particular, the regulation imposes strict operational, record-keeping and data-managements requirements to trade repositories.
70. Most respondents to the DP agreed that DLT could be used for regulatory reporting, or more broadly for reporting purposes. Those parties that are subject to regulatory reporting requirements could use certain DLT applications or DLT supported functions to fulfil their reporting obligations in accordance with the applicable regulatory and supervisory reporting requirements. Trade repositories also could leverage the technology.

71. ESMA realises that some changes to the existing regulatory requirements may be needed, e.g., if DLT is widely deployed across securities markets and regulators have a direct access to the information stored on DLT. This scenario seems relatively remote for the time being.

6.5 Other possible regulatory issues

72. Another important legal issue, although not new when it comes to post-trade activities, would be to determine the applicable law. As an example, national laws may provide that a security is governed by the law of the place where the security is located/registered or where the records of the security are kept. In a DLT environment, it might be less clear where the securities and their records are located.
73. DLT could introduce new functions or roles. Examples include the provision and maintenance of DLT infrastructure and protocols, the coding and management of smart contracts, the creation and storage of private keys, etc. Those do not explicitly fall in the scope of CSDR or other EU legislation, and could in principle be performed by entities other than the existing market infrastructures providers. Regulators would need to decide whether and how they might want to regulate those functions, considering the potential risks. Importantly, any regulatory action targeted at those functions would need to be considered in a broader context to avoid any unintended consequences, e.g., an unlevel playing field for incumbent firms and new players. Also this might trigger the need for regulators and supervisors to adapt some of the current supervisory practices.
74. Finally, ESMA anticipates that other legal questions will arise as the technology develops and its applications become more tangible.

6.6 ESMA's way forward

75. ESMA will continue to monitor market developments around DLT to assess whether regulatory action may be needed. At this stage, ESMA believes that it is premature to fully appreciate the changes that the technology may introduce and that any regulatory action would be precipitate. In light of the responses to the DP, ESMA has not identified major impediments in the current EU regulatory framework that would need to be addressed in the short term to allow for the first applications of DLT to securities markets to emerge in a scenario where DLT would be used to optimise processes within the current market structure.
76. Meanwhile, a number of concepts or principles, e.g., the legal certainty attached to DLT records or settlement finality, may require clarification. Also, ESMA realises that, beyond financial regulatory issues, broader legal issues, such as securities ownership, company law, insolvency law or competition law, may have an impact on the deployment of DLT.
77. Active EU and international regulatory engagement and cooperation are paramount in ESMA's view to ensure both that the DLT does not create unintended risks and that its

benefits are not hindered by undue obstacles. ESMA has noted that some national regulators have launched or are considering launching initiatives to foster the emergence of innovations such as DLT, in their jurisdiction. Those initiatives may facilitate innovations beneficial to securities markets and investors (though clearly must avoid unintended consequences, e.g, the potential for regulatory arbitrage).

78. ESMA believes that the industry should work towards solutions to the issues the technology poses. A clear direction and decision on the application of DLT to securities markets from market participants will help structure the dialogue between the market participants and regulators.

Appendix – Summary of the Responses to ESMA’s DLT Discussion Paper

Q1, Q2, Q3 - Do you agree with the list of possible benefits? Do you see any other potential benefits? How would these benefits be affected if DLT were not applied to the entire security lifecycle?

Clearing and settlement

1. Most respondents believe that DLT could increase the speed and efficiency of post-trade processes, in particular the clearing and settlement of certain financial transactions. However, several respondents highlighted that other technologies could provide similar benefits.
2. Many respondents do not consider combining clearing and settlement into a single step as a priority. They also wonder about the possible spill-over effects, e.g., on liquidity, of instantaneous clearing and settlement. They envisage flexible settlement cycles rather than a compulsory T1 or T0 settlement as a real improvement. As to cross border operations, while a single shared solution (DLT or any other technology already available) would be helpful to accelerate flows, other elements, e.g., funding timelines, foreign exchange constraints and the need to perform compliance checks, are important elements to consider.

Record of ownership and safekeeping of assets

3. The vast majority of respondents agree that DLT could facilitate the record of ownership and the safekeeping of assets, by providing a single source of truth and by making ultimate beneficial ownership transparent through the life of an asset and through the custody chain. Many highlight the importance of smart contracts, e.g., to enhance the processing of corporate actions. Yet, several respondents point to the need to move to universal standards to reap the benefits of DLT, which is likely to raise a number of challenges.
4. A number of respondents wonder how the role of custodians and CSDs might evolve with DLT. While some believe that these intermediaries could in theory become somewhat redundant, others insist that CSDs perform certain functions, e.g., notary or registration functions, that will remain necessary in a DLT environment.

Reporting and oversight

5. Facilitating the collection, consolidation and sharing of data for reporting, risk management and supervisory purposes was also mentioned as one of the potential key benefits of DLT. Two respondents raised some concerns on the difficulties that regulatory bodies might experience in adapting to DLT systems. Another respondent highlighted that DLT might be less user-friendly than current reporting systems but that a number of vendors were developing interfaces between DLTs and conventional reporting databases.

Counterparty risk

6. Most respondents agree that shorter settlement cycles could reduce counterparty risk. However, they highlight the need to distinguish between cash 'spot' transactions and transactions with a maturity, such as derivatives, for which counterparty risk has to be managed throughout the life of the instrument. Also, eliminating counterparty risk for 'spot' transactions would require that the trading is either on DLT or can be transferred to the clearing system in real-time.
7. Although some feel that the role of CCPs may evolve with DLT, it is a shared opinion that DLT would not eliminate the need for CCPs, for derivatives transactions and also for 'spot' transactions to the extent that there will still be potential delays between execution and settlement which will retain the need for clearing. Also, multilateral netting, which is another function of CCPs, does not seem to apply as effectively across multiple counterparties in DLT.

Collateral management

8. The majority of respondents consider that DLT could provide efficiency gains to collateral management processes, e.g., by facilitating the traceability of beneficial ownership or the computation of collateral needs. This could help optimise the use of collateral, reduce collateral disputes and minimize costs. Yet they realise that a number of elements, e.g., the scope of assets available on DLT or the ability of the industry to use a single source of reference data, might constrain those benefits. One respondent also said that existing collateral management systems were sophisticated and provided near real time inventory visibility. As to the need for collateral, the general feeling is that DLT could help reduce collateral requirements, e.g., in the case of cash 'spot' transactions, but certainly not eliminate them, as there would still be some counterparty risk.

Availability, security, resilience and costs

9. Most of the respondents expressed some concerns in relation to the alleged elevated availability, security and resilience of DLT systems, in particular in relation to large volumes of data. Several argued that these features were still unproven. Also, although a general reduction of costs is possible in the longer term, they fear that the costs related to the development and implementation of such a technology are high in the short to medium term.

Other possible benefits listed in the Discussion Paper

10. Most respondents did not comment on the potential benefits of DLT in relation to pre-trade information and the matching of buyers and sellers. Those who gave their opinion were mostly in agreement that this was not the primary focus of current market initiatives.

Other possible benefits not listed in the Discussion Paper

11. One additional key benefit identified by respondents is related to enhanced Know Your Customer and Anti-Money Laundering processes. Because DLT would enhance the traceability of transactions it could facilitate those processes. The enhanced sharing and storing of reference data would also contribute to more robust and efficient KYC and AML checks.
12. Other benefits include enhanced client servicing – e.g., through a single information hub made available to clients – more efficient funding processes – as payment flows would be anticipated better – and streamlined issuance processes. Another benefit would be a general reduction in the number of intermediaries not only due to efficiency gains in clearing and settlement, but also to asset tokenisation, i.e. digitilisation of asset ownership and transferability. Finally, DLT is seen by some as a positive development likely to spur innovation and competition.
13. All but one respondents shared the opinion that the full benefits of DLT would be achieved in a scenario where the technology is deployed in a consistent and homogeneous manner across market segments and throughout the entire security lifecycle. However, it is unanimously considered more likely that DLT develops and spreads across markets, instruments, locations and participants gradually.
14. There are a number of pros and cons attached to this gradual deployment, as highlighted by several respondents. A stepwise approach would limit the necessary investments and allow for incremental improvements before the technology is widely adopted. Meanwhile it might increase complexity and operational risks, e.g., because of the need to maintain several systems. Some respondents argued that the focus should be on identifying processes or business segments where the benefit/cost ratio of moving to the new technology would be the highest.

Q4, Q5, Q6, Q7 - Which activities, market segments and types of assets are likely to be impacted the most by DLT? How is DLT likely to modify the way securities markets operate? According to which timeframe is DLT likely to be deployed? How might your organisation benefit from the introduction of DLT? Are you working on a concrete application of DLT?

15. The vast majority of respondents see post-trade activities as likely to be impacted the most by DLT. KYC and AML processes come also high on the list. There is quite a consensus that DLT could help reduce the number of intermediaries involved in the settlement process. One respondent suggested that DLT could make certain intermediaries redundant, e.g., custodians as the services that they provide could be made available on a peer to peer basis or through new service providers with access to the chain. Several others said that over time DLT could transform the role of market infrastructure providers, e.g., clearing houses, CCPs, CSDs and custodians. However, the majority of respondents believe that it is unlikely that DLT will eliminate the need for CCPs. Several insisted that CSDs performed certain functions, e.g., notary or registration functions, that would remain necessary in a DLT environment.

16. Most respondents agree that adoption would start in niche, possibly unregulated, low volume and relatively 'simple' markets. Sophistication would increase over time, once the concept has been proven. Several respondents said that they expected DLT to be applied to cash or short term instruments first, although others said that non-cleared derivatives, e.g., Cross Currency Swaps and non-eligible exotic products, would come before cash instruments. One respondent highlighted that it would be generally easier to leverage on the technology for static data (e.g. securities reference data, corporate action information from prospectuses) rather than for transaction processing. Another respondent said that it anticipated significant potential in the field of customer identification and transaction recording and identification for alternative asset classes such as real estate and private equity.
17. There is consensus that widespread adoption is still some way off. Many respondents anticipate some niche applications and several noteworthy proof of concepts in the short term, i.e., in the next one to three years. Then specific internal bank and fund solutions could emerge. Finally, 10 years from now, DLT could start challenging current financial market infrastructures. Two respondents highlighted that DLT and legacy systems would need to co-exist for the next 20 to 30 years, depending on the degree of acceptance from investors.
18. Generally speaking, respondents to the consultation explained that their organisation would take advantage of the benefits listed in the DP. In particular, the use of the DLT could lead to lower operational costs. DLT could also enhance resilience and cyber security.

Q8, Q9, Q10: Do you agree with the challenges identified by ESMA? Do you see other challenges? Which solutions do you envisage for those challenges?

Scalability

19. For many respondents, it remains to be proven whether DLT is able to handle large volumes of transactions. One respondent believed that the technology would not be able to handle large volumes in the near future. Others were confident that solutions to scalability issues would be found. One respondent was of the view that DLT was already scalable.

Interoperability

20. Several respondents highlighted the need to ensure interoperability between DLTs and between DLTs and legacy systems, which will require a certain level of standardisation as well as coordination between market participants.

Treatment of cash

21. Many respondents agreed that in order to take full advantage of DLT and in particular to achieve full Delivery Versus Payment, DLT networks would need to process central bank money. The possibility for DLT networks to process central money will also be critical for achieving instantaneous settlement of certain transactions if there is a desire by the industry to go in that direction.
22. However, some respondents pointed out that it might not be necessary for fiat money to be issued on DLT and that solutions using commercial bank money existed. Also, one contributor stressed that not all transactions require simultaneous movements of cash. Therefore, there might be transactions for which it would not be a challenge not to have fiat currencies issued into distributed ledgers.

Recourse mechanism, position netting, margin finance and short selling

23. While the majority of respondents agreed that having a recourse mechanism in place in a DLT environment was a challenge, some were confident that technical solutions would be found, in particular for permissioned-based DLT networks.
24. Similarly, several respondents were of the view that solutions would be found to allow the netting of transactions. According to one respondent, bilateral netting is already possible in a DLT environment. This respondent is currently exploring various solutions to enable multilateral netting using third-party services that sit over the ledger.
25. Several respondents disagreed with the assumption that the possession of assets or cash was a prerequisite to transact in a DLT environment. One said that solutions would be found to allow short selling.

Governance

26. For many respondents, appropriate governance frameworks will play a key role to ensure trust and provide legal certainty to market participants. Many of them agreed that permissioned-based DLT networks would be the most appropriate for financial markets. One respondent however disagreed that permissioned-based DLT networks were more appropriate. According to this respondent, all permissioned-based systems remain in the proof-of-concept stage of development. In contrast, permissionless systems have been running in public for almost ten years and are battle-tested.
27. For several respondents, governance frameworks should include rules to approve/reject authorised participants and minimum requirements in terms of risk management, conduct of business rules and capital. One respondent highlighted that financial market intermediaries are well-placed to provide governance for DLT-based services because they are already subject to regulatory oversight.

Privacy issues

28. Although respondents generally agreed that there would be a need to ensure privacy, several of them did not believe that it was a challenge as such, in particular for

permissioned-based DLT networks. According to them, solutions already exist that allow cryptography to partition sections of data. Also, data shading techniques allow for a minimal amount of required transactional data to be held at each node - to reduce storage requirements and increase speed - rather than the full history of the entire ledger.

29. However, one contributor was of the view that currently there is no scalable solution for ensuring privacy. One respondent pointed out that the existing European privacy framework had not been constructed with a distributed model in mind which meant that there were aspects of the framework that were challenging for certain DLT developments.

Regulatory and legal challenges

30. See sections 5 to 10 below.

Other challenges

31. One respondent stressed the need for financial market participants to develop clear business cases and coordinate their efforts to set standards and ensure interoperability. One respondent believed there was a risk of market fragmentation in the near future with individual technology providers trying to impose their solutions.
32. Two respondents saw the lack of technical knowledge – individuals with a thorough understanding of DLT are a scarce resource – as a challenge.
33. Some challenges could also arise from the transnational nature of DLT. For example, a tax may apply on a given transaction depending on its place of execution. One respondent was of the view that the law applicable to DLT networks should be specified in advance to avoid conflicts.
34. Greater coordination between market participants was often cited as a necessary condition to successfully apply DLT to securities markets. A 'network effect' would also be needed. Market initiatives are seen as helpful in that regard.

Q11, Q12, Q13 - Do you agree with the analysis of the key risks? Do you see any other potential risks? How could these risks be addressed?

Cyber risk, fraud and money laundering

35. The vast majority of respondents are of the view that cyber risk would not increase in a permissioned-based DLT environment. Rather, they consider that DLT would be less vulnerable to cyber-attacks than the existing systems, thanks to its distributed and shared features - not only data but also processing can be replicated. Yet, they recognise that DLT, like any other system, does not eliminate cyber risk. One respondent wondered whether a coordinated Distributed Denial of Service attack on validation nodes could result in outages and systemic risk. Several respondents stressed that the security of DLT would

be dependent on its weakest link, hence the need to impose requirements on participants to the network.

36. On the concern that a hacker might have access to all of the information on DLT, several respondents argued that the impact would be no different than in a non-DLT environment. On DLT, information would typically be encrypted – which may not be the case with current systems – and protected by different encryption keys. Also some recent designs, as highlighted by several respondents, provide that only the transactions that the participant is involved in are stored on the participant’s infrastructure. Another respondent highlighted that one risk related to intrusion is the risk that the system continues to look as if it is functioning properly when in reality it has been hacked.
37. The risk of 'cracking' the encryption algorithms is considered low, although possible. One respondent insisted on the risk that technical evolutions, e.g., developments in quantum computing, may render current security schemes ineffective in the future. This risk needs to be addressed by the cyber security industry as a whole, as it has broader implications than DLT.
38. On the question of fraudulent activities and money laundering, several respondents highlighted that the participants to the network would be known in a permissioned-based framework. Robust governance would ensure that only trustworthy participants are accepted. In addition, DLT would allow for more transparency on transaction history and beneficial owners, which would enhance KYC and help trace and prevent fraud. Additional safeguards could also be built around DLT, e.g., use of Big Data to enhance KYC, etc.
39. Several respondents stressed the need to address the risks attached to the management and storing of private keys.

Operational risks

40. Most respondents support the view that DLT could potentially reduce operational risks, through a greater automation and standardisation of back office processes. Yet, they also concur with the view that new types of operational risks could emerge.
41. Glitches and failures could potentially have wider consequences than in currently applied technologies, considering that DLT solutions are shared between a greater number of participants. Also an error could be replicated between all participants within a network. One respondent argued on the contrary that a glitch would have less consequences as it would be mitigated by the entire network.
42. While smart contracts could in principle help reduce operational risks, several respondents highlighted that errors in the coding of smart contracts could create widespread risks. Some also pointed to the dependence of smart contracts on external data sources and wondered what would happen if the external data are flawed or become unavailable. As an example, establishing the liability of respective parties would be difficult. Several made reference to the recent DAO incident to illustrate their point.

43. Several respondents argued that such risks could be controlled through the rigid enforcement of coding standards and methods in the way smart contracts are constructed and allowed to operate. They admitted that the design of such smart contracts was still unclear.

Market volatility, interconnectedness and new pockets of risks

44. Most respondents disagreed that DLT was likely to foster herding behaviour and to increase market volatility in times of stress for two main reasons. First, DLT is unlikely to affect trading strategies, as its focus is on post-trade processes. Second, it should enhance the traceability of trades. One respondent argued that volatility drivers would therefore be easier to spot, which would make the whole financial system more controllable and accountable.
45. However, others said that smart contracts could create risks of herding. Because they have pre-determined embedded triggers, they could act in a similar fashion to trading algorithms and create market wide stress or disruption if triggers are activated simultaneously across multiple contracts. Also faster settlement could put considerable strain on market volatility in times of market stress.
46. Respondents expressed mixed views on the potential for higher interconnectedness. One respondent said that DLT would reduce interconnectedness because it would reduce settlement times, therefore extinguishing interbank liabilities more frequently. A handful of others said that it could increase interconnectedness by bringing more players on the same network and expanding the reach of the network to new market segments.

Fair competition and orderly markets

47. Most respondents agreed that risks associated with competition and market manipulation deserved close monitoring, including by regulators. Several felt that certain of those risks could be addressed at an early stage in the development stage of DLT solutions. In that regard, the development and implementation of previous shared systems provide a useful guide.
48. Some argued that the DLT could foster sound and fair competition by lowering barriers to entry, including through reduced costs and simplified contracts and operating models. Others are concerned that firms with limited resources might not be able to bear the costs associated with DLT (e.g., migration costs or costs of access once DLT has been deployed) and stress the need to prevent anti-competitive behaviours (e.g., 'hidden' rules in the system). Some said that consortium approaches and/or open source initiatives could help alleviate that risk.
49. Several respondents dismissed the risk of having some participants to the network using the information made available by others to front-run them or manipulate the market, on the ground that participants would be known and trustworthy in a permission-based framework. Several stressed the need to have multiple and differentiated levels of access,

to prevent participants to see the transactions of others. One respondent pointed to the fact that existing DLTs have been designed with just one class of participants on the network. Others said that they were exploring a system with multiple levels of access.

Q14, Q15: Do you think that DLT will be used for one of the scenarios presented in the Discussion Paper? How could compliance with the regulatory requirements attached to each scenario be ensured?

1. Generally speaking, respondents believe that all the clearing scenarios described in the DP may materialise. However, at this stage, many respondents find it difficult to determine for which exact purposes this nascent technology will be more suitable. They wonder what the drivers for switching to DLT would be, and how DLT might take over the critical functions of CCPs, such as risk management, counterparty credit reviews, default management, etc.
2. Some respondents provided more granular feedback for each scenario. They highlighted that the likelihood and timeline of each scenario may vary. Broadly speaking, respondents see more likely, and more likely to happen sooner, DLT performing clearing activities for the products not mandated to be cleared.
3. Firstly, respondents see a more obvious case for using DLT to clear spot transactions, e.g., repos. They argue that over time, there may be a reduced need for CCPs to stand between buyers and sellers for spot transactions, provided that settlement cycles are reduced - other issues such as DLT performance or the availability of a netting functionality were also mentioned.
4. Secondly, with respect to term transactions, although respondents indicated that any of the scenarios covered in the DP may materialise at some point, some argue that it is unclear how they would materialise. Also there is likely to be a continuing need for CCPs.
5. For term transactions such as OTC derivatives not subject to mandatory central clearing, some respondents indicate that the functions or requirements related to the trade lifecycle of such transactions, such as bilateral margining or trade reporting, could be achieved with DLT.
6. Finally, respondents indicate that, independently from the type of transaction being cleared as discussed in the previous paragraphs, there may be more immediate applications of DLT with respect to clearing activities. The technology may provide some optimisation opportunities for CCPs, and thus for clearing activities, around reconciliation, reporting and other similar functions.
7. In summary, as put by one respondent, “in the short term, it is expected that Financial Market Intermediaries would utilise DLT, rather than DLT assuming the role of the FMI itself”.

8. Moving from the topic of which scenarios from the discussion paper are more likely to materialise to the topic of how compliance with the regulatory requirements related to clearing would be ensured, respondents have in general identified two types of market structures.
9. In the first model, the so called 'Optimised Model', certain optimisations could be achieved thanks to DLT, but the roles and responsibilities of Financial Market Intermediaries would not be fundamentally modified. They usually associate this model to the short term.
10. In the second model, the 'New Model', a new re-engineered market structure, underpinned by DLT, would emerge. Roles and responsibilities in this new model are still to be defined.
11. Under the first model, the optimised model, the DLT would bring operational efficiencies without presenting regulatory challenges. The existing EU regulations would remain relevant and the FMI using DLT would continue to be responsible for compliance with the rules.
12. Under the new model, several respondents argue that some of the policy objectives might be achieved differently and regulatory requirements would need to evolve, taking into account both the risks and benefits brought by DLT.
13. These respondents often comment that regulators need to work with the industry to understand the various applications of DLT, their objectives and the new market structure they are aiming at, in order to ensure the existence of an appropriate regulatory framework. This appropriate regulatory framework could include some authorisation regimes, where applicable, and new controls. Respondents explain that regulators would need to be prepared to substantially adjust the regulatory framework, where appropriate, reflecting the new roles, the associated liabilities and the related controls, in order to support new business models.
14. Under the new model, respondents explain that regulators could be one of the nodes in the network, or have access to one of the nodes, along with the appropriate private & public keys, in order to be able to monitor all the transactions that are relevant for their mandates or to monitor the activity of their supervised entities.
15. In addition, some of the relevant laws and regulations could be coded in DLT, potentially through smart contracts. Market participants would ensure that the technology processes transactions, including clearing functions, based on the applicable laws and regulations, thus fulfilling the regulatory compliance thanks to the code itself.

Q16, Q17: Do you think that the DLT will be used for one of the scenarios presented in the Discussion Paper? How could compliance with the regulatory requirements attached to each scenario be ensured?

16. The vast majority of respondents believe that settlement is a key application area for DLT. Respondents confirmed that the three scenarios described in the DP may materialise but

said it was too early to form a clear view, e.g., proof of concepts have been relatively small in scale and often isolated.

17. They highlighted the importance of clear legal representation of responsible parties in a DLT environment and their accountability vis-a-vis regulatory requirements.
18. Scenario 1.1, i.e., DLT is not designated as SSS and settles securities transactions not in the scope of CSDR, is most likely in the short term. In that case, DLT's use would be limited to targeted, smaller scale projects and would not conflict with the existing regulatory and legal environment.
19. Scenario 1.2, i.e., DLT as settlement internaliser, may follow, as it could help communities test DLT on a subset of the global market.
20. There were split views if, ultimately, CSDs might deploy DLT as their core settlement system, i.e., Scenario 2. Some respondents saw this possible in the long term, including potentially the replacement of T2S by a DLT platform, while others mentioned several barriers:
 - Current limited functionalities of DLT as opposed to highly sophisticated legacy systems, e.g., DVP, auto collateralisation, settlement discipline regime, etc.;
 - Constraint of the investment cycle given recent investments in T2S;
 - Strict regulatory framework.
21. Respondents said that adoption of DLT is most likely to arise from its incremental ability to optimise processes under the existing framework of post-trade market infrastructure providers and regulation ('Optimised Model'), but could also arise through a substantial restructuring of this framework in which market infrastructure providers adopt new roles ('New Model').
22. According to many respondents, DLT would extend to new types of products, services and transactions, which would trigger the need for new rules.
23. Several respondents highlighted that some of the functions, services and roles that DLT would provide are covered by CSDR (e.g. notary function for securities admitted to trading, being a Securities Settlement System, provision of settlement in central bank money, provision of a settlement discipline regime, provision of settlement subject to SFD protection, etc). These functions may therefore be performed only by an entity authorised as CSD, and CSDR applies, regardless of the underlying technology.
24. Some others functions, services or roles may not be covered by CSDR. The latter can be the result of:
 - A political decision not to legislate certain functions at the EU level. Examples include the registrar or transfer agent functions, the notary function for securities not admitted to trading, internalised settlement.

- Specific functions or roles resulting from the introduction of DLT, e.g. provision and maintenance of the DLT platform, determination of DLT protocols, smart contract management, access and identity management, provision of access to the network, links or interoperability between DLT platforms, etc. These do not explicitly fall in the scope of CSDR or other EU legislation, and could be performed by other entities than existing market infrastructures.
25. Several respondents mentioned that compliance with the existing framework should not be driven by the technology, and that regulatory objectives should be technology agnostic.
26. However, some respondents highlighted that critical concepts such as settlement finality, securities lending, re-hypothecation, short-selling, novation, etc. may require re-imagining with DLT in mind. Indeed, today's regulation assumes a certain configuration of institution types and automation mechanisms. Depending on the scenario in which DLT is introduced, some assumptions may no longer apply. Regulators could have to adapt regulation with a focus on desired outcomes. Minimum standards might be useful.
27. Several respondents argued that no legal or regulatory changes should be made before DLT is tested in the current environment.
28. On the other hand, some argued that regulators should engage from an early stage, i.e., prior to design being signed off. The most effective way to ensure compliance is to design solutions in collaboration with a broad array of compliance professionals and regulators, thereby taking those critical concerns into account from the very start of the development process.
29. Some respondents highlighted the possibility for regulators to take a more active part in the operations of DLT. A regulatory body could be one of the nodes in the network with appropriate private and public keys and hence be able to monitor settlements.

Q18, Q19: Do you think that the DLT will be used for safekeeping and record-keeping purposes? How could compliance with the regulatory requirements be ensured?

30. There was broad agreement regarding the potential of DLT to be used for safekeeping and record-keeping purposes at issuer level and at investor level, even though, according to several respondents these concepts may become obsolete in their traditional sense with DLT.
31. According to one respondent, through DLT and the use of public and private keys, regulators could have access to the relevant information, an issuer could see the ownership of his securities and an investor could obtain a view on his investments. For the extraction of that information a specific software could be required.
32. According to one respondent, DLT will need to evolve to the point that it is demonstrably suitable for record-keeping from a security, data privacy and governance standpoint, as required by regulation. DLT compliance with regulatory requirements remains, to a great

extent, unexplored and considerable work is still required. Key questions such as who should be regulated, and by whom, are yet to be answered, and the answer is far from straightforward due to the decentralised and cross-border nature of distributed ledgers. Moreover, it is not yet clear whether existing regulation would need to be adapted for distributed ledgers, or whether new regulation will need to be created.

33. Respondents highlighted a series of benefits in relation to the application of DLT to safekeeping and record-keeping of ownership (see section on benefits for further details)

34. At the same time, respondents mentioned a number of challenges that would need to be overcome in order to enable the application of DLT to safekeeping and record-keeping of ownership:

- Harmonization of securities ownership, company and insolvency laws;
- Ability to dematerialise certain assets, divergent issuance structures, lack of harmonised settlement and asset servicing processes;
- Enforceability of asset transfers and transactions performed through DLT;
- Interaction with CSDR requirements.

35. Some of the regulatory questions that, according to respondents, would need to be addressed are:

- What would be the economic and legal rights attached to holding assets on a DLT network?
- Who are participants/accounts?
- What constitutes the final record?
- How are assets issued in a DLT environment, and what would be the impact of maintaining the same asset in both a DLT and 'traditional' environment?
- Who is responsible for ensuring integrity of the issue and investor protection?
- Which assets are in scope? DLT networks have the potential to accept a wider range of assets than traditional securities.

36. The majority of respondents highlighted the need for regulators to be engaged in the process and the changing business models that emerge from the adoption of DLT: collaboration between policy makers and those involved in the development of the technology itself is crucial. New regulation may be necessary for the new roles.

37. Many respondents suggested that ESMA should work with peer regulators, other global bodies and private industry to assess the end goals of securities record-keeping and data privacy requirements in order to determine appropriate compliance standards.

Q20, Q21: Do you think that the DLT will be used for regulatory reporting purposes? Please explain, with concrete examples where appropriate. How could compliance with the applicable regulatory requirements be ensured?

38. Most respondents agree that DLT could be used for Regulatory Reporting. More broadly, they feel that reporting in general, and not only regulatory reporting, is an area where DLT could provide major benefits.
39. Like with many other functions previously discussed in the paper, respondents have stated that DLT, when applied to reporting, could be used under the optimised model or the new model.
40. Under the optimised model, respondents argue that DLT could be used to improve the current processes of certain entities or FMIs. DLT could facilitate the collection, consolidation and sharing of data for reporting or regulatory reporting purposes.
41. Whereas, under the new model, DLT would ensure a single and true data source, removing or improving issues linked to the reporting related processes, such as consolidation of data or reconciliation of mismatches. In addition, DLT would provide real time access to regulators to this single and true data source.
42. It is to be noted that some respondents have indicated working on some DLT applications that include the reporting function amongst the targeted benefits.
43. Moving to the question of ensuring compliance, respondents referred again to the two models, the optimised model and the new model.
44. With respect to the optimised model, several respondents have explained that the applicable regulatory framework would not need to change as DLT would be a technology optimisation project.
45. However, with respect to the new model, several respondents also argue that regulators should look at the potential solutions brought by DLT, especially in terms of transparency and data protection, and from there, reflect and decide on the new types of safeguards required.
46. Some respondents explain that regulators should check whether the use of DLT can allow market participants to achieve the same policy objectives targeted by existing regulations, while operating outside of the existing post trade infrastructure. For instance, if transparency is provided by DLT, some respondents argue that there may not be a need for separate data warehouses/trade repositories.
47. Under the new model, respondents explained that participants to a DLT application, when designing DLT, would need to ensure that all information that is required by the regulator is available in the DLT environment. Then, regulators would need to build the connections to the respective DLT in order to obtain the data for their respective purposes.
48. On the issue of compliance, it is to be noted that several respondents flagged certain issues which are also dealt with earlier in the DP, but that are quite relevant in the context of regulatory reporting. They explain that the key issues, and thus challenges when designing

DLT solutions with respect to reporting via a DLT, include data protection and confidentiality as well as cyber security.

49. Like with the other functions being assessed, several respondents have argued that there is the need for an ongoing discussion between regulators and market participants to ensure an adequate regulatory framework is developed to meet the several use cases that will emerge.
50. They explain that compliance with regulatory requirements can be best ensured by embedding these requirements at the level of DLT, which would be done directly within the code itself or in the set of rules governing the functioning of the DLT.

Q22: Do you think that the DLT could be used for other securities-related services than those already discussed, in particular trading and issuance?

51. Several respondents were of the view that DLT could be used for trading purposes. Several pointed out that it would be more relevant for illiquid assets which do not require immediate price discovery (private equity, funds, illiquid bonds, unlisted securities and syndicated loans) because of the latency in reaching consensus.
52. For the issuance of assets, DLT could act as a centralised reference data centre. For example, DLT could issue unique securities identifiers, such as CUSIP.

Q23, Q24: Do you see potential regulatory impediments to the deployment of DLT? Should regulators react to the deployment of DLT and if yes, how?

53. Many respondents are still at an early stage with the technology and feel that they are not in the position to identify specific regulatory issues yet. The general view is that the current regulatory framework does not represent major impediments to the deployment of DLT, although there may be a few specific exceptions, e.g., rules in the UK which mandate a paper based approach to moving stock in and out of CREST, thus making it difficult to implement off-CREST settlement. One respondent highlighted that it is the commercial business logic – or lack of – of DLT, which is currently being investigated, that will ultimately accelerate or stall the deployment of DLT. Regulatory issues are not a first order factor in this process.
54. Several respondents pointed to a number of questions/uncertainties that regulators will need to address before DLT can be widely and efficiently deployed, the key being to have clarity on the mechanics of settlement finality and changes in legal ownership. The list below provides an overview of these questions:
- Which legal framework will apply to digital assets?
 - Are the mechanics of issuance of a security on DLT compatible with current rules around dematerialisation and the requirement for securities to be held centrally?
 - Should tokenised assets be regulated, e.g., should they be considered as MiFID financial instruments?

- Is the current definition of a Central Securities Depository under CSDR compatible with a decentralised distributed ledger?
 - Will the level of protection in the event of an insolvency situation be the same as in the current infrastructure?
 - Which jurisdictional law will apply, e.g., for ownership rights, place of settlement or disputes, where there may be multiple nodes in different locations?
 - Who would regulate what and what role would self-regulation play?
 - Will regulators satisfy themselves with only viewing data that falls within their jurisdiction?
55. One respondent said that their main concern was data privacy, and how to manage this issue both technically and legally – for instance in relation to the violation of data privacy laws. Another respondent highlighted that the immutability of records in the case of natural persons could be in contradiction with Regulation (EU) 2016/679 General Data Protection Regulation, Article 17 Right to erasure ('right to be forgotten').
56. Differences in regulatory frameworks across jurisdictions are a major issue for most respondents, considering that DLTs are to be global and global markets are closely interconnected. They also highlighted the need to avoid a silo approach as post-trade activities are highly interconnected.
57. The vast majority of respondents feel that regulatory action would be premature at this stage. First, and as discussed above, many feel that DLT applications are unlikely to raise major regulatory issues in the short-to-medium term. Second, many are concerned that regulations should remain 'neutral' vis-à-vis the technology used by market participants to fulfil their obligations. Also regulation should provide for a level playing and any adaptations to the existing regulatory framework would need to be considered in a broader context than just DLT. Finally, a number of respondents fear that premature regulation could undermine DLT's potential. One respondent said that a standalone regulatory framework for DLT would create a disproportionate regulatory burden on those falling within its scope. The creation of a specific supervisory authority or regulatory body would likely have the same effect.
58. That being said, many respondents emphasise that regulators should have a proactive approach to the technology. They encourage regulators to monitor market developments closely and to engage with market participants to better understand the potential risks and benefits attached to DLT. They advise them to consider ways to address both the risks arising, and the barriers to the emerging benefits.
59. Several respondents highlighted that regulation has to keep pace with market developments in order to remain relevant and workable. In the case of DLT, they feel that some changes may become necessary as the technology matures. As an example, one respondent said that regulators should look at the new roles that could emerge in the post-trade infrastructure, e.g., for CCPs or custodians, as a result of DLT deployment. Another made reference to some risk mitigants that could become redundant. Another said that

regulators might need to move away from the concept of central clearing. Yet, respondents realise that any regulatory change will need to be supported by a strong business case.

60. Several respondents would welcome clarifications from regulators on the rules likely to apply to DLT, e.g., through guidelines that would clarify the scope and interpretation of the applicable regulations. Others encourage regulators to provide what they call a 'broad framework' for DLT, e.g., minimum requirements in terms of governance structure, risk assessment, control of access and protection of data. They point to the CPMI-IOSCO Principles for Financial Market Infrastructures as a useful basis for these requirements. Regulators could ensure that the DLT governance body satisfies all relevant principles and review their application.
61. One respondent also said that the current terminology is open to misinterpretation, which creates confusion, and that an industry initiative to standardise terminology around Blockchain/DLT and smart contracts would be useful. Several would welcome an active engagement from regulators at an early stage, to avoid that DLT takes a path that is not acceptable to regulators.
62. Several made reference to a sandbox approach as a relevant tool to help market participants test DLT and facilitate its deployment. One respondent argued that small scale initiatives that pose no material risk to consumers and market stability could benefit from some regulatory waivers. Another said that regulators could facilitate DLT deployment in selected segments, such as SME post-trade first, and then progressively expand its authorised scope as it matures.
63. Yet, a respondent warns that the current rules provide important safeguards. Regulators should therefore not be over-awed by claims of revolution and disruption by DLT. Another respondent is concerned that there may be a risk of regulatory arbitrage, if some jurisdictions are more supportive to the technology than others. Many stressed the need for European and global cooperation to foster the emergence of common standards and best practices. One respondent argued that DLT should be authorised and supervised at European rather than national level. Another respondent said that the T2S framework provided a useful basis for coordination.
64. Interestingly, respondents suggested some key areas of focus for regulators. These include external data consistency and lineage and Disaster Recovery.
65. Finally, several encouraged regulators to test the technology to see how it might enhance their monitoring and oversight functions, e.g., for AML, KYC compliance, market manipulation or insider trading.