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Of standards and technology: ISDA and technological change in the OTC derivatives market

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ABSTRACT

For enthusiasts, distributed ledger technology (DLT) and smart contract technology (SCT) promise a future of frictionless interactions and decentralisation. In practice, however, it is widely acknowledged that this vision faces significant challenges. These include legal challenges, technological challenges, but also implementation challenges. The latter arise because delivering the DLT/SCT vision does not take place in a vacuum, but in a setting populated by existing market actors that operate on the basis of pre-existing technologies and absent an industry-wide layer of standards to support technological change and the vision of frictionless interactions. This article seeks to contribute to the literature interested in implementation challenges. Its aim is two-fold: to examine implementation challenges and to take stock of current market efforts to overcome them. In particular, this article focusses on the efforts of the International Swaps and Derivatives Association (ISDA) and its initiatives to 'standardise to digitise'. It will show that these initiatives can usefully be examined as an attempt to help the industry coordinate on a common foundational standards layer. However, this article also finds that the success of ISDA's efforts is by no means certain. Nor are its efforts without raising some concerns.

A. Introduction

The 2010s will be remembered as a time of significant interest in, and considerable hype about, distributed ledger technology (DLT). DLT is the technology behind distributed ledgers. The latter are information stores or databases that are shared among a (decentralised) network of connected computers (or nodes). Made of 'a clever combination of existing technologies',[1] DLT emerged as a stand-alone technology from Bitcoin, of which it is the backbone. Together with 'smart contracts', essentially computer code that allows specific non-discretionary actions to be automatically performed if

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[1]See Akber Datoo, *Legal Data for Banking – Business Optimisation and Regulatory Compliance* (Wiley 2019) 239.

specified conditions are satisfied, DLT gained mainstream interest across a whole raft of industries, including the financial industry. For enthusiasts, DLT is potentially a game changer – a cure to the ills of inefficient processes and the excesses of centralisation. Thanks to technology, the future promises to be frictionless (or frictionless-*ish*) and more decentralised. In the financial sector in particular, DLT is meant to have a wide range of possible applications. In markets for 'over-the-counter' (OTC) derivatives for example, DLT is seen as a possible answer to antiquated, and indeed at times manual, post-trade processes and an ageing IT infrastructure.

However, in practice, it is widely acknowledged that the DLT/SCT vision of frictionless markets and decentralisation faces significant challenges.[2] Broadly speaking, commentators interested in identifying challenges have focused on issues with the technology, the adequacy of the law to deal with the technology, and finally the actual implementation of the technology by market participants. Challenges in the latter area arise because implementing the DLT/SCT vision does not take place in a vacuum, but in a setting populated by existing market actors that operate on the basis of pre-existing technologies and absent a shared industry-wide layer of standards to support technological change and the vision of frictionless interactions. This article seeks to contribute to the literature interested in implementation challenges. It pursues two aims. First, it discusses implementation challenges, drawing for this purpose on a number of concepts, especially the need for coordination, the role of network effects and switching costs, and the impact of power. Secondly but most importantly, this article takes stock of current market efforts to overcome implementation challenges. In particular, this article focusses on the work of the International Swaps and Derivatives Association (ISDA). ISDA has been at the forefront of the standardisation of trade documentation in the OTC derivatives market for several decades. Lately, ISDA emerged as a fervent supporter of new technologies. Building on its credentials as market standard setter, it launched several standard setting initiatives to support technological change and help bring the industry closer to a frictionless future. This article seeks to shed light on ISDA's efforts to 'standardise [in order] to digitise'.[3] Among ISDA's initiatives is the Common Domain Model (CDM), whose origins can be traced back to the hype that surrounded DLT in the mid 2010s and which is ISDA's answer to the absence of industry conventions on how to digitally represent derivative products, and the processes and events that affect these products over their lifetime. Another noteworthy initiative is the ISDA Clause Taxonomy and Library which takes a first step

[2]For references, see especially n 39–51 below.
[3]ISDA, 'Standardise to digitise' (January 2020) 6:1 IQ ISDA Quarterly 12, 13, available at <https://www.isda.org/a/8ALTE/IQ-ISDA-Quarterly-January-2020.pdf>.

in the direction of a legal agreement data model and a possible industry-wide automation of suitable contractual clauses through technologies such as 'smart contract technology' (SCT). This article assesses these initiatives against our findings on implementation challenges. Specifically, it will argue that ISDA's initiatives can usefully be examined as an attempt to resolve part of the coordination game 'frictionless trade' by helping the industry coordinate on a common foundational standards layer which is widely seen among industry actors as an important steppingstone to industry-wide technological change.[4] What is more, it will show that in order to improve the odds of a large-scale adoption of the CDM, ISDA is not just engaging with the market. It is also engaging with the regulatory community and actively encouraging it to leverage its coordination efforts by embracing its CDM initiative. However, this article also finds that, as ISDA seeks to transition from an analogue age to the digital age, the success of its initiatives is by no means certain. In particular, it will be argued that the future of the CDM as a successful industry standard is open to question. Moreover, ISDA's efforts to see public actors leverage its coordination efforts are not without raising some concerns.

This article proceeds as follows. Part B introduces two basic value propositions associated with DLT and SCT. Part C examines the challenges to technological change and the above value propositions, focussing in particular on implementation challenges. Part D turns to ISDA's initiatives and how they seek to contribute to easing implementation challenges. Part E revisits ISDA's initiatives – especially the CDM – and takes a more critical look at ISDA's efforts vis-à-vis the market, but also the regulatory community. Part F concludes.

B. The vision

This section describes two basic propositions that can be associated with technologies such as DLT and SCT (II.). First, however, this section begins by introducing the relevant technologies (I.).

I. The technologies

DLT is a comparatively young technology, but that potentially has multiple applications for the financial industry.[5] A distributed ledger is essentially a database that is shared among a distributed network of connected

[4]See n 50 below.

[5]For a good overview of blockchain/DLT, see e.g. World Bank Group, 'Distributed Ledger Technology (DLT) and Blockchain' (2017) FinTech Note No. 1, available at <http://documents.worldbank.org/curated/en/177911513714062215/pdf/122140-WP-PUBLIC-Distributed-Ledger-Technology-and-Blockchain-Fintech-Notes.pdf>.

computers which are known as 'nodes'. Unlike a centralised database which is kept and controlled by a central database administrator, a key feature of DLT is that the data records are 'collectively maintained and controlled' by the network.[6] Each participant to the network will have an identical record of the ledger. Crucially, since there is no trusted 'central validation system' in the case of a distributed ledger,[7] any new addition to the database is validated through a consensus mechanism that ensures agreement on the state of the ledger among network participants.[8] Hence, given the absence of a central validation system, '[t]rust in the intermediary' is said to be replaced 'with trust in the underlying code and consensus rules'.[9] DLT also relies extensively on cryptography to validate and record data securely.[10] Ultimately, the aim is for participants to share a view of the data that is identical and (virtually) immutable, and thereby to make sure that 'I know that what I see is what you see'.[11]

That said, DLT platforms can implement very different features with respect to access, transparency, privacy, and so on. In a permissionless implementation for example, no central entity controls access. All that is required to join and interact with participants in a permissionless network is the right combination of hardware and software.[12] On the other hand, in permissioned implementations, access to a network is controlled by an owner or administrator.[13] Members of the network are 'known or somewhat trusted'.[14]

Prima facie, DLT can be used for various purposes. As in the initial Bitcoin implementation, it can (and does) serve as the basis for cryptocurrencies. More generally, it can be used to record and manage the evolution of all sorts of data over time. This might be transaction data, know-your-customer data, etc. Moreover, it can be used to tokenise things, that is to create a digital representation of, say, an asset, a right or even a currency which can be recorded and managed on a distributed ledger. Combined with SCT, which is essentially computer code that allows specific non-discretionary actions

[6]ibid 1.
[7]ESMA, 'The Distributed Ledger Technology Applied to Securities Markets' (ESMA50-1121423017-285, 7 February 2017) 4.
[8]Tim Swanson, 'Consensus-as-a-service: a brief report on the emergence of permissioned, distributed ledger systems' (R CEV, 6 April 2015) 4, available at <http://www.ofnumbers.com/wp-content/uploads/2015/04/Permissioned-distributed-ledgers.pdf>, noting further that a consensus mechanism is a 'set of rules and procedures that allows maintaining [a] coherent set of facts between multiple participating nodes'.
[9]Christian Catalini and Joshua Gans, 'Some simple economics of the blockchain' (2019) MIT Sloan Research Paper No. 5191-16 at 9, available at <https://ssrn.com/abstract=2874598>.
[10]*ESMA* (n 7) 4.
[11]Richard G Brown, 'The Corda platform: an introduction' (May 2018) 4, available at https://www.corda.net/content/corda-platform-whitepaper.pdf.
[12]*World Bank Group* (n 5) 11.
[13]ibid ix–x.
[14]Primavera De Filippi and Aaron Wright, *Blockchain and the Law* (Harvard University Press 2018) 31.

to be automatically performed if specified conditions are satisfied,[15] the proposition is that ultimately a great many things (e.g. tasks, obligations, processes) can be automated and performed more efficiently on a distributed ledger.

The financial industry has taken interest in permissioned implementations of DLT and SCT, with both technologies acting as a catalyst for financial firms to consider revisiting their often ageing IT infrastructure. Moreover, several DLT platforms are now established in the market for enterprise (permissioned) DLT platforms. These platforms include Corda, which was developed by the technology firm R3 with the backing of financial market participants;[16] J.P. Morgan's Quorum, which was developed as a permissioned implementation of Ethereum, a generic permissionless DLT platform;[17] or Fabric, a permissioned blockchain platform hosted by the Linux Foundation and on which IBM's commercial platform is based.[18]

II. The future is frictionless and decentralised

DLT is supposed to offer market participants a range of opportunities – to do old things better by eliminating existing costs and inefficiencies; or to do altogether new things that hitherto could not be done without DLT/SCT. Indeed, some of the more radical propositions that combine DLT and SCT foresee a future where these technologies lead to a deep-seated transformation of the organisational environment. Underpinning these claims are broadly speaking two 'ideal type' propositions about the future. These propositions are, to put it simply, that the future is frictionless (1.) and that the future is decentralised (2.).

1. The future is frictionless

DLT, together with SCT, are supposed to eliminate many of the frictions that are currently characteristic of a variety of processes. These frictions might relate to assets or data, and might arise in areas that are currently not well automated.[19] Thus, for example, recording and managing data on a distributed ledger is meant to offer a solution to issues that currently arise when data is recorded in multiple separate databases and when records subsequently

[15]On smart contracts, see e.g. ISDA and Linklaters, 'Whitepaper: smart contracts and distributed ledger – a legal perspective' (August 2017), available at <https://www.isda.org/a/6EKDE/smart-contracts-and-distributed-ledger-a-legal-perspective.pdf> Datoo (n 1) 233 defining smart contracts as essentially 'coded instructions which execute on the occurrence of an event'.

[16]For details, see *Brown* (n 11).

[17]For details, see the Quorum White Paper, available at <https://github.com/jpmorganchase/quorum-docs/blob/master/Quorum%20Whitepaper%20v0.1.pdf>.

[18]For an overview of Hyperledger Fabric, see <https://www.hyperledger.org/wp-content/uploads/2020/03/hyperledger_fabric_whitepaper.pdf>.

[19]Highlighting current frictions affecting post trade processes, see e.g. *ISDA* (n 3) 14 quoting Lee Braine (director of research and engineering at Barclays).

fail to match, say, because data was recorded differently (or incorrectly), or was not updated.[20] Addressing this problem gives rise to a process known as reconciliation, which adds cost and may require time-consuming manual interventions. Reconciliation is a common practice in the financial world and a symptom of the complexities of the IT infrastructure of many banks. This infrastructure is often characterised by multiple and possibly overlapping internal systems (e.g. trading, settlement, risk, collateral management and regulatory reporting systems) which hold records of a trade and which interact with each other or with external systems.[21] While there are standards governing financial messaging which facilitate communication between systems (e.g. Financial products Markup Language (FpML), which is a common financial messaging standard for derivatives), different systems still implement different data models, which creates the risk of 'breaks' and drives the need for reconciliation.[22]

DLT and smart contracts are also supposed to offer opportunities to optimise the transfer of assets. In the OTC derivatives market, ISDA has, for example, singled out the processing of 'collateral' (or margin) – i.e. assets that are transferred or segregated to secure obligations – as an area that could potentially benefit from new technologies such as DLT and smart contracts.[23] Among other things, it has pointed out that firms still often rely on manual processes to settle collateral transfers.[24] It has described a lack of

[20] See e.g. *Brown* (n 11) 2 noting that '[w]e believe markets will move towards models where parties to contracts collaborate to maintain accurate, shared records rather than maintaining their own independent and inconsistent systems which require extensive reconciliation processes to ensure consistency. Duplicates, reconciliations, failed matches and breaks will be things of the past. Isolated pools of trapped assets will be no more'. Similar views have also regularly been put forward by ISDA. See more recently e.g. ISDA, 'ISDA response to HM Treasury consultation and call for evidence on UK regulatory approach to cryptoassets and stable coins' (19 March 2021) 4, available at <https://www.isda.org/a/UkATE/ISDA-response-to-HMT-cryptoasset-and-stablecoin-consultation.pdf> identifying among the potential benefits of DLT that it allows developing 'shared workflows' on the basis of a shared representation of a trade and noting further that 'this would remove the need for many of the duplicative reconciliation processes that exist today, such as reconciliation for settlement, compression, and margining purposes'. Among public actors, see Bank for International Settlements, 'Distributed ledger technology in payment, clearing and settlement – an analytical framework' (February 2017) 13, available at https://www.bis.org/cpmi/publ/d157.pdf, noting that '[b]y allowing information that is in a common format to be shared across participants to a transaction, the use of DLT may reduce data discrepancy, facilitate quicker reconciliation and eliminate or reduce burdensome back office activities'.

[21] See Martin Walker, *Front-to-Back: Designing and Changing Trade Processing Infrastructure* (Risk Books 2018) 174 noting that '[h]aving multiple systems with records of the same trades is a common scenario. At a minimum, a trading system and a settlement system will have records of those trades. Typically, that set of trades will also be recorded in numerous other systems – such as risk, regulatory reporting and collateral management systems'.

[22] Where different systems rely on different data models, the interaction between message and data model will involve additional translation steps, which can create new opportunities for error. See ibid 59.

[23] See for details, ISDA, 'Legal guidelines for smart derivatives contracts: collateral' (September 2019), available at <https://www.isda.org/a/VTkTE/Legal-Guidelines-for-Smart-Derivatives-Contracts-Collateral.pdf>. Note that this concerns OTC trades that are not centrally cleared (at 16).

[24] *ISDA* (n 3), 14 noting that '[t]he fact that a fax is often still required to authorise the release of collateral is widely considered primitive in a world where digitisation has already transformed so many manual processes and reduced operational risk in other businesses'.

automation as a 'major bugbear'[25] and pointed to SCT as potentially the way forward.[26] Specifically, the proposition is one of 'smart derivatives contracts', which could automate the performance of certain aspects of a derivatives transaction (e.g. the transfer of collateral and related processes, such as the assessment of collateral eligibility, and different calculation and valuation processes)[27] by relying on computer code in order to engage with and execute automatically suitable contractual terms.[28] These terms would be part of a written contract, but expressed in the contract in a form that allows for automation or, alternatively, incorporated by referring to relevant code that would be set out elsewhere.[29]

2. The future is decentralised

Related to this first proposition is a second proposition about decentralisation.[30] Decentralisation has been described as 'a process of delegating the functions of one entity to many entities'.[31] As noted earlier, DLT is supposed to eliminate the need for a trusted central entity to record, verify or validate data. By the same token, it is meant to eliminate a single point of failure and improve system integrity. Moreover, by disintermediating transactions, DLT is also supposed to lead to significant cost savings.[32]

[25] ibid.

[26] *ISDA* (n 23) 11 noting that ' … there is likely to be significant potential for the application of smart derivatives contracts in the context of ISDA collateral documentation and the collateral management process'.

[27] ibid. In this context, ISDA talks of a 'heavy chain' DLT implementation where collateral is tokenized and housed on the ledger.

[28] These terms might be operational in nature in the sense that they are characterised by 'conditional logic' such as that a specific action must take place at a 'specified time' or following a 'specified event'. See *ISDA and Linklaters* (n 15) 10. See also ISDA 'ISDA legal guidelines for smart derivatives contracts: interest rate derivatives' (2020) 15, available at https://www.isda.org/a/I7XTE/ISDA-Legal-Guidelines-for-Smart-Derivatives-Contracts-IRDs.pdf. In the academic literature, see e.g. *De Filippi and Wright* (n 14) 95. However, note that operational terms have been found not to be devoid of complexity. See for details, Christopher Clack and Ciaran McGonagle, 'Smart derivatives contracts: the ISDA Master Agreement and the automation of payments and deliveries' (2018-2019) 28, available at <https://arxiv.org/pdf/1904.01461.pdf>.

[29] *ISDA and Linklaters* (n 15) 14, referring to this model as the internal model. An alternative model is known as the external model where the 'code would not be part of the legal contract; all it would do would be to provide a mechanism for the automatic performance of a contract written in a natural human language' (ibid).

[30] Decentralisation has proven a popular theme in academic contributions, including in the outstanding work of Yochai Benkler, e.g. *The Wealth of Networks – How Social Production Transforms Markets and Freedom* (Yale University Press 2006) and more recently in various contributions on 'decentralised finance', see e.g. Dirk Zetzsche, Douglas Arner and Ross Buckley, 'Decentralized Finance' (2020) 6 Journal of Financial Regulation 172; Emilios Avgouleas and Aggelos Kiayias, 'The architecture of decentralised finance platforms: a new open finance paradigm' (2020) Edinburgh School of Law Research Paper No. 2020/16, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3666029. For a critical view of the use of the term, see Angela Walch, 'Deconstructing "Decentralization" – exploring the core claim of crypto systems' in Chris Brummer (ed), *Cryptoassets: Legal, Regulatory, and Monetary Perspectives* (OUP 2019).

[31] R3 primer series 1, 8, available at https://www.r3.com/wp-content/uploads/2019/01/R3-Quick-Facts.pdf.

[32] On costs associated with having to rely on intermediaries, see *Catalini and Gans* (n 9) 6–7.

However, DLT is also meant to have a more fundamental quality. For some, DLT is supposed to be a technology that allows reshaping an organisational landscape that is characterised by concentrations of control or power. [33] Thus, DLT is supposed to offer a vision of a future no longer dominated by 'centralised' businesses which because of switching costs or network effects, have market power which they have come to exploit (e.g. by extracting rents).[34] In the academic literature, Davidson, De Filippi and Potts, for example, argue that DLT as a 'technology of decentralisation'[35] can lead to deep seated transformations to the organisational landscape. Rooted in transaction cost economics, their analysis suggests that decentralised ledgers can be a 'potential substitute for the economic coordination' that is offered by economic institutions such as markets or firms.[36] This vision of decentralised DLT platforms that compete with firms, markets, etc. as an alternative mode of coordinating economic activity is predicated on the supposed governance efficiency of DLT over other modes of coordination.[37] The authors conclude by postulating that a wide-scale adoption of DLT may ultimately result in an 'evolution of the economic institutions of capitalism itself'.[38]

C. The implementation challenge

The aim of this part is to focus on challenges to the above (ideal type) propositions. Challenges to technological change and the vision of decentralised and frictionless markets have been widely acknowledged and examined in a broad range of contributions. Broadly speaking, these contributions have focused on (i) the technology (ii) the law and (iii) the process of adoption (or implementation) by market participants. With respect to the technology, commentators have among other things pointed out that DLT, or SCT for that matter, is a young and immature technology,[39] that DLT may not be

[33] See e.g. KJ Erickson, 'The future of network effects: tokenization and the end of extraction' (*Medium*, 17 July 2018) <https://medium.com/public-market/the-future-of-network-effects-tokenization-and-the-end-of-extraction-a0f895639ffb>.

[34] See e.g. ibid.

[35] Sinclair Davidson, Primavera De Filippi and Jason Potts, 'Blockchains and the economic institutions of capitalism' (2018) 14 Journal of Institutional Economics 639, 649.

[36] ibid 649. Their argument builds on the transaction cost account of Coase and elaborated by Williamson and others in the new institutional economics movement (see Ronald H. Coase, 'The nature of the firm' (1937) 4 Economica 386; Oliver Williamson, *The Economic Institutions of Capitalism – Firms, Markets, Relational Contracting* (The Free Press 1985)).

[37] To evaluate these efficiencies *Davidson, De Filippi and Potts* (n 35) 649–53, focus on the role that blockchain can play in controlling opportunism – or 'self-interest seeking with guile' (Williamson (n 36) 47) – or as a monitoring device. With respect to monitoring, the authors draw on the early work of Armen Alchian and Harold Demsetz, 'Production, information costs, and economic organization' (1972) 62 American Economic Review 777.

[38] *Davidson, De Filippi and Potts* (n 35) 653.

[39] e.g. Michèle Finck, *Blockchain Regulation and Governance in Europe* (CUP 2018) 34; Mimi Zou, 'Code, and other Laws of Blockchain' (2020) 40 Oxford Journal of Legal Studies 645, 655; Zenu Sharma and Yun Zhu, 'Platform development in blockchains, risks, and regulation' in Maurizio Pompella and

sufficiently scalable,[40] that it may not be secure enough[41] or indeed that it may serve criminal activities.[42] Authors such as Walch have also taken issue with the claim that DLT is a technology of decentralisation given the pockets of control that may characterise even permissionless systems.[43] Of much interest to legal scholarship have been the many legal challenges that the operation of DLT or SCT creates in areas such as property and contract law,[44] data protection law,[45] insolvency law,[46] or indeed financial law. In the latter field, contributors have inter alia focused on liability risks for network participants.[47] They have pointed out that a 'decentralised' DLT network does not square well with the requirements of financial regulation built around centralised institutions.[48] More fundamentally, they have pointed out that the territorial scope of much of the law will stand in the way of a frictionless transnational market space.[49]

This part will not engage with debates on technological or legal challenges, although the significance of these challenges is acknowledged. Instead, this (and the next parts) will focus on the third type of challenge, that is the implementation challenge. For the present purposes, implementation challenges can be characterised as 'external' since they are not inherently about the technology. Nor are the fundamentally about the law. They arise because realising the above value propositions, does not take place in a vacuum, but in a setting populated by existing market actors that operate on the basis of pre-existing technologies and absent a shared industry-wide layer of standards to support industry-wide technological change and the

Roman Matousek (eds), *The Palgrave Handbook of FinTech and Blockchain* (Palgrave Macmillan 2021) 307, 319.

[40] e.g. Paul Klimos, 'The distributed ledger technology: a potential revamp for financial markets?' (2018) 13 Capital Markets Law Journal 194, 210.

[41] e.g. Angela Walch, 'The Bitcoin blockchain as financial market infrastructure: a consideration of operational risk' (2015) 18 New York University Journal of Legislation & Public Policy 837, 859–64 (in relation to Bitcoin).

[42] e.g. Philipp Paech, 'The governance of blockchain financial networks' (2017) 80 Modern Law Review 1073, 1093.

[43] *Walch* (n 30) 52.

[44] e.g. Kevin Werbach and Nicolas Cornell, 'Contracts ex machina' (2017) 67 Duke Law Journal 313; Michel Cannarsa, 'Interpretation of contracts and smart contracts: smart interpretation or interpretation of smart contracts' (2018) 26 European Review of Private Law 773; Sarah Green and Ferdisha Snagg 'Intermediated securities and distributed ledger technology' in Louise Gullifer and Jennifer Payne (eds), *Intermediation and Beyond* (Hart 2019); Kelvin Low and Eliza Mik, 'Pause the blockchain legal revolution' (2019) 69 International and Comparative Law Quarterly 135.

[45] e.g. Michèle Finck, 'Blockchains and the General Data Protection Regulation' (2018) 4 European Data Protection Law Review 17.

[46] *Paesch* (n 42) 1098.

[47] Dirk Zetzsche, Ross Buckley and Douglas Arner, 'The distributed liability of distributed ledgers: legal risks of blockchain' (2018) 4 University of Illinois Law Review 1361.

[48] Randy Priem, 'Distributed ledger technology for securities clearing and settlement: benefits, risks, and regulatory implications' (2020) 6 Financial Innovation 1, 17.

[49] See e.g. Matthias Lehmann, 'National blockchain laws as a threat to capital markets integration' (2021) 26 Uniform Law Review 148.

vision of frictionless (or frictionless-*ish*) interactions.[50] Implementation challenges have been examined in several contributions. These include Micheler's and von der Heyde's assessment of the impact of existing market structure on the future of DLT for intermediated securities, and Mainelli's and Milne's empirical work on the prospect of an industry-wide adoption of DLT in the post-trade area.[51] Following in the footsteps of these contributions, this part will put the process of adoption front and centre and approach implementation challenges by reference to a number of concepts, that is especially the crucial need for coordination (I.), the role of network effects and switching costs (II.), as well as the impact of power (III.). Moreover, by identifying challenges, this part will provide the necessary background for examining ISDA's recent initiatives on digitisation, which are the subject matter of parts D and E.

I. Coordination problems

1. The many layers of coordination

For any technology that promises frictionless interactions, coordination problems are among the most fundamental issues to overcome. In short, a frictionless future presupposes that market participants coordinate on common solutions and coordination is typically not without complications. For one, there is plenty to choose from. This includes the technology of which DLT is prima facie but one choice. Where the choice is DLT, the menu of potential choices also extends to a specific DLT platform (e.g. Fabric, Corda, Quorum), the potentially competing applications that may run on the same or on different platforms; and, depending on market structure,[52] various potential technological requirements that may be needed to allow interactions between users across these platforms and applications – for example, in order

[50]The importance of foundational standards is widely acknowledged among industry actors. See e.g. Ian Allison, 'Barclays, Goldman Champion ISDA Standard for blockchain derivatives – U.K.-based bank Barclays is pushing hard for a data standard for derivatives, as a foundation for that market to adopt distributed ledger technology' (*CoinDesk Insights*, 26 April 2018) <https://www.coindesk.com/markets/2018/04/26/barclays-goldman-champion-isda-standard-for-blockchain-derivatives/>; Kevin Rutter, 'The myth of easy interoperability' (14 December 2017) 4, available at <https://www.r3.com/wp-content/uploads/2018/04/Myth_of_Easy_Interop_R3.pdf>; *ISDA* (n 3).

[51]Eva Micheler and Luke von der Heyde, 'Holding, clearing and settling securities through blockchain/distributed ledger technology: creating an efficient system by empowering investors' (2016) 31 Journal of International Banking & Financial Law 652; Michael Mainelli and Alistair Milne, 'The impact and potential of blockchain on the securities transaction lifecycle' (2016) SWIFT Institute Working Paper No. 2015-007, available at <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2777404#>. Both studies offer useful insights. Micheler and von der Heyde, for example, highlight the role that incumbents play, a point that I will turn to when considering the role of power in section III. Mainelli and Milne meanwhile highlight the key importance of coordination. Coordination is a key consideration for the purpose of this article. See esp. section I below and Parts D and E.

[52]No dominant DLT solution has so far emerged and it is not likely that the market will tip to a dominant provider any time soon.

to exchange data or digital assets.[53] Importantly, to ensure smooth interactions across a market, industry wide coordination on common data and process requirements may also be required. Indeed, inconsistencies at this foundational level will diminish the case for any technology whose proposed value is inherently about enabling market participants to interact without friction. To be sure, the need for, or extent of, coordination at this level might vary depending on the use case. Obviously, it will be a lesser issue for activities that are not data or process rich. However, in the financial field, the reality is likely to be different. The OTC derivatives market offers an example. The OTC derivatives industry is wide and diverse. The products that are traded can be simple (or vanilla), but they can also be complex and highly customised. Trades can be short-lived, but they can also have a long life. Importantly, during their 'post-trade' lifetime (that is, following the execution of the trade), multiple events may come to affect a trade and the obligations of each party. These include events of default, termination, novation, payment and so on. These events will need to be processed accurately within the systems of different parties.[54] In this context, ISDA has noted that firms often operate multiple interdependent and duplicative systems.[55] It has pointed out that within these systems firms often have their own way of representing trades, events and processes (e.g. calculating amounts to pay) that take place during the lifecycle of a derivatives trade.[56] In

[53]To be sure, in the absence of coordinated outcomes, there may be possible workarounds. For example, Application Program Interfaces (APIs) are commonly used to allow different computer systems to interact. But such an approach may have noteworthy drawbacks: for example in terms of ensuring data consistency or in terms of creating dependence on a third party that operates the APIs (see World Economic Forum 'Inclusive deployment of blockchain for supply chains: Part 6 – a framework for blockchain interoperability' (2020) 14, available at <https://www.weforum.org/whitepapers/inclusive-deployment-of-blockchain-for-supply-chains-part-6-a-framework-for-blockchain-interoperability>, noting that APIs 'may not be able to guarantee eventual data consistency across the two blockchain platforms' and that an API 'centralizes trust to whoever operates the APIs'). Besides, relying on such workarounds would diminish the value proposition of DLT since it would mean applying fixes that DLT was meant to make a thing of the past.

[54]See *Walker* (n 21) noting at 18 that '[t]he key point of the trade lifecycle in relation to the design of infrastructure is that all those events have to be correctly processed in a timely manner'.

[55]ISDA, 'ISDA Whitepaper: the future of derivatives processing and market infrastructure' (September 2016) 18, available at <https://www.isda.org/a/UEKDE/infrastructure-white-paper.pdf> noting that the 'current derivatives ecosystem consists of a complex set of interdependent, duplicative systems and processes with inconsistent operating rules'.

[56]See e.g. Scott O'Malia 'Unlocking value via process standards' (*ISDA*, 2 August 2017) <https://www.isda.org/2017/08/02/unlocking-value-via-process-standards/> noting that '[t]here is no concrete, shared description of even the most basic market activities that we all take for granted, like posting margin or novating a trade. That means each firm has tended to develop its own policies and procedures for each event, and has represented them differently in internal systems'. See also Scott O'Malia, 'Technology & standards: unlocking value in derivatives markets' (*ISDA*, 30 November 2017) <https://www.isda.org/a/pM0EE/ISDA-Technology-Conference-Nov-30-2017-Scott-OMalia-Remarks.pdf> pointing out that a maturity extension might be represented 'as a change to an existing transaction at one firm, but a new trade at another'; Scott O'Malia, 'ISDA technology forum: opening remarks' (*ISDA*, 8 November 2018) <https://www.isda.org/2018/11/08/isda-ceo-scott-omalia-opening-remarks-at-isda-tech-forum-ny/> noting that '[e]ach firm – and even each trading desk – established its own systems and its own unique set of representations for events and processes that occur during the lifecycle of a trade'. See also Bank of England, 'Transforming data collection from the UK financial sector' (Discussion Paper, January 2020) 30, available at https://www.

this context, it has repeatedly referred to a 'lack of commonality' between firms[57] and highlighted inconsistent data representations as among the top obstacles to improve post-trade processing.[58] Similar views are held by Nair and Braine (of Barclays) who identify inconsistent processes, inconsistent data and duplicated data as 'fundamental industry problems'.[59] For them, the result is a 'perfect storm of industry inefficiency in post-trade processing'.[60]

Furthermore, where the use of SCT is contemplated, additional challenges will need to be overcome. As noted, SCT is supposed to improve interactions across the market by automating the execution of contractual terms which are amenable to the type of conditional logic that smart contracts follow.[61] Realising this vision requires coordination. It presupposes that market participants agree on suitable clauses and on how to express these clauses in computer code.[62] Prima facie, ISDA's paper-based documentation including the ISDA Master Agreement facilitates the coordination task to the extent that it represents an industry sanctioned standards layer of contractual terms that align with commercial practices, as well as applicable legal and regulatory requirements.[63] However, in reality, matters are more complicated. Making legal text machine-readable and -executable, requires, among other things, that great attention be paid to structure and language precision. However, the ISDA paper documentation was not drafted with a future automation through smart contract technology in mind. It leaves scope for variation, and market participants regularly customise terms.[64]

bankofengland.co.uk/-/media/boe/files/paper/2020/transforming-data-collection-from-the-uk-financial-sector.pdf?la=en&hash=6E6132B4F7AF681CCB425B0171B4CF43D82E7779, noting that '[e]very firm will have their own way of defining and storing most types of data, so there will be differences in how data points are labelled, formatted, and even whether they are collected and stored'.

[57] See e.g. ibid 'Unlocking value' and 'Technology & standards'.

[58] *ISDA* (n 3) 16, reporting the results of a post trade survey and noting that 'beyond resource and budget constraints, the biggest obstacles to reaching the desired future state in post-trade processing are inconsistent data representations and a low level of standardisation of technology and interfaces'.

[59] Aishwarya Nair and Lee Braine, 'Industry adoption scenarios for authoritative data stores using the ISDA Common Domain Model' (Chief Technology Office, Barclays, 2020) 2, available at https://arxiv.org/pdf/2007.06507.pdf.

[60] ibid.

[61] *Datoo* (n 1) 254. Conditional logic can be described in 'if-then' terms: e.g. *if* a stated event occurs, *then* the following action is taken.

[62] The code will need to be validated in order to ensure that the chosen contractual term and its representation in code have the same legal effects. See ISDA, 'Legal guidelines for smart derivatives contracts: introduction' (January 2019) 11, available at <https://www.isda.org/a/MhgME/Legal-Guidelines-for-Smart-Derivatives-Contracts-Introduction.pdf>. See also for details on validation, *Clack and McGonagle* (n 28) 25–26; ISDA and King & Wood Mallesons, 'Smart derivatives contracts: from concept to construction' (October 2018) 12–14, available at <https://www.isda.org/a/cHvEE/Smart-Derivatives-Contracts-From-Concept-to-Construction-Oct-2018.pdf>.

[63] ISDA and King & Wood Mallesons ibid 8.

[64] In particular, the Schedule of the Master Agreement leaves parties room to make changes. In practice, it is thus not uncommon for parties to settle for terms other than the standard terms that are included in the pre-printed portion of the Master Agreement. See Ciarán McGonagle, 'A Step to Digitised Documentation' (January 2020) 6:1 IQ ISDA Quarterly 18, 18–19, available at https://www.isda.org/a/8ALTE/IQ-ISDA-Quarterly-January-2020.pdf.

2. Coordination games

Coordination is difficult *also* because it presupposes a meeting of minds with respect to which outcome to coordinate on. Moreover, even if actors prefer coordination to an absence of coordination, they might prefer different coordinated outcomes. Game theory offers a way to illustrate the relevant issues at a basic level. Game theory examines in a highly stylised way, the interactions of strategically minded actors (known as 'players') and, based on a demanding set of assumptions, seeks to explain and predict the outcomes of these interactions. It has proven a useful analytical tool to illustrate problems of cooperation between actors.[65] It is also a useful tool for examining coordination problems.[66] McAdams describes coordination problems as arising where actors can achieve 'some mutually desired outcome – or avoid some mutually undesired outcome – only by combining their actions in a certain way … '.[67] However, since there is more than one way to combine actions in a coordination game, players need to 'coordinate on *the same* combination' in order to achieve the desired, or avoid the undesired, outcome.[68] In more technical terms, coordination games are said to display multiple Nash equilibria.[69] In a pure coordination game, the players are 'indifferent' between (Nash) equilibria.[70] However, whilst they share an interest in 'coordinating on some equilibrium', the game's structure does not allow to single out any specific equilibrium.[71] Hence, players face the problem of knowing which equilibrium to coordinate on. As McAdams put it '[g]iven two or more plausible matches, the problem is predicting which one the other player(s) will use'.[72] Therefore, finding a way to coordinate *expectations* among players – 'the one course of action that their expectations of each other can converge on'[73] – is crucial.

[65] Richard H. McAdams, 'Beyond the prisoners' dilemma: coordination, game theory, and law' (2009) 82 Southern California Law Review 209, 218. By far, the best-known example is the (one-shot) Prisoner's dilemma game where the unavoidable failure of players (or prisoners) to cooperate 'is worse *for each prisoner* than another possible outcome' (at 216).

[66] ibid 218, noting that '[g]ame theory identifies another pervasive problem: the need to *coordinate*'. See also Richard H. McAdams, *The Expressive Powers of Law – Theories and Limits* (Harvard University Press 2017) 31, the Prisoner's Dilemma is limited to situations where an actor 'want[s] to take some action *no matter what the others do*' whereas coordination is about an actor 'wanting to take some action *only if others also do the same*'.

[67] *McAdams* (n 65) 219.

[68] ibid 219.

[69] A 'Nash' equilibrium is a 'stable situation in which no decision maker has an incentive to change strategy given the strategies chosen by the others'. See Thierry Pénard, 'Game theory and institutions' in Éric Brousseau and Jean-Michel Glachant (eds), *New Institutional Economics: A Guidebook* (CUP 2008) 158, 160.

[70] Judith Mehta, Chris Starmer and Robert Sugden, 'The nature of salience: an experimental investigation of pure coordination games' (1994) 84 The American Economic Review 658, 658.

[71] ibid.

[72] *McAdams* (n 66) 24.

[73] See Thomas Schelling, *The Strategy of Conflict* (Harvard University Press 1980) 54 and at 86 describing a pure coordination game as a situation where 'each player's best choice of action depends on the action he expects the other to take, which he knows depends, in turn, on the other's expectations of his own'.

That said, many coordination games are not of a pure type. They are mixed motive games or impure coordination games, such as the 'Battle of Sexes' game, in which there is an element of conflict between players' preferences.[74] For example, consider the case of two firms, which both prefer coordination over no coordination, but each prefers implementing an outcome that is closer to, say, its own data and process representations. In comparison to a pure coordination game, coordination problems are further exacerbated in this situation because players are not indifferent between equilibria.[75] To be sure, since players are said to prefer coordination over a lack of coordination in a battle of sexes game, coordination can prima facie still be achieved.[76] As in a pure coordination game, an answer may come from outside the game's formal structure, in a way that makes an equilibrium focal.[77] There will be more to say about focal points later.

II. Network effects and switching costs

Having examined coordination problems, this section turns to the role of network effects and switching costs. It begins by observing that for any technology (DLT or other) that promises to make industry-wide interactions seamless, 'value' will depend importantly on how far the technology is adopted.[78] Thus, whether it is the recording and managing of shared data, or the transfer of digital assets, across a network, the more users join the network, the more opportunities for frictionless interactions across the network. In these circumstances, 'value' cannot be dissociated from usership and value propositions that focus solely on the supposed prowess of a technology in enabling frictionless interactions are therefore better viewed as referring to an *expected* value – that is, an anticipated value that is contingent on having a wide adoption base.[79] Indeed, seen in this light, DLT is no different to other past

Zeckhauser describes this reasoning as 'if he thinks that I think' reasoning: Richard Zeckhauser, 'Distinguished fellow – reflections on Thomas Schelling' (1989) 3 Journal of Economic Perspectives 153, 154.

[74]To be accurate, players are said to have 'common and conflicting preferences' in such a game, *McAdams* (n 66) 35.

[75]Richard H. McAdams and Janice Nadler 'Testing the focal point theory of legal compliance: the effect of third-party expression in an experimental Hawk/Dove game' (2005) 2 Journal of Empirical Legal Studies 87, 92.

[76]Recall that in a battle of sexes game, players have a distributional conflict. Nevertheless, according to *McAdams* (n 66) 43, '[a]lthough the size of the focal point effect is a contingent and empirical matter, there is no reason a priori to think that it disappears entirely as the magnitude of the conflict grows' (at 43).

[77]On focal points, see *Schelling* (n 73) and *McAdams* (n 66) who draws on Schelling's work.

[78]On network effects with respect to DLT, see also *Klimos* (n 40) 210. In a different context, see also Marcel Kahan and Michael Klausner, 'Standardization and innovation in corporate contracting (or "the economics of boilerplate")' (1997) 83 Virginia Law Review 713, 725–26 highlighting that the value of network products depends both on the 'inherent benefits' related to the product's technical qualities as well as on the network benefits.

[79]To be sure, given the wide range of potential applications of DLT, there will be use cases where value can be realised independently of a wide adoption base. Think for example of a market actor that seeks to protect itself against cyber-attacks by implementing DLT as part of a 'technological diverse system'

technologies whose value, because of the presence of so-called network effects, does not only depend on what a technology has to offer. Think for example of the (now out of fashion) fax machine:[80] the value for a user increases as others also adopt it.[81] The more adopters, the greater the value of the network.[82]

The point about network effects is important. Theory predicts that in the presence of network effects, a new technology may not, or may not easily, gain traction among market participants. This may be because of an externality problem, which causes a new technology to be under-adopted.[83] Crucially, it may also be because of coordination issues which affect adoption. Thus, the presence of network effects further underscores the role which expectations play in influencing outcomes. Specifically, in markets with network effects, it is common to say that expectations about how others decide will prove crucial for the fate of network products: 'if players expect others to adopt, they too will adopt'.[84] Once a critical mass of users have joined a network or once further adoption is 'confidently foreseen', 'further self-reinforcing adoption follows'.[85] Markets with strong network effects are thus said to be 'tippy', meaning that such markets can give rise to 'winner-take-all' dynamics if they tip towards one dominant technology or technology provider.[86]

However, failure to gain a sufficient foothold in network markets can amplify failure.[87] In other words, insufficient adoption can also be 'self-

(see David Mills et al., 'Distributed ledger technology in payments, clearing, and settlement' (Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C., 2016-095) 33, available at https://www.federalreserve.gov/econresdata/feds/2016/files/2016095pap.pdf). But to the extent that DLT is meant to herald a new era of seamless interactions across the financial industry, this will not be the case.

[80] Laura Noonan, 'Banks' blockchain comedown' *Financial Times* (London, 19 February 2019) <https://www.ft.com/content/122de77c-3483-11e9-bd3a-8b2a211d90d5>.

[81] e.g. Catherine Tucker, 'Network effects and market power: what have we learned in the last decade' (2018) Antitrust 72, 72. See also Michael Katz and Carl Shapiro, 'Network externalities, competition, and compatibility' (1985) 75 American Economic Review 424, 424 noting that ' … the utility that a given user derives from the good depends upon the number of other users who are in the same "network" as is he or she'.

[82] Of course, this might not always be true, see *Tucker* ibid 76–77 who points out that network effects can be 'localized'.

[83] Joseph Farrell and Paul Klemperer, 'Coordination and lock-in: competition with switching costs and network effects' in Mark Armstrong and Robert Porter (eds), *Handbook of Industrial Organization* Volume 3 (Elsevier 2007) 1967, 2019–20. Highlighting this issue in a securities markets context, see Robert Ahdieh, 'Making markets: network effects and the role of law in the creation of strong securities markets' (2003) 76 Southern California Law Review 277, 300.

[84] See *Farrell and Klemperer* ibid 2025.

[85] ibid. See also Geoffrey Heal, 'Price and market share dynamics in network industries' in Graciela Chichilnisky (ed), *Markets, Information and Uncertainty – Essays in Economic Theory in honor of Kenneth J. Arrow* (CUP 1999) 191, 192 noting that critical mass will provide 'strong incentives to other potential users to join'.

[86] Michael Katz and Carl Shapiro, 'Systems competition and network effects' (1994) 8 Journal of Economic Perspectives 93, 106 for further details and describing tipping as 'the tendency of one system to pull away from its rivals in popularity once it has gained an initial edge'.

[87] Carl Shapiro and Hal Varian, *Information Rules – a Strategy Guide to the Network Economy* (Harvard Business School Press 1999) 174.

reinforcing'.[88] The literature talks in this context of a death spiral 'if low adoption persuades others not to adopt'.[89] Moreover, where network effects are present in *existing* (but incompatible) technology, there can be additional complications. Under such conditions, network effects may act as 'glue' between users' choices, which will make it more difficult to coordinate a switch 'to something better but incompatible',[90] especially if, as Farrell and Klemperer point out, such a decision involves individual switching costs.[91] The point about switching costs has special relevance in the financial/banking sector which is information and data intensive and which accordingly is reliant on a combination of hardware and software to record, process and communicate data. The required IT infrastructure within a financial institution can be especially complex and often develops organically as a result of tactical rather than long-term strategic choices. Thus, a firm's IT infrastructure is often made of a patchwork of systems – legacy and others – that interact and complement each other.[92] Moreover, the absence of industry wide standards means that systems which process and record data often have different data models. Replacing or making changes to this interconnected patchwork of hardware and software can have a substantial price tag. The prospect of significant learning cost as well as the risk of seeing operations seriously disrupted as a result of changes to this infrastructure are also likely to be part of the cost calculus. All this means that switching to a new (incompatible) technology is likely to be hard and so-called lock-in to legacy systems and infrastructure a very likely problem.[93]

III. Power

As noted, DLT is supposed to remove the need for centralisation and by doing so become a key enabler of organisational change. However even assuming that DLT as a technology were such an enabler, concentrating solely on the technology, risks concealing important factors that contribute in practice to determining the prospect of organisational change. Specifically, this section turns to *power* and in this context the role of incumbents in influencing or stifling technological change that risks being at odds with their interests.[94]

[88] *Farrell and Klemperer* (n 83) 2025.
[89] ibid.
[90] ibid 2028.
[91] ibid.
[92] See generally *Walker* (n 21).
[93] Besides 'technology lock-in', users might also experience 'vendor lock-in'. Vendor lock-in arises where a user cannot rely on alternative providers to, for example, make required 'follow-on' purchases (e.g. software updates, replacement parts). See *Shapiro and Varian* (n 87) 120.
[94] Power is also a key consideration in Walch's analysis of 'decentralisation' (see *Walch* (n 30)). However, Walch is mainly interested in power within DLT systems whereas power in our context is of interest as an external force that can shape or influence technological change. Note in this context also the

Market power can present itself in various forms.[95] It might be in the form of rents that incumbents are able to extract where users experience lock-in. It might be in forms other than pricing.[96] Dan Awrey, for instance, highlights how intermediaries who gain power because of their market position can shape market structure to serve their own interests.[97] He draws on Kathryn Judge's work on intermediary influence who argues that intermediaries who yield power ('influence', in Judge's account) because of 'informational and positional advantages', use it in 'self-serving ways' to influence the evolution of institutional arrangements.[98] Judge's and Awrey's accounts offer a starting point for examining what 'power' might mean in our context. However, to see how in the present context, incumbents can yield power to shape or stifle changes, it is necessary to elaborate on the notion of dependence and its relation with power. It was Emerson who pointed out that power was a property of a relation rather than the quality of an actor.[99] Thus, to say that an actor had power was a meaningless statement unless one specified 'over whom'.[100] For Emerson, power then 'reside[d] implicitly in the other's dependency'.[101]

The relationship between power and dependence is, it is submitted, of analytical relevance when examining the relations between technology firms (DLT platform providers or technology providers that build on top of these platforms) and incumbents with significant positional advantages. Consider for example, financial market infrastructures – a type of centralised institution. They are few and far between. They benefit from access to a large network of users, which prima facie puts them in an influential position to help drive the adoption of new technologies. They also benefit from the fact that they

contribution of *Micheler and von der Heyde* (n 51) whose analysis also points to the role that incumbents can play in influencing technological change.

[95]Dan Awrey, 'The limits of private ordering within modern financial markets' (2014-2015) 34 Review of Banking and Financial Law 183, 198.

[96]ibid.

[97]ibid, noting further (at 198–99) that 'this influence can also be used to undermine the emergence and adoption of disruptive technologies that represent a threat to this power'.

[98]Kathryn Judge, 'Intermediary influence' (2015) 82 University of Chicago Law Review 573, 577.

[99]Richard Emerson, 'Power-dependence relations' (1962) 27 American Sociological Review 31, 32.

[100]ibid.

[101]ibid. Although Emerson was concerned with social relations, his basic insight on power and dependence is of explanatory relevance in many different interaction settings. For example, dependence is the basis of the power of a firm (e.g. to set prices) over customers in case where the latter experience lock-in. Switching costs, which are typically associated with lock-in, are a measure of this dependence. Prima facie, the latter will vary directly with the amount of switching costs that a customer will suffer if she were to switch to a rival firm. Dependence – that is, the dependence of actors on intermediaries – also explains in some of the examples that Judge identifies, why intermediaries can yield influence (or power). See e.g. Judge's account of the influence that real estate agents yield (*Judge* (n 98) 586–87). She explains how as a result of network effects and the ability of real estate agents to control access to the Multiple Listing Service (MLS), real estate agents developed positional advantages. Implicit in this description is that the combination of network effects and access control is at the origin of dependence – that is, the dependence of buyers/sellers on real-estate agents – which the latter can exploit in order to maintain high fees.

operate in a highly regulated and hence cost intensive market environment which creates barriers to entry for new participants. Technology firms that develop DLT platforms or DLT applications for financial markets fall short along all of these dimensions. They lack access to a user base and critical mass to make a DLT network economically viable. They also lack regulatory licenses to operate in a highly regulated financial market context. Under these circumstances, it is a short step to conclude that technology firms will often depend on incumbents to advance their technology, and that they will actively court, and seek to engage with, incumbents who will benefit from their positional advantages and the fact that there is no shortage of technology providers that seek to offer DLT solutions.[102] This account of dependence then has implications for predictions that DLT will usher in an era of organisational change and decentralised finance. To put it simply, under the above conditions, outcomes are skewed towards the powerful.[103] Accordingly, DLT is more likely to prevail if its design choices are not at odds with the preferences/interests of powerful incumbents, including with respect to disintermediation or decentralisation. Indeed, under these circumstances, new technologies may only in fact offer incumbents new opportunities to extend their dominance to new areas and as a result further entrench their already significant positional advantages.[104]

[102]Indeed, in practice, there are many examples of technology firms engaging with incumbents, for example as technology supplier or as consultant. Prominent cases are the collaboration between Deutsche Börse Group and HQLA^{X}; the Australian Stock Exchange and Digital Asset; the Swiss Stock Exchange and R3; DTCC with Axoni, R3 and IBM; or Fnality with the backing of a consortium of banks. On collaboration between Fintech firms and financial institutions, see also Luca Enriques and Wolf-Georg Ringe, 'Bank–fintech partnerships, outsourcing arrangements and the case for a mentorship regime' (2020) 15 Capital Markets Law Journal 374.

[103]In a different context, but along the same lines, see also Henry Farrell's comments on Yochai Benkler's transaction cost analysis of commons-based peer production (Henry Farrell 'Why Coase's penguin didn't fly' (*blogpost, Crooked Timber*, 21 July 2017) <https://crookedtimber.org/2017/07/21/why-coases-penguin-didnt-fly/>). Farrell argued that Benkler had been oblivious to the role played by power in his work. Benkler responded and disagreed, drawing on his extensive body of work (see Yochai Benkler 'Of penguins and power' (*blogpost, Crooked Timber*, 25 September 2017) <https://crookedtimber.org/2017/09/25/of-penguins-and-power>).

[104]Concerns that new technologies might allow incumbents to extend their dominance have, for example, been raised in relation to ASX, the Australian Securities Exchange, and its project to replace CHESS – the Clearing House Electronic Subregister System – with distributed ledger technology. See Jamie Smyth and Philip Stafford, 'ASX users urge Australian exchange to delay blockchain project' *Financial Times* (London, 25 June 2020), available at https://www.ft.com/content/9acde1ba-184a-4827-880f-a5168275da38. Another prominent example among centralised institutions that tries to make the most of DLT is the Depository Trust & Clearing Corporation (DTCC) – a post-trade financial market infrastructure. Describing itself as 'enabler of a potential paradigm shift toward a new distributed platform' (see DTCC, 'Embracing disruption – tapping the potential of distributed ledgers to improve the post-trade landscape' (January 2016) 10, available at https://www.dtcc.com/blockchain), the DTCC has tried to get ahead of the curve and carve out a role for itself in a DLT enabled environment by collaborating with IBM and DLT technology firms, Axoni and R3. Note that at the time of writing, neither the ASX's nor the DTCC's initiatives have come to fruition.

D. Addressing implementation challenges: the role of the International Swaps and Derivatives Association

Part C examined implementation challenges. This part zooms in on the OTC derivatives market in order to take stock of current market efforts to overcome such challenges. In particular, this article focusses on the OTC derivatives market, and in this context, on the work of the International Swaps and Derivatives Association (ISDA). ISDA has been described as the 'de facto trade association of the global OTC derivatives industry'.[105] Its membership is wide and diverse. It is most well-known for its work on the standardisation of OTC derivatives documentation. More recently, it has emerged as a fervent supporter of new technologies. Specifically, it has advocated technological change, as an answer to an ageing post-trade infrastructure and processes among market participants which it deems inefficient, costly and generally not fit for purpose.[106] Accordingly, it has launched several initiatives to support technological change and bring the industry closer to a frictionless future. Some of these initiatives focus on legal challenges. For example, ISDA has issued a range of publications which identify and examine legal issues raised by DLT and SCT.[107] However, most of ISDA's efforts have been spent elsewhere, that is on implementation challenges. Building on its credentials as a market standard-setter, it has launched several standard-setting initiatives. This part, together with Part E, focusses on these initiatives and examines them in light of our findings in Part C. Specifically, this part begins by examining ISDA's initiatives against our findings on the role and importance of coordination. As a reminder, when examining implementation challenges, it was shown that a future of seamless interactions presupposed coordination on a wide range of underlying requirements, including data, process and legal data requirements. Moreover, using basic game theory, it was explained why coordination among actors was likely to be complicated. This part assesses how ISDA's initiatives seek to contribute to addressing the coordination conundrum. For this purpose, this part begins by turning to the concept of focal points as a solution to coordination problems (I.). Next, it examines ISDA's initiatives as seen through a focal point lens (II.).

I. Coordination and focal points

The aim of this section is to introduce the concept of focal points, as described in the work of Thomas Schelling.[108] Schelling saw focal points as a solution to the problem of coordinating in the face of multiple equilibria. Specifically, Schelling ascribed to a focal point an important

[105] *Awrey* (n 95), 205.
[106] See for details *ISDA* (n 3) 11–17.
[107] e.g. *ISDA and Linklaters* (n 15); *ISDA*, (n 62); *ISDA* (n 23).
[108] *Schelling* (n 73). See also *McAdams* (n 66) who draws on Schelling's work.

potential quality: to permit actors to form mutually consistent expectations and by the same token to allow coordination to take place. As Schelling observed,

> '[p]eople *can* often concert their intentions or expectations with others if each knows that the other is trying to do the same. Most situations – perhaps every situation for people who are practiced at this kind of game – provide some clue for coordinating behavior, some focal point for each person's expectation of what the other expects him to expect to be expected to do.'[109]

For Schelling, a 'prime characteristic' of many focal points was 'some kind of prominence or conspicuousness'[110] and 'some kind of uniqueness'.[111] Importantly, according to Schelling, a third party could help to resolve a coordination game by 'draw[ing] expectations to a focus',[112] even if all that the third party had to offer was a 'power of suggestion'.[113] Moreover, focal points could help to resolve pure coordination games, but also mixed-motive games.[114]

Schelling's ideas have proved influential. In the law and economics literature for example, they figure prominently in McAdams's work who focusses inter alia on standardisation and contends that, by acting as a focal point, standards can offer a solution to coordination problems.[115] It is submitted that what McAdams contends with respect to state-sponsored standards is also true of industry standards. Thus, for example, the ISDA Master Agreement, the centre piece of the ISDA documentation architecture for OTC transactions, can be thought of in terms of its focal point value. This focal point account starts with the observation that parties that seek to transact in the OTC derivatives market may find themselves in a situation that is akin to a (mixed-motive) coordination game: parties must agree on common contractual terms for their future transactions; each party favours its own terms, but parties also share an interest in coordinating on common terms.[116] In such a situation, standard terms – the terms of the Master Agreement in the present

[109] *Schelling* (n 73) 57. Schelling went on to suggest that such clues might stem from the characteristics of a particular location. However, expression could produce a focal point too (see *McAdams* (n 66) 43–44). Parties might decide to speak to each other, even if the words uttered remained entirely unenforceable ('cheap talk'). See *McAdams* (n 66) 44.

[110] *Schelling* (n 73) 57.

[111] *ibid* 58. Schelling offered illustrations, but he also made it plain that what could be said to precisely amount to a focal point was in final analysis difficult to pin down. See ibid 58, noting that 'we are dealing with imagination as much as with logic; and the logic itself is of a fairly casuistic kind'.

[112] ibid 68.

[113] ibid 144.

[114] *McAdams* (n 66) 23.

[115] ibid 70

[116] See generally Robert Ahdieh, 'The strategy of boilerplate' (2006) 104 Michigan Law Review 1033, 1039, noting with respect to bargaining that 'each party desires the best possible price; each wants its favored warranty terms, and the like. But each one only wants as much as it can have while still preserving the prospect of agreement'. On coordination and bargaining, see also *McAdams* (n 65) 236–37; Karen Eggleston, Eric Posner and Richard Zeckhauser, 'The design and interpretation of contracts: why complexity matters' (2000-2001) 95 Northwestern University Law Review 91, 112.

case – can be the obvious place to settle,[117] or to borrow Schelling's words, the point 'at which each [party] expects the other not to expect to be expected to retreat'.[118]

Hence, the Master Agreement can prima facie help market participants to resolve a coordination game that they hitherto faced when seeking to agree terms for their transaction. Indeed, the Master Agreement has undoubtedly been exceptionally successful in enabling coordination. Cementing its status is that it benefits from a critical mass of users and from self-reinforcing adoption dynamics. ISDA's more recent initiatives on digitisation and automation now hope to replicate the success of the Master Agreement. It is to these initiatives that I am turning next.

II. ISDA's initiatives on digitisation

This section examines ISDA's initiatives on digitisation, as seen through a coordination/focal point lens (1.). Next, it goes on to show that these initiatives not only seek to engage the industry, but also the regulatory community, thereby potentially strengthening the focal point effect of these initiatives for market participants (2.).

1. Enabling coordination: ISDA's standardisation initiatives for the digital age

Before examining ISDA's initiatives in light of our findings on coordination and focal points (b), it is first necessary to introduce them (a).

a) The Common Domain Model and the Clause Taxonomy and Library.

The centrepiece of ISDA's initiatives on digitisation is the ISDA Common Domain Model (CDM) which ISDA introduced in 2017. The CDM has been described as 'standardised, machine-readable and machine-executable blueprint for how financial products are traded and managed across the transaction lifecycle'.[119] It was developed by a RegTech firm, REGnosys, for ISDA. The CDM 'blueprint' is ISDA's answer to the absence of industry conventions

[117]That there is truth in this 'focal point' account is also supported by ISDA which noted that, '[b]ack in the early days of the derivatives market, the publication of the ISDA Master Agreement gave firms a common template they could use to negotiate derivatives trading relationships, removing the chaos of having to agree terms when each party had its own preferred agreement with its own unique clauses and definitions'. ISDA, 'Road to Digitisation' (January 2020) 6:1 IQ ISDA Quarterly 11 at 11, available at https://www.isda.org/2020/01/30/standardise-to-digitise-iq-january-2020/.

[118]*Schelling* (n 73) 70.

[119]'Rosetta documentation – overview the ISDA CDM', available at https://docs.rosetta-technology.io/cdm/readme.html. See also ISDA, 'ISDA CDM 2.0 FAQ – March 2019', available at http://assets.isda.org/media/649ca60c-2/b3dd70a2-pdf/ describing the CMD as a 'machine-readable and machine-executable data model for derivatives products, processes and calculations'. See also ISDA 'What is the ISDA CDM' (2018), available at https://www.isda.org/a/z8AEE/ISDA-CDM-Factsheet.pdf. The ISDA CDM software can be accessed through a portal, which requires registration (see https://portal.cdm.rosetta-technology.io/#/login).

on how to digitally represent derivative products as well the processes and events that affect these products over their lifetime. The importance of achieving consistency at this level was discussed earlier. As noted, the fact that parties involved in a trade typically have their own ways of representing trades, events and processes in their internal systems can generate inconsistencies, which by re-introducing friction and scope for failure, undermines the very value proposition of technologies such as DLT. Thus, a market-wide adoption of the CDM would minimise the need for reconciliation processes between systems[120] and create key foundations that new technologies such as DLT can leverage.[121]

Since announcing its intention to work on common domain models in its 2016 White Paper on the future of derivatives processing,[122] the CDM has become ISDA's flagship initiative on digitisation and automation. Other industry associations have since followed in ISDA's footsteps. This is the case of the International Securities Lending Association (ISLA) which represents industry interests in the area of securities lending and financing,[123] and the International Capital Markets Association (ICMA) which represents the interests of firms that participate in the international capital market.[124] Both associations are collaborating with ISDA on a common domain model.[125]

The CDM is not ISDA's only initiative in this area. Besides its work at the operational level, ISDA is also working on the further standardisation and digitisation of its legal documentation. The ISDA Clause Taxonomy and Library, for example, seeks to improve on the standardisation that the ISDA documentation is currently offering. As noted earlier, the Master Agreement and its associated documentation offers a legal agreement standards layer. However, the ISDA documentation was not drafted with a future automation through smart contracts in mind. It lacks the required structure and precision.

[120]See ISDA, 'Unleashing the CDM' (January 2020) 6:1 IQ ISDA Quarterly 22, at 22 noting that '[b]y creating a standard representation for events and processes that occur throughout the trade lifecycle, the CDM eliminates the need to constantly cross-check and reconcile trade information'.

[121]ISDA, 'What is the ISDA CDM?' (February 2021) 7 ISDA Quarterly 39, noting at 39 that '[t]he ISDA CDM creates a foundation for long-term process transformation using emerging technologies like cloud, distributed ledger and artificial intelligence. The ISDA CDM is available in machine-readable and machine-executable formats and languages that can be consumed by those technologies'. See also *ISDA*, 'ISDA CDM 2.0 FAQ' (n 119) noting that the '[u]se of the ISDA CDM will speed up the development of new technology solutions for the derivatives market by allowing providers to focus on what they specialize in – the technology – rather than requiring them to interpret and represent derivatives market events and processes individually. The resulting technology solution will also be interoperable with other offerings'.

[122]*ISDA* (n 55) 26.

[123]See https://www.islaemea.org/about-isla/.

[124]ICMA, 'International Capital Market Association – an overview' (March 2021) 2, available at https://www.icmagroup.org/assets/documents/Media/Brochures/2021/ICMA-Overview-brochure-160321.pdf.

[125]ISDA 'ISDA and ISLA agree to closer collaboration on digital initiatives' (July 2020), available at https://www.isda.org/2020/07/27/isda-and-isla-agree-to-closer-collaboration-on-digital-initiatives; ICMA, 'Common Domain Model (CDM)' available at https://www.icmagroup.org/Regulatory-Policy-and-Market-Practice/repo-and-collateral-markets/fintech/common-domain-model-cdm/.

Indeed, the scope that it leaves for customisation and variation may not only unnecessarily complicate actual negotiations, but it is also problematic for a possible industry-wide automation of contractual provisions.[126] To realise the latter vision, a common legal agreement data model and common digital representations of suitable contractual provisions is required.[127] The Clause Taxonomy and Library, which ISDA developed together with D2 Legal Technology (D2LT), a technology firm, aims to take a first step into this direction.

To be clear, the Clause Taxonomy and Library is not a legal agreement data model. The taxonomy lists, maps and properly defines a range of common clauses that are found in ISDA master agreements (and subsequently, in credit support documentation), as well as *variants* of such clauses as they were identified following a review of thousands of negotiated agreements.[128] Importantly, these are organised by reference to *business outcomes* that the clauses achieve. Thus, in the case of payment netting for example, this outcome may be to net payments that are due in relation to the same transaction or, say, payments that are due in relation to a certain group of transactions.[129] Once consolidated by reference to business outcomes, the clauses and their variants are presented in the form of model wording that is available to market participants as part of the clause library.[130] This approach seeks to focus minds on substance rather than form, and by doing so to discourage parties from spending efforts and energy on unnecessarily customising contractual language. Important for our discussion is that the taxonomy, by properly defining clauses as well as organising clauses according to business outcomes and, by the same token, decoupling form from substance, serves the imperatives of structure and precision which are *sine qua non* for a future automation through new technologies. Thus, the Clause Taxonomy and Library is meant to function as the starting point for building a common legal agreement data model to express legal agreements in a form that may make automation possible.[131] In short, it enhances standardisation in a way that helps the progression from a legal agreement standards

[126] *ISDA* (n 23) 8 noting that ' … the continuing customization of standard-form documentation and the bespoke wording agreed between contracting parties across their legal agreements creates … obstacles to further digitization of legal documentation and the implementation of new technology to deliver increased automation of contractual events and obligations'. *ISDA* (n 3), 17 noting that ' … the lack of standardisation hampers efforts to digitise documentation and automate certain contractual terms'.

[127] On data modelling in a legal context, see the excellent coverage by *Datoo* (n 1) 53–88.

[128] For a very good introduction to the purpose and workings of the Clause Taxonomy and Library, see the ISDA webinar which is available at https://www.isda.org/2020/06/23/what-is-the-isda-clause-library-2/.

[129] This is a somewhat simplified example. For details, see ibid.

[130] As part of the building of a clause, parties may be required to make certain choices by selecting or removing variables set out in each selected clause. They may also have to add allowable values for the selected clause (e.g. an amount or date that requires specification). See ibid.

[131] See *ISDA* (n 28) 10 noting that the Clause Library seeks inter alia to 'provide the basis of a legal agreement data model for the ISDA Master Agreement'. See also *ISDA* (n 3) 20, noting that '[i]ncreased standardisation of legal documentation through the ISDA Clause Library project is a vital component of

layer (the ISDA Master Agreement and its related documentation) to a future legal agreement data model. Ultimately, the aim is to be in a position to represent the 'digitised expressions' of suitable standard clauses in the ISDA CDM and by doing so to align the work on legal documentation (the taxonomy/library) with ISDA's work at the operational end (the ISDA CDM).[132]

Besides the ISDA CDM and the Clause Taxonomy and Library, ISDA is pursuing several other initiatives – for example, ISDA Create which is an online platform that allows documentation to be created, agreed and managed online.[133] ISDA is also working on overhauling its interest rate derivatives definitions. These definitions are a crucial component of ISDA's OTC documentation. Like the Clause Taxonomy and Library, ISDA's ambition is to eventually be in a position to integrate this work on legal documentation with its work on automation at the operational end.

b) Enabling industry coordination on substance and strategy. Schelling's insights on the role that focal points can play when coordination is required, offers a lens to understand and explain the value of ISDA's standardisation initiatives. Recall that a frictionless (or frictionless-*ish*) future presupposes industry-wide coordination, that is, on technology of which DLT, or a specific variation of DLT, is but one choice; on common or interoperable solutions at the platform and application level; and – importantly – on common foundational standards (technological, data, process or legal agreement data) on which industry-wide agreement is required or desirable to make frictionless interactions without complicated workarounds across the industry a reality. Along each dimension, there are multiple choices and prima facie differing preferences across the industry for each of them. The 'vacuum of indeterminacy',[134] which surrounds industry-wide coordination in the derivatives market is substantial. To be sure, one answer to a coordination problem is communication among players (market participants). However, the derivatives community is wide and diverse and the size and diversity will stand in the way of efforts to communicate effectively.[135] Against this background, ISDA's initiatives to 'standardise to digitise' can be viewed as an attempt to

ISDA's strategy for delivering enhanced legal documentation standards and facilitating further automation of derivatives products through the development of smart derivatives contracts'.

[132] *ISDA* (n 23) 37, noting that '[t]his digitized expression of standard-form clauses can then be modelled in the ISDA CDM, resulting in the creation of a common collateral process model comprising standardized events and processes that are aligned with industry standard representations of the underlying contractual provisions'. See also ISDA, 'Digital benefits: a member perspective' (6 August 2020), available at https://www.isda.org/2020/08/06/digital-benefits-a-member-perspective.

[133] ISDA, 'ISDA Master Agreement and ISDA Clause Library Added to ISDA Create' (21 January 2021), available at https://www.isda.org/2021/01/21/isda-master-agreement-and-isda-clause-library-added-to-isda-create/. The ISDA Clause Library is going to be part of ISDA Create. Note that ISDA Create was built by Nakhoda, Linklaters' technology start up (ibid).

[134] I borrow the words from *Schelling* (n 73) 68.

[135] See similarly Robert Ahdieh, 'Law's signal: a cueing theory of law in market transition' (2004) 77 Southern California Law Review 215, 241.

resolve part of the coordination game 'frictionless trade'. Specifically, by putting forward 'mutualised industry solutions',[136] the aim is to draw the industry's expectations 'to a focus'[137] – to 'bring the industry together' in ISDA's words[138] – and enable coordination on a foundational standards layer (i.e. data and process standards, and more structured legal agreement data) 'for a more robust, automated and digital post-trade infrastructure'.[139] Importantly, the ISDA CDM or the Clause Taxonomy and Library may have a good claim to salience (or 'focal point' status) because of the prominence and uniqueness of ISDA as an industry standard setter in the OTC derivatives market: '[e]veryone expects everyone else to expect everyone else to expect'[140] that ISDA is the place where common solutions for the OTC market are found.

What is more, ISDA's ambition to enable coordination is arguably just as much about substance than about strategy. This is because by focussing on foundations, ISDA also effectively encourages market coordination on something akin to an *evolutionary* strategy that aims to bring about industry-wide technological change incrementally from the bottom-up as opposed to radical and rapid change in favour of a technology such as DLT/SCT. The benefits of an evolutionary strategy can arguably be viewed in light of a number of circumstances. For one, it helps build a layer of compatibility or interoperability across the OTC market, which reduces the risk of users being left stranded on 'digital islands' where network benefits are lost because of incompatibilities between different technologies or systems. A priori, it can also facilitate integration with existing systems which is practically speaking, a more likely scenario for supporting technological evolution in the OTC market than a wholesale replacement of legacy systems and technology. Arguably, however, chief among relevant circumstances is the significant amount of indeterminacy that separates the present state of trade processing from a supposedly frictionless future state. This indeterminacy also extends to the technology that is meant to bring the industry closer to such a future state. Significant uncertainty remains over which, if any, new technology will win over the market. Indeed, it is apparent that ISDA has stayed clear of addressing the technology challenges that DLT raises and to which I referred in Part C. Admittedly, the launch by ISDA of the CDM initiative coincided with, and indeed appears to owe much to, the industry hype about DLT that was prevalent in the 2010s. However, the CDM can be leveraged by a

[136] *ISDA* (n 3) 17.
[137] I borrow the words from *Schelling* (n 73) 68.
[138] ISDA, 'ISDA's vision for a smart future' (30 May 2017), available at https://www.isda.org/2017/05/30/isdas-vision-for-a-smart-future/.
[139] ISDA, 'Impetus for automation' (20 April 2020), available at https://www.isda.org/2020/04/20/impetus-for-automation/.
[140] *Schelling* (n 73) 91.

range of IT architectures and different technologies, including, but not only, DLT.[141] Likewise, initiatives such as the ISDA Clause Taxonomy and Library are part of the groundwork for a possible future legal agreement data model that a variety of technologies may leverage in the future. Although ISDA emerged as cheerleader for SCT, it is plain that questions about the feasibility of translating ISDA terms into code remain to be answered.

2. Strengthening the focal point effect? ISDA and the regulatory community

Above it was suggested that the CDM or the Taxonomy and Clause Library may have a good claim to represent a focal point solution for market participants because of ISDA's prominence and uniqueness as an industry standard setter. Arguably, the salience of these initiatives for market participants is further enhanced by ISDA's efforts vis-à-vis the regulatory community. Indeed, in contrast to the literature's characterisation of ISDA's work on OTC documentation as an effort to stay clear of regulatory authority,[142] ISDA has actively sought to engage with regulators over its digitisation initiatives. Specifically, it has encouraged this community to leverage its coordination efforts by adopting the CDM.

Prima facie, there are good reasons for public actors to pay attention to the industry's efforts. Like market participants, they stand to gain from a future where interactions with market participants are frictionless*(-ish)*. Importantly, they also stand to gain from a common foundational standards layer.[143] In the UK for example, both the FCA and the Bank of England have highlighted ISDA's foundational work in the context of their initiatives on regulatory

[141]Christopher Clack, 'Design discussion on the ISDA Common Domain Model' (29 November 2017) 2, available at https://arxiv.org/pdf/1711.10964.pdf.

[142]Annelise Riles, *Collateral Knowledge – Legal Reasoning in the Global Financial Markets* (University of Chicago Press 2011) 32.

[143]See PA Consulting, 'Digital regulatory reporting – a review of phases 1 and 2 of the digital regulatory reporting initiative' (September 2020), available at https://www2.paconsulting.com/rs/526-HZE-833/images/DRR-Report-Sept-2020.pdf, describing a 'common data standard' as 'a crucial component of enabling reporting automation'. The benefits of a shared standards layer have also been acknowledged by the FCA. See 'Digital regulatory reporting: pilot phase 1 report', 13, available at https://www.fca.org.uk/publication/discussion/digital-regulatory-reporting-pilot-phase-1-report.pdf, noting that '[f]or regulatory reporting to be automated, not only do the instructions need to be provided as code, but that code ultimately needs to reference data provided by firms. To do this efficiently that data must be provided in a standardised format' and noting further (at 17) '[s]hould the standardised format used by a DRR [digital regulatory reporting] system be embedded in firms' internal processes more broadly, the benefits for firms and regulators would be significant. Regulatory reporting could become a process in a broader group of firm operational processes, rather than a separate process in its own right. This would have major benefits as improvements in data quality used for internal purposes would also improve regulatory data. This raises the question of whether adopting DRR should follow other industry initiatives to standardise operational data'. See also ISDA, 'Time to digitize trade reporting' (17 February 2021) available at https://www.isda.org/2021/02/17/time-to-digitize-trade-reporting/.

reporting and data collection.[144] ISDA's efforts to engage with regulators can arguably be viewed as that of a veritable institutional entrepreneur,[145] that actively seeks to frame the issue of technological change for the regulatory community as one of data and process standardisation via common domain models. In its 2016 White Paper on the future of derivatives processing, ISDA already stressed that it expected mutual benefits for regulators and the industry if common domain models 'that systematically reflect how the market operates, from pre-trade to books and records'[146] were referenced in rules and technical standards.[147] Since then, it has sought an 'active dialogue' with regulators on how the ISDA CDM might be used for regulatory reporting purposes.[148] As noted, ISDA's efforts have not gone unnoticed. In the UK, ISDA's work was given support in the van Steenis review on the Future of Finance.[149] Moreover, the FCA experimented with the CDM in the context of a pilot on digital regulatory reporting (DRR),[150] with the FCA acknowledging that, prima facie, differences in the way firms represent data are a barrier on the way to greater automation.[151]

[144]'Digital regulatory reporting: phase 2 viability assessment', 22–23, available at https://www.fca.org.uk/publication/discussion/digital-regulatory-reporting-pilot-phase-2-viability-assessment.pdf; Bank of England (n 56) 33.

[145]I am very grateful to Dan Awrey for encouraging me to think of ISDA as policy entrepreneur in this context. For the literature on institutional entrepreneurship, standards can be described as 'key facets' of an 'institutional space'. Thus, by defining common standards, actors can 'build attributes of their technologies directly into emerging institutional structures'. See Raghu Garud, Sanjay Jain and Arun Kumaraswamy, 'Institutional entrepreneurship in the sponsorship of common technological standards: the case of Sun Microsystems and Java' (2002) 45 Academy of Management Journal 196, 197.

[146]*ISDA* (n 55) 18.

[147]ibid. See also at 26, noting that with respect to developing common domain models that 'ISDA's MITOC [the Market Infrastructure and Technology Oversight Committee] will oversee this initiative and liaise with regulators to identify the earliest possible use cases of these models from both a regulatory and commercial standpoint, as well as how they may be used to support publication of future rules and technical standards'.

[148]*ISDA* (n 120) 23. See also, *ISDA* (n 143). ISDA has promoted and showcased the CDM with regulators internationally, including in Europe and the US. See ISDA's response to ESMA's consultation on technical standards on reporting, data quality, data access and registration of trade repositories under EMIR REFIT, 14–15, available at https://www.esma.europa.eu/file/56157/download?token=8yUgKWzl. In the US, see ISDA, 'ISDA's Common Domain Model (CDM)' (Technology Advisory Committee meeting, CFTC, 26 February 2020), available at https://www.cftc.gov/media/3536/TAC022620_ISDACommonDomainModel/download; ISDA, 'Written statement of Scott O'Malia, Chief Executive Officer, International Swaps and Derivatives Association – US Senate Committee on Agriculture, Nutrition and Forestry' (25 June 2019), 12, available at https://www.isda.org/a/0ePME/Testimony-to-US-Senate-Committee-on-Agriculture-Nutrition-and-Forestry-25062019.pdf. ISDA together with the CDM's developer REGnosys, also participated in the G20 TechSprint, organized by the Bank of International Settlements and the Saudi G20 Presidency in 2020, winning in the regulatory reporting category. See BIS, 'BIS innovation hub and Saudi G20 Presidency announce TechSprint winners' (Press release, 6 October 2020), available at https://www.bis.org/press/p201006.htm.

[149]Huw van Steenis, 'Future of finance – review on the outlook for the UK financial system: what it means for the Bank of England' (June 2019) 11, available at https://www.bankofengland.co.uk/-/media/boe/files/report/2019/future-of-finance-report.pdf?la=en&hash=59CEFAEF01C71AA551E7182262E933A699E952FC.

[150]Specifically, a proof-of-concept was designed in which a digitized version of reporting rules was modelled in the CDM. See 'Digital regulatory reporting: phase 2 viability assessment' (n 144) 22–23.

[151]'Digital regulatory reporting: pilot phase 1 report' (n 143) 13, noting that '[f]or regulatory reporting to be automated, not only do the instructions need to be provided as code, but that code ultimately

To be sure, although actors such as the FCA have shown interest in the CDM,[152] much of the work has been exploratory. Crucially, the interest of public actors is primarily in the regulatory reporting and data collection area; they are interested in how these areas could be improved through digitisation and automation. However, in practice, a firm's reporting system is just *one* among a series of systems within its IT infrastructure that hold transaction records,[153] and that commonly implement different data models. Thus, even if successful, ISDA's efforts to engage with public actors could prima facie have little impact beyond a firm's reporting processes. However, if seen through a focal point lens, this may not necessarily be so. If successful, ISDA's efforts would have made the CDM more, rather than less, salient in the eyes of market participants. Accordingly, the focal point effect of the CDM would be enhanced and the odds of the CDM being embedded more widely across a firm's operational processes, and ultimately across the industry as whole, would improve as well.

E. Technological change and the International Swaps and Derivatives Association: outlook

The aim of this part is to take a critical look at ISDA's ambitions, both in relation to the industry and in relation to the regulatory community. Section I begins by reassessing ISDA's efforts to enable industry coordination. It returns for this purpose to the lessons learned in Part C on the role of network effects, switching costs and power in shaping the future of technological change. Section II revisits ISDA's efforts in relation to the regulatory community in order to ask a simple question, but with potentially wide-reaching consequences: is leveraging industry standards, the way forward to enable industry-wide coordination?

I. Enabling industry coordination: the CDM paradox

By trying to enable coordination on foundational standards, ISDA arguably made sure not to lose sight of the sheer complexity of securing an industry-wide implementation of new technologies. Even so, the success of ISDA's initiatives cannot be taken for certain. Indeed, some of ISDA's past initiatives have failed entirely. ISDA's 2011 Equity Derivatives Definitions (the '2011 Definitions') offer, for example, an illustration. These definitions are part of

needs to reference data provided by firms. To do this efficiently that data must be provided in a standardised format'.

[152] ibid 17. See also Bank of England (n 56) 32.

[153] See *Walker* (n 21) 174 noting that '[h]aving multiple systems with records of the same trades is a common scenario. At a minimum, a trading system and a settlement system will have records of those trades. Typically, that set of trades will also be recorded in numerous other systems – such as risk, regulatory reporting and collateral management systems'.

the documentation associated with the ISDA Master Agreement. The 2011 Definitions sought to improve on the earlier 2002 ISDA Equity Derivatives Definitions (the '2002 Definitions'). For ISDA, the latter had not proved to be an effective standardisation tool, which ISDA also deemed to 'pose serious practical problems for automation in the equity derivatives market'.[154] However, by ISDA's own admission, its efforts to improve this state of affairs largely failed. Thus ISDA reported that the 2011 Definitions had almost never been used, as the market continued to prefer the earlier 2002 Definitions.[155]

A fortiori, an industry wide adoption of the CDM cannot be taken for granted. Indeed, our focal point account has so far assumed too easily that market participants are willing to coordinate a switch to the CDM. In practice, market participants might be reluctant to adopt the CDM for the same reason that they might be reluctant to adopt new technologies: the implementation and switching costs associated with an adoption of the CDM are likely to be substantial. As pointed out earlier, the banking sector is process and data rich and typically relies on a patchwork of interconnected systems which can implement different data models. Accordingly, it can be expected that implementing the CDM will be hard and the price tag substantial.[156] Exacerbating matters further are a number of factors. First, the CDM is like DLT mostly a *network* product whose value depends importantly on it being adopted by a wide user base. The CDM's stand-alone value will accordingly be limited. Moreover, the presence of network effects will complicate even a gradual industry adoption of the CDM.[157] The point is worth noting for it has been suggested that the most likely adoption scenario of the CDM is one where it is embraced gradually by the industry over time.[158] However, because of network effects, the benefits of adopting the CDM are effectively backloaded. Accordingly, as long as the CDM network remains small, the benefits of joining the network will be limited and market participants' incentives to adopt will be too. Secondly, the value proposition of seeking further standardisation in the post-trade space through initiatives such as the CDM is not one of short-term costs for substantial future profits. It is one of substantial short-term costs for future cost *savings*. The fact that post-trade initiatives are not generating direct profits for market participants may, especially if combined with the prospect of substantial short-term costs, make these initiatives harder to 'sell' to market participants.[159] Thirdly, the incentives of

[154]ISDA, 'ISDA legal guidelines for smart derivatives contracts: equity derivatives' (2020) 16, available at https://www.isda.org/a/CLXTE/ISDA-Legal-Guidelines-for-Smart-Derivatives-Contracts-Equities.pdf.
[155]ibid 22.
[156]In this sense, see also Martin Walker, 'Challenges in adopting a common domain model for securities finance' (2019) 14 Securities Finance Monitor 24, 27.
[157]In the network literature, see also *Farrell and Klemperer* (n 83) 2045 noting that 'network effects discourage gradual, small-scale entry (offering a small network at first)'.
[158]See e.g. *Clack* (n 141) 2.
[159]I am very grateful for Christopher Clack for pointing this out to me.

firms to support standardisation initiatives such as the CDM may well be further diminished if current levels of post-trade cost also effectively keep new market entrants – hence possible new competitors – at bay.[160]

However, this is not the end of the story. Arguably, a centralised institution could still help drive an industry adoption of the CDM. Thus, a financial market infrastructure for example, could, because of its size or because of market expectations, act as an influential adopter.[161] Indeed, as far as DLT is concerned, it is precisely this role that the Depository Trust & Clearing Corporation (DTCC) – a post-trade financial market infrastructure – hopes to claim for itself.[162] The latter has engaged in an ambitious project to leverage DLT in relation to its Trade Information Warehouse, a centralised, electronic trade database for credit default swaps, which also offers processing of lifecycle events (e.g. payments, credit events) for OTC credit derivative transactions.[163] To be sure, the DTCC's efforts to implement DLT have yet to come to fruition.[164] However, the more relevant point is that what – in principle – is true of DLT is also true of an initiative such as the CDM that seeks to build foundations for technologies such as DLT: the benefits of being adopted by a centralised institution could be substantial. Financial market infrastructures have emerged as a key pillar of post financial crisis reform. Whilst already benefiting from a privileged position prior to the financial crisis (e.g. because of their wide network of users), extensive reforms, which followed the financial crisis, have further strengthened their positional advantages. Market participants are now subject to extensive obligations and requirements in the OTC market. At a technical level, discharging these obligations requires a firm's internal systems to interact smoothly with those of market infrastructures. The need for systems to interact could in turn open a path for driving the adoption of the CDM via centralised institutions.

[160]Houston, et al., make a similar point in their report on standards in global financial markets They note that because standardisation can undermine the market power and negatively impact the profitability of incumbents, the latter may be reluctant to support standardisation. See Kevin Houstoun, Alistair Milne and Paul Parboteeah, 'Preliminary Report on Standards in Global Financial Markets' (11 May 2015) 18–19, available at https://swiftinstitute.org/wp-content/uploads/2015/05/Report1-11th-May-2015.pdf.

[161]See generally Joseph Farrell, 'Standardization and intellectual property' (1989) 30 Jurimetrics 35, 39–40.

[162]The DTCC has portrayed itself as an 'enabler of a potential paradigm shift toward a new distributed platform' (see DTCC, 'Embracing disruption – tapping the potential of distributed ledgers to improve the post-trade landscape' (January 2016) at 10, available at https://www.dtcc.com/blockchain), and argued that 'it is best positioned to support and coordinate the evaluation and standardization of the distributed ledger platform, help address industry challenges and determine whether it is a better solution than existing technology' (at 2).

[163]See for details, https://www.dtcc.com/repository-and-derivatives-services/derivatives-services/trade-information-warehouse.

[164]The DTCC's project to upgrade its trade information warehouse by using DLT has been postponed; see Ledger Insights, 'DTCC's multi-trillion dollar DLT platform to launch late 2022 at earliest' (4 February 2021), available at https://www.ledgerinsights.com/dtccs-multi-trillion-dollar-dlt-platform-to-launch-late-2022-at-earliest/.

The point that a financial market infrastructure could prove influential in driving the adoption of the CDM echoes our earlier finding in Part C on the role which powerful incumbents can play in advancing new technologies. As a reminder, it was argued that the positional advantages of centralised institutions put them in a unique place to advance DLT, but also to influence change in a way that entrenched or even extended their dominance. With respect to the CDM, it is plain that market participants on the sell side, who hoped to streamline post-trade processes and cut cost by embracing new technologies, are far from excluding centralised institutions. Instead, they are actively encouraging discussions on how the latter can help drive the adoption of the CDM. Thus, Nair and Braine of Barclays, which has long been a supporter of the ISDA CDM, discuss how the CDM could be leveraged by market infrastructures in combination with the adoption of a central authoritative data store (ADS) that would be operated by a market infrastructure and that would act as a golden source of trade data.[165] They identify different possible stages of integration between the internal systems of a market participant and the ADS operated by a market infrastructure and describe the 'target state' as one that sees a full adoption of the CDM by market participants.[166]

Hence, in summary, it is submitted that the fate of the CDM, as a successful foundational industry standard that is supposedly an important facilitator of industry-wide technological change in the OTC derivatives market, is far from certain and may itself depend on overcoming a range of challenges. These include significant switching costs and realising network effects. Moreover, industry-wide success may ultimately depend on whether, and under what conditions, centralised institutions are willing to leverage their positional advantages to help drive the CDM's adoption. This conundrum is what I term the CDM paradox: whilst designed to ease the implementation challenges of new technologies in the OTC market and help deliver the DLT/SCT vision, the future of the CDM as a successful industry standard may in the end be contingent on overcoming some of the very same challenges.

II. Is regulatory leverage of industry standards the way forward?

Admittedly, ISDA is not only looking at the industry to embrace its coordination efforts. As we saw earlier, it is also encouraging public actors to leverage its efforts through regulatory actions. The aim of this section is to reflect on ISDA's ambitions vis-à-vis the regulatory community and in doing so to bring our discussion on implementation challenges to a close.

As noted earlier, ISDA's efforts to engage public actors could, if successful, take the industry a step closer to the vision of seamless interactions across a

[165] *Nair and Braine* (n 59).
[166] ibid 4.

full range of operational and reporting processes. However, there are reasons to be cautious when considering leveraging industry standards such as the CDM. For one thing, regulatory leverage could cut short a period of ongoing market experimentation. Arguably, this point is especially important in the context of standardisation efforts of the ambition of the CDM, which deals with a subject matter (digitisation) that is significantly complex and one that will require continued attention. Crucially, caution is warranted because leveraging industry standards might create a new form of lock-in for market participants. However, unlike in a market context where lock-in is typically associated with switching costs/network effects, lock-in in the present context would have its origin in the authority that regulators lend to industry standards. Like in a market context, such lock-in cannot be assumed to be benign. In particular, it raises concerns if industry actors are able to retain some form of control or influence over the standard which they are able to exploit in order to further ends that do not align with the interests and objectives of public authorities. In the case of ISDA for example, it is plain that its efforts are not that of a selfless actor. ISDA defends the interests of its members, not the market at large and even less so the general interest. Indeed, given the very broad membership of ISDA, it is conceivable that among its membership, ISDA privileges some interests over others. The politics of decision-making within ISDA remain largely a black box.

To be sure, the answer to the above concerns may be to insist on 'openness'. Indeed, in a market context, offering 'open' standards is a common response to concerns over lock-in and opportunistic behaviour.[167] A technology provider may thus distribute its software under an 'open source' software license.[168] For example, R3, the technology firm behind CORDA, distributes CORDA as an 'open source' version,[169] making the source code freely available in order to encourage user adoption.[170] Public actors interested in

[167]'Openness' can be a veritable strategy that is actively embraced by technology providers This is well documented by *Shapiro and Varian* (n 87) 196–203. In the operating system market, such practices are documented by Jonathan Barnett, 'The host's dilemma: strategic forfeiture in platform markets for informational goods' (2011) 124 Harvard Law Review 1861.

[168]On the meaning of open source, see the Open Source Initiative, defining open source software as software 'that can be freely accessed, used, changed, and shared (in modified or unmodified form) by anyone'. See https://opensource.org/faq#osd. In relation to open source software, see also *Barnett* ibid.

[169]The open source version is available under the Apache 2.0 license. According to the CEO of R3, 'Corda is 100% open source. The reason for this is simple: the only platforms that will thrive in the long term will be the open ones. Who in their right mind would choose a closed source platform in an industry with such network effects?'. See David Rutter, 'Statement from R3 CEO, David E. Rutter' (11 June 2018), available at https://www.r3.com/blog/statement-from-r3-ceo-david-e-rutter.

[170]R3 has sought to build an active ecosystem around its open source version, encouraging developers to engage with the open source distribution. However, at the same time, R3, as a profit seeking business, also offers an enterprise version, which is a commercial, revenue generating, distribution of CORDA. Both distributions are interoperable, but the latter comes with access to support, as well as with additional features such as a blockchain application firewall.

new technologies have also expressed a preference for open standards. As the Bank of England put it,

> '[w]here regulators take a role in driving adoption of a standard, there is a case for ensuring it is open and technology agnostic, in order that it can be widely used and not favour particular users or vendors'.[171]

Last but not least, the benefits of pursuing an open strategy in order to encourage adoption have not escaped ISDA either.[172] It has described the CDM as an open standard and hailed it as available to the 'entire market free of charge'.[173]

However, 'openness' is an inherently vague concept. In a commercial context, Varian and Shapiro for example point out that firms which appear to make their technology freely available may often still assert control elsewhere, for instance by keeping control over changes to the technology.[174] Likewise, Barnett identifies several ways in which open-source projects can be 'reprivatised', such as by controlling the rights to code contributions.[175] As far as ISDA's claim to 'openness' is concerned, there is also cause to be cautious. First, even though ISDA claims that the CDM is 'open', other tools such as ISDA Create are not. The latter is a commercial venture with Linklaters. It is a platform for negotiating, creating and managing legal data from ISDA documentation, which platform ISDA is also actively cheerleading. Crucially, the CDM and ISDA Create are meant to complement each other. Accordingly, a standard such as the CDM, which is supposed to be 'open', might still effectively serve to support a 'closed' platform such as ISDA Create. Secondly, at closer look, it is apparent that ISDA yields significant influence over the CDM governance structure. The latter consists of a three-level committee structure.[176] At the bottom, are the CDM working groups which are active in the development of CDM elements. Participants can include both ISDA members as well as non-members 'from the CDM user community'.[177] Among these working groups is also the recently created DRR working group which was set up in order to work on digital regulatory reporting and engage with the regulatory community.[178] Meanwhile, amendments to the CDM must be submitted to

[171]Bank of England (n 56) 35. See also FCA, 'Digital regulatory reporting – feedback statement on call for input' (FS18/2, Feedback Statement, October 2018) 27.
[172]ISDA, 'ISDA publishes CDM 2.0 for deployment and opens access to entire market' (20 March 2019), available at https://www.isda.org/2019/03/20/isda-publishes-cdm-2-0-for-deployment-and-opens-access-to-entire-market/. Note that ISDA's claim that access to the CDM was open has been questioned. See PA Consulting (n 143) 22, noting that '[t]he CDM … sits behind a portal that requires user contract details for access'.
[173]ISDA, 'Opening Remarks Scott O'Malia, ISDA Chief Executive' (ISDA AGM Hong Kong, 10 April 2019), available at https://www.isda.org/a/zMSME/ISDA-CEO-AGM-Opening-Remarks-April-10-2019.pdf.
[174]*Shapiro and Varian* (n 87) 199.
[175]*Barnett* (n 167) 1901.
[176]Details are available at https://docs.rosetta-technology.io/cdm/readme.html#the-cdm-governance.
[177]ibid.
[178]*ISDA* 'Time to digitize trade reporting' (n 143).

ISDA staff and the Architecture & Review Committee 'for approval'.[179] The latter includes 'subject matter experts, senior technologists, as well as practitioners in business process, legal documentation, and technical modelling'.[180] At the top level is the Executive Committee which sets strategy and, inter alia, oversees the activity of the working groups and the Architecture & Review Committee. Its members are senior executives that were 'appointed by the ISDA Board'.[181]

These observations about the CDM's governance are of obvious relevance. To put it simply, how can the CDM be truly open if ISDA continues to exercise significant influence over its governance? If regulatory leverage of foundational industry standards was indeed the future, ISDA's role and its continued influence over the CDM's governance would be a matter of concern. Accordingly, the CDM's governance arrangements would need to change. ISDA would need to embrace a notion of 'openness' that is well beyond what it is currently offering. 'Openness' would need to be commensurate with the authority that regulators would lend to the CDM. It could not be a form of openness that is mediated by an industry association. In particular, it would require ensuring that the governance of the CDM does not serve as a backdoor for vested interests to exert control. Accordingly, in practice, the CDM's governance would need to foresee a strong role for regulators,[182] and crucially, be open to a broad, diverse and indeed competing range of interests in order to address concerns about capture by interests that benefit from information and knowledge advantages.[183] With regulators in the driving seat, ISDA would take its place among other participants. Admittedly, a more diverse membership, with regulators in the driving seat, may have its downsides. Different interests might come into conflict which might slow down or otherwise negatively affect output. Regulatory leverage could accordingly have a profound impact on a market initiative such as the CDM. There will be pros and cons to consider. However, the bottom line is that ISDA would need to relinquish control. The current CDM governance structure which puts ISDA in the driving seat would no longer be fit for purpose.

F. Conclusion

The aim of this article was to contribute to the literature on DLT and SCT by focussing on implementation challenges and especially on ISDA's recent

[179] See n 176.
[180] ibid.
[181] ibid.
[182] There appears some consensus among market actors on the point that developing the FCA's digital regulatory reporting agenda in collaboration with the industry will require regulators to 'take the lead'. See *FCA* (n 171) 24.
[183] As Kwak puts it, inviting competing interests can help 'to equalize the influence of different interest groups'. See See James Kwak, 'Cultural capture and the financial crisis' in Daniel Carpenter and David A Moss (eds) *Preventing Regulatory Capture – Special Interest Influence and How to Limit it* (CUP 2014) 71, 96.

groundwork to 'standardise [in order] to digitise',[184] an area which has received little scrutiny by legal, and law and economics, scholars so far. After presenting implementation challenges in Part C, Part D argued that recent initiatives such as the CDM or the Taxonomy and Clause Library could usefully be examined as an attempt by ISDA to help the industry coordinate on a common foundational standards layer to support technological change and a future of frictionless (or frictionless-*ish*) interactions. Moreover, it was shown that far from attempting to stay clear of regulatory authority, ISDA was actively encouraging regulators to leverage its coordination efforts by embracing the CDM. Part E then went on to take a critical look at ISDA's ambitions. It was argued that the success of foundational initiatives such as the ISDA CDM was by no means certain. Specifically, it was submitted that whilst designed to ease the implementation challenges of technologies such as DLT, the future of the CDM as a key facilitator of technological change might paradoxically depend on overcoming some of the very same challenges. These included significant switching costs and realising network effects. Moreover, it was argued that ultimately the CDM's future might well come to depend on whether, and under what conditions, central institutions were willing to drive its adoption. The article ended by returning to ISDA's efforts vis-à-vis the regulatory community. It argued that caution was advised when considering reusing industry standards, especially if industry actors were able to retain control or influence over such standards. It was argued that the answer to concerns may lie in the concept of 'openness' – a notion, which it was submitted, extended not only to the standard itself but crucially also to its governance.

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