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THE IMPACT OF TECHNOLOGICAL INNOVATIONS ON DERIVATIVES DOCUMENTATION: A BUY-SIDE PERSPECTIVE

Smart derivative contracts and blockchain are two new technologies that are designed to improve efficiency and streamline processes supporting derivatives transactions, including documentation processes. The authors discuss these technologies from a buy-side perspective, focusing on a variety of issues, including automatable smart contract terms and data harmonization. They then turn to the impact of the new technologies on buy-side entities, discussing customizability, dispute resolution, and the importance of ascending the learning curve.

By Blake Estes and Willa Cohen Bruckner *

Advances in technology have resulted in greater efficiencies and lower costs across a wide spectrum of industries, and the derivatives industry is exploring how it, too, can benefit from technological innovation. Following the 2007-2009 financial crisis and the resulting reforms in the G20 countries, the complexity of the operation of the derivatives markets has increased significantly.[1] As a result of post-financial crisis reform mandates, market participants have had to layer mechanisms and practices for addressing reporting, clearing, execution, and margin responsibilities (among others) into legacy infrastructure. Each of these additional responsibilities creates compliance and risk management challenges, and introduces inefficiencies and costs into derivatives documentation and processing. The derivatives industry is looking to a variety of technology solutions to address certain of these frictions in its markets.

The benefits of technology solutions are most obvious for large sell-side financial institutions that engage in a high volume of derivatives transactions and documentation with myriad customers. For buy-side entities,[2] however, the benefits of such new technologies are less clear, as each buy-side entity must balance the advantages of increased efficiency and reduced costs against the disadvantages of a diminished ability, in some cases, to customize trading arrangements. As momentum builds for the next wave of derivatives innovation through technology, buy-side entities can

[1] G20 Leaders Statement: The Pittsburgh Summit (September 24-25, 2009), Pittsburgh, Pennsylvania, http://www.g20.utoronto.ca/2009/2009communique0925.html. In an effort to address systemic risks to the global financial system posed by financial derivatives following the financial crisis, leaders of the world's G20 countries met in Pittsburgh, Pennsylvania to devise a more robust framework of regulations for OTC derivatives.

[2] In using the term "buy-side entities", we refer to entities other than large financial institutions (*e.g.*, corporates, hedge funds and other funds, and small financial institutions).

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learn from past developments in the derivatives industry to best prepare for the upcoming changes. In addition, buy-side entities can look for opportunities to influence the way in which particular technology developments will shape the processing of derivatives documentation.

This article examines two of the most potentially significant technological innovations in the derivatives industry: smart derivatives contracts and blockchain technology. We assess the potential impact of these new technologies on derivatives documentation and the ways in which buy-side entities can position themselves to benefit meaningfully from technological developments.

KEY TECHNOLOGICAL INNOVATIONS: SMART DERIVATIVES CONTRACTS

One of the most notable anticipated technological innovations in derivatives documentation and trade processing is the introduction of smart contracts.[3] Smart contracts, self-executing agreements written in computer code, could improve the efficiency of the derivatives markets by automating the performance of some processes, including the performance of certain contractual obligations between trading counterparties. The code in a smart contract can automatically initiate actions in response to the occurrence of certain other actions or the satisfaction of specified pre-conditions.

Notwithstanding the potential virtues of smart contract technology, there are practical challenges associated with the use of smart contracts that derivatives market participants must consider, including (1) identifying contractual terms that are susceptible to automation and developing a common language to express those terms in software and (2) ensuring the legal enforceability of automated contractual terms expressed in computer code, rather than natural language.

Selection of Automatable Contract Terms and Development of a Common Language

A key first step for the development of smart derivatives contracts is to identify the provisions of a typical derivatives contract that automation would make more efficient and less error-prone. Comprehensively delineating contractual rights and obligations, and embedding contractual performance in computer code requires careful consideration and forethought. The legal standards that govern modern contract law have been developed over hundreds of years and serve to fill the gaps in the contract parties' relationship in ways that the parties cannot completely prescribe by written contract. Generally, contractual counterparties are not required to predict all possible outcomes of their contractual relationship because the abiding legal standards that govern that relationship are implicit in the contract between the parties. It is difficult to see highly automated smart contracts fully replicating the body of law surrounding contract interpretation, so it is essential to carefully select the types of contractual provisions that, if automated, would continue to honor and implement the parties' respective obligations and provide them with the benefit of their respective bargains.

Provisions susceptible to automation must operate based on conditional logic. In other words, the operation of the provision must be based on the satisfaction of a pre-condition that can be reliably defined. The parties must be able to know with certainty that the event that constitutes the defined condition to performance has or has not occurred. Examples of definable conditions in a typical derivatives contract may include the passage of a certain period of time or the payment of cash into or from a bank account. The occurrence (or non-occurrence) of each of these events can be easily tracked and measured, such that they could reliably serve as the basis for consequential actions.

Other types of triggering events in derivatives contracts may also be definable but are much more complicated to effectively represent in a smart contract, for example, net asset value declines or ratings downgrades in the context of termination events. While the occurrence of a ratings

[3] Christopher D. Clack and Gabriel Vanca, *Temporal Aspects of Smart Contracts for Financial Derivatives*, Centre for Blockchain Technologies, Department of Computer Science, University College London (2018), http://www0.cs.ucl.ac.uk/staff/C.Clack/research/Clack-TemporalAspectsSmartContracts.pdf. Also, International Swaps and Derivatives Association, Inc. and King & Wood Mallesons, *White Paper: Smart Derivatives Contracts: From Concept to Construction* (October 2018), https://www.isda.org/a/cHvEE/Smart-Derivatives-Contracts-From-Concept-to-Construction-Oct-2018.pdf.

downgrade or a net asset value decline of a sufficient magnitude is a binary event that either occurs or does not occur, the data input necessary to trigger the automated response is unlikely at this time to be compatible with smart contract code. The automated operation of these types of provisions in a smart contract would require the integration of the smart contract system with the external sources of triggering data, such as a rating agency or a fund administrator.

The typical derivatives contract also includes a wide range of provisions that may not be suitable for automation because they require a measure of subjectivity or the occurrence of a pre-condition that cannot be reliably measured and represented in software. Notable examples include provisions regarding the calculation of early termination payments, a termination event based on the termination of a fund counterparty's investment adviser, and many representations and warranties (for example, representations regarding eligible contract participant status or ERISA[4] compliance). Moreover, even with potentially automatable provisions, circumstances may arise in which a party to a derivatives contract does not want to immediately enforce its rights under that contract, for commercial, strategic, or other reasons. A party may also knowingly permit a breach of the contract to occur because, for example, the cost of continued compliance exceeds the cost of breach. In any event, the parties to a derivatives contract may see themselves as being better off through a negotiated outcome, rather than an automated response to a default or other triggering event, because the response may have disproportionate or unprofitable consequences for one or more of the parties.

Once the appropriately automatable provisions of a derivatives contract are identified, the expression of those provisions must be converted into a form that may be written into an executable computer program with control over the real-world elements necessary for execution (for example, bank accounts). The automation will be most effective with a standardization of terminology to describe the performance-related events under a derivatives contract. The International Swaps and Derivatives Association, Inc. ("ISDA") is working on a framework, ISDA's Common Domain Model (the "CDM"), to provide the industry with a shared, standardized representations of events and actions that occur throughout the lifecycle of a derivatives trade.[5] The CDM, which is discussed in greater detail later in this article, seeks to create a standard blueprint for derivatives events and actions that may serve as the base language for the expression of key legal terms in software format.[6]

Legal Enforceability of Smart Derivatives Contracts

As an operational matter, a smart contract may perform its pre-coded function, but legal enforceability of the smart contract is a separate matter. Will courts in the United States and around the world recognize the computer code as the embodiment of a legal agreement between the parties to the smart contract? The law of smart legal contracts is largely undeveloped and most countries have provided little or no guidance regarding the legal enforceability of smart contracts. As a result, parties to smart contracts operate under significant uncertainty if a dispute or an unanticipated circumstance develops, even if a contract performs as coded. In addition, in the absence of compatible legal treatment of smart contracts world-wide, transacting through smart derivatives contracts in a global market might introduce enough legal ambiguity to diminish the value of the efficiency gains from automation.

Moreover, it is not yet clear what role courts will play in resolving smart contract disputes. When a contract written exclusively in natural language does not clearly express a party's intent, a court may be called upon to supply its interpretation of intent. Presumably, if smart contract coding is recognized as a binding legal obligation, the courts will serve a similar role resolving disputes between parties to a smart contract. If, for example, the functioning of the smart contract failed to meet one or more of the parties' expectations or, in a legal contract that combines natural language portions with smart contract functions, an inconsistency exists between the smart contract coding and natural language provisions in the contract, courts may serve as arbiters of intent for those disputes. As such, the software written into the contract would be an important data point, along

[4] "ERISA" refers to the Employee Retirement Income Security Act of 1974.

[5] ISDA, Press Release, *ISDA Publishes First Digital Iteration of the Common Domain Model* (June 5, 2018), https://www.isda.org/a/k9HEE/ISDA-Publishes-First-Digital-

footnote continued from previous column…

Iteration-of-the-CDM-FINAL.pdf. *See also*, ISDA, *ISDA Common Domain Model Version 1.0 Design Definition Document* (October 2017), https://www.isda.org/a/gVKDE/CDM-FINAL.pdf.

[6] ISDA, Fact Sheet, *What is the ISDA CDM?* (2018), ("Having a single, common digital representation of derivatives trade events and actions will enhance consistency and facilitate interoperability across firms and platforms, providing a bedrock upon which new technologies can be applied.").

with other relevant information, for a court to consider in resolving the dispute. Judges and lawyers are trained to analyze and interpret natural language contracts, but smart contracts that rely, in whole or in part, on the functioning of computer code may present new challenges for courts that necessitate a combined fluency in the law and technology.

The challenges of smart contract dispute resolution may be especially relevant for buy-side entities who have not been involved in the development of smart contract systems and are therefore less likely to fully understand the mechanisms and consequences of their operation. The automation that makes a smart contract appealing as a means of increasing efficiencies also places significant pressure on each party to that contract to ensure that the smart contract coding represents the accurate expression of its intent. The buy-side party should consider the consequences of the smart contract's coding before agreeing to the contract because, unlike a natural language contract in which human intervention is necessary for an action to take place, the opportunity to discuss a dispute or an anticipated dispute before an automated action is completed by the smart contract may be elusive.

KEY TECHNOLOGICAL INNOVATIONS: BLOCKCHAIN TECHNOLOGY

Another technological innovation that is likely to influence the future operation of the derivatives markets is blockchain technology.[7] Blockchains are distributed databases that are shared and maintained among the databases' participants. A blockchain network uses cryptographic methods to transparently and permanently verify trusted transactions among its participants. Information stored on a distributed blockchain cannot be overwritten without consensus among the network participants. Two core principles behind distributed blockchains are that (1) no central gatekeeper or other intermediary is needed to enable transactions recorded on the blockchain (and a central gatekeeper or intermediary cannot censor transactions), and, as already noted, (2) transactions may only be modified through consensus among the network participants. Owing to these virtues, blockchain technology, if implemented at scale, may fundamentally alter the manner in which the capital markets operate.[8] Processes for documenting, settling, and recording transactions in securities and other financial products, corporate governance, and auditing are potentially ripe for efficiency gains through blockchain technology. Over-the-counter transaction processing in many financial markets is complex, inefficient, and requires the manual interaction of many players. Blockchain implementation is seen as a way of eliminating (or materially reducing) costs resulting from reconciliation, transaction processing errors, and the use of trusted intermediaries.[9]

Blockchains may also serve as the foundation for innovations in derivatives documentation, including smart contracts.[10] The immutability, transparency, and censorship-resistant nature of blockchain technology make it well-suited to serve as the base technology for smart derivative contract systems. Smart contracts running on blockchain technology may offer a potent combination that could re-shape the manner in which derivatives transactions are documented and executed.

Despite its potential benefits, blockchain technology faces barriers to implementation in the derivatives industry, including scalability concerns. The most significant barrier to blockchain adoption in capital

[7] ISDA. and Linklaters, *White Paper: Smart Contracts and Distributed Ledger – A Legal Perspective* (August 2017), https://www.isda.org/a/6EKDE/smart-contracts-and-distributed-ledger-a-legal-perspective.pdf.

[8] Bank for International Settlements, Committee on Payments and Market Infrastructures, *Distributed ledger technology in payment, clearing and settlement, An analytical framework* (February 2017), https://www.bis.org/cpmi/publ/d157.pdf.

[9] The Depository Trust & Clearing Corporation, White Paper, *Embracing Disruption, Tapping the Potential of Distributed Ledgers to Improve the Post-Trade Landscape* (January 2016). Also, The Depository Trust & Clearing Corporation, Fact Sheet, *The Next Generation of TIW* (2018), http://www.dtcc.com/derivatives-services/trade-information-warehouse. Several industry-wide blockchain initiatives are being developed for the over-the-counter derivatives markets, notably the effort by the Depository Trust & Clearing Corporation ("DTCC") to improve credit derivatives processing. DTCC is currently working with a number of global financial institutions and credit derivatives market infrastructure providers to re-platform DTCC's credit derivatives Trade Information Warehouse (the "TIW") on distributed ledger technology and cloud technology. The TIW serves as a primary record for bilateral credit derivatives, performing lifecycle events, payment calculations, and settlement. The re-platformed TIW is intended to streamline, automate, and reduce the costs of derivatives processing by creating a system based on common data standards and governance, avoiding a costly reconciliation process.

[10] ISDA and Linklaters, *White Paper: Smart Contracts and Distributed Ledger – A Legal Perspective, supra* note 7.

markets, however, may be a lack of alignment of interests among market participants. Blockchain is a shared technology, the success of which requires all participants in the relevant network to agree to its adoption. The derivatives markets have a number of diverse constituencies – sell-side dealers, buy-side counterparties, exchanges, and swap execution facilities, among others. Not all constituencies will benefit equally from blockchain implementation. Some participants may see insufficient gain from blockchain implementation to invest in the technology in the first place, and resistance or indifference from other market participants could delay implementation. The leadership needed to create consensus and advance the development of blockchain technology applications for derivatives documentation will likely come from sell-side entities, who will take this initiative to maximize the efficiencies and other cost savings from the technology. Direction may also come from industry regulators through sell-side firms, over whom the regulators have primary regulatory authority, or from market infrastructure providers, such as exchanges and central clearing parties, who reach the market through large sell-side firms. As such, buy-side entities will need to diligently monitor the progress of the sell-side-driven development of blockchain applications that may impact their derivatives trading operations.

DERIVATIVES DATA HARMONIZATION

A significant obstacle to the implementation of new technologies in the derivatives markets is the fragmented nature of the documentation and trade management processes within firms.[11] In a bid to address the issue of systems incompatibility and create a baseline universal language in derivatives trading, ISDA has published a digital representation of its CDM, which is a blueprint for actions and processes that typically occur during the lifecycle of a derivatives trade.[12] According to ISDA, before blockchain technology and smart contracts can address certain of the inefficiencies and attendant costs of derivatives documentation and trading, the fundamental issue of reconciling disparate processes among market participants must be resolved. As the derivatives trading markets have evolved over the last 40 years, market participants have developed their own unique sets of representations for typical events that occur during the lifecycle of a derivatives trade. Firms have created derivatives documentation and trading processes tailored to meet their particular needs, and to fit within their existing systems and infrastructure. This disparate approach to derivatives systems development creates inefficiencies and increased risk of error. Counterparties are often required to bridge inconsistent systems to be able to negotiate trading documents and, once documentation is complete, to continually reconcile their trades to ensure that each is relying on the same information. The documentation and trade reconciliation processes represent key friction points in derivatives trading that can consume significant amounts of time and resources of market participants. The CDM is intended to (1) streamline derivatives documentation and processing, eliminating the inefficient trade reconciliation process[13] and (2) provide the foundation for the development of new technology solutions to be built on top of the CDM, which may include blockchain-based solutions and smart contract systems.[14]

ISDA has also developed ISDA Create, an online tool intended to allow parties to negotiate, execute, and deliver derivatives documents, and to store data from such documents within the on-line tool.[15] ISDA Create is intended to provide its users with a digital record of the users' documents and data. The first application of the ISDA Create technology, ISDA Create – IM, was created by ISDA in partnership with a leading law firm for use in connection with the initial margin

[11] Institute of International Finance, *Addressing Market Fragmentation: The Need for Enhanced Global Regulatory Cooperation* (January 2019), https://www.iif.com/Portals/0/Files/32370132_iif_fsb_fragmentation_report.pdf.

[12] ISDA, Press Release, *ISDA Publishes First Digital Iteration of the Common Domain Model, supra* note 5. *See also*, ISDA, *ISDA Common Domain Model Version 1.0 Design Definition Document, supra* note 5.

[13] *Id*. Primary among the goals for the CDM is to provide a common technical representation for derivatives events and process that will facilitate interoperability across the systems of disparate market participants and enhance consistency across documentation and trades.

[14] *Id*. The CDM may also be able to create standards to support innovation and promote the adoption of new technologies in the derivatives marketplace, enhancing consistency and boosting the potential for these services to operate across firms and platforms. Technologies like smart contracts and blockchains offer the potential for automation and cost reduction, but common standards are a pre-requisite for mass adoption of these technologies. The CDM is meant to be the digital standard on top of which these types of technology applications may be built. With a shared standard, technology solutions may achieve greater interoperability, operational efficiency and cost reduction.

[15] ISDA, Fact Sheet, *What is ISDA Create?* (2018), https://www.isda.org/a/6ITME/ISDA-Create-Fact-sheet-FINAL-1.pdf.

requirements for uncleared swaps.[16] A wide range of market participants, including buy-side and sell-side firms, will come within the scope of the initial margin regulations for uncleared swaps in 2019 and 2020, creating a need for swap dealers to efficiently negotiate initial margin documentation with large numbers of counterparties.[17] The ISDA Create-IM platform, the full version of which was launched January 31, 2019, is intended to allow parties to automate, negotiate, and execute initial margin documentation with multiple counterparties simultaneously.[18] ISDA has indicated that it expects to expand its offerings under ISDA Create to include other documentation sets, such as the Schedule to the ISDA Master Agreement.[19]

ISDA's development of ISDA Create, along with the CDM and similar industry initiatives, reflects ISDA's belief that the representation of the data at the core of trading relationships must be harmonized to achieve the efficiencies promised by innovative technology solutions.

IMPACT OF NEW DERIVATIVES TECHNOLOGIES ON BUY-SIDE ENTITIES

The technology-driven efficiency gains discussed in this article may be enjoyed by all market participants, but not necessarily equally. The market participants with the largest volume of trading activity and the most complex infrastructure to support that volume stand to obtain the greatest benefits from many technological innovations. As such, sell-side dealers with significant business lines that provide extensive derivatives-related services to a large number of buy-side customers are the primary proponents of the new technologies. Other than, perhaps, for a few high profile buy-side entities with significant market presence, the position of buy-side entities vis-à-vis their sell-side counterparts and challenges for the buy-side in adopting technology will limit, in many cases significantly, the value of technological advances for buy-side entities unless they take proactive steps to change that dynamic. The experiences of buy-side entities during the movement towards standardization of documentation through ISDA's documentation framework may offer valuable lessons, as the buy-side faces the next wave of standardization, this time through technology.

Less Customizability

As noted previously, technologies that automate derivatives processes, including documentation processes, have the potential to create efficiencies in the overall derivatives ecosystem, reducing frictions and costs for all market participants. Maximization of the anticipated efficiency gains requires increased standardization throughout the industry, which comes at the cost of customizing of relationships between counterparties. A sell-side firm reaps the greatest benefits from process efficiency when all its customers are treated the same or, at least, very similarly. The sell-side's preferred one-size-fits-all approach to derivatives documentation likely means it will be more costly for a buy-side entity to create a customized arrangement, as sell-side dealers seek to recoup the incremental costs of customization.

The buy-side's struggle to preserve customized trading relationships in the face of a broad industry movement toward standardization is not new. The drive for greater efficiency has shaped the evolution of derivatives documentation since the 1980s. From the industry's early days, market participants have tried to streamline the documentation process. ISDA, the derivatives industry's largest trade association, has led the movement towards more standardized documentation. The ISDA-crafted documentation architecture, including the commonly used forms of Master Agreement and Credit Support Annex, as well as the various definitions booklets, have come to dominate the landscape of derivatives documentation. The ISDA documentation set provides a foundation of basic terms with general applicability that is intended to reduce costly and time-consuming bilateral negotiations.

ISDA has also developed a protocol process to effect amendments to derivatives documentation on a market-

[16] ISDA, Press Release, *ISDA and Linklaters Launch Full Version of ISDA Create* (January 31, 2019), https://www.isda.org/a/nwgME/ISDA-Publishes-Full-Version-of-ISDA-Create-press-release.pdf.

[17] The U.S. statutory provisions for margin on uncleared swaps are included in Title VII of the Dodd-Frank Act. The provisions of Dodd-Frank addressing margin are codified as Section 4s(e) of the Commodity Exchange Act, 7 U.S.C. § 6s(e), and Section 15F of the Securities Exchange Act of 1934, 15 U.S.C. § 78o-10, respectively. Implementing regulations were adopted by the federal banking regulators in November 2015, published at Margin and Capital Requirements for Covered Swap Entities, 80 Fed. Reg. 74,840 (November 30, 2015), and by the Commodity Futures Trading Commission in January 2016, published at Margin Requirements for Uncleared Swaps for Swap Dealers and Major Swap Participants, 81 Fed. Reg. 635 (January 6, 2016).

[18] ISDA, Press Release, *ISDA and Linklaters Launch Full Version of ISDA Create, supra* note 16.

[19] *Id*.

wide basis.[20] An ISDA protocol is a multilateral mechanism that provides an efficient means of implementing industry-wide contractual changes over a broad number of counterparties, such as changes driven by regulation or modifications in market structure. ISDA posts the text of the relevant protocol on its website, and parties adhere to the protocol through submission of adherence letters and, in some cases, by also providing information and making choices through an on-line system. Once both parties to an existing agreement covered by a protocol text adhere to that protocol (and, for certain protocols, identify each other as counterparties), the agreement between the two parties is deemed to be amended in accordance with the terms of the protocol. The standardized amendment language through the ISDA protocol process reduces the need for costly reconciliation of different versions of amended terms.

Experience from past standardization initiatives demonstrates that careful work on the part of buy-side entities can result in productive customization of derivatives documentation. A long-standing common misperception among many buy-side entities is that ISDA's documentation set is not customizable. This misperception is fed by large sell-side institutions' push to reduce costs by assigning negotiation and documentation responsibilities to more junior personnel who may lack the experience and authority to authorize modifications to the institution's preferred form of documentation. A buy-side entity that believes derivatives documents cannot be customized may not take the time to closely review the documentation provided by the sell-side, and as a result, the buy-side entity may lose the opportunity to modify aspects of the documentation that do not fit well with its unique business or operational characteristics. In addition, it may be unprepared when a problem develops in its trading relationship or when a market-wide disruption occurs, such as the Lehman Brothers insolvency, because it is not familiar with the terms of its contracts.

By clearly defining priorities with respect to substantive issues and tradeoffs within derivatives relationships and documentation, buy-side entities have been able to tailor their derivatives contracts to better suit their organizations. To achieve those results, a buy-side entity would look to improve its position by exploring the limits of a sell-side counterparty's negotiating points and the sell-side entity's tolerance and costs for accommodating arrangements outside its preferred approach. Throughout the process, buy-side entities must seek to devise and advocate for creative solutions to impasses. Buy-side entities should take a similar approach to contract negotiation in the face of new technologies.

Learning Curve Associated with New Technologies

With the introduction of new technologies that must be adopted industry-wide to be effective, all market participants will have to ascend a learning curve to understand the implications for their respective businesses, and to determine how best to integrate new processes into their existing systems and infrastructure. Many sell-side entities will already be familiar with the new technologies by the time they are introduced to buy-side customers. Buy-side entities, in contrast, may have to adapt the new technologies against the backdrop of time-sensitive matters, such as an impending transaction or the commencement of a new trading strategy. This technology integration process may be especially burdensome for smaller market participants who will be faced with the task of reformulating fundamental processes without a deep bench of personnel dedicated to managing that transformation. It is crucial for buy-side entities to closely follow the development and progress of new technology initiatives that will impact the derivatives industry. Each buy-side entity should consider the implications of each initiative for its organization, and what changes it must make to its current infrastructure and processes to accommodate the technologies ahead of sell-side-driven deadlines for implementation. The sell-side has the market breadth to drive the timing of adoption, so each buy-side entity should think in advance how best to prepare its organization to avoid disruption in trading activity.

Buy-side entities can begin to learn about the new developments by participating in industry trade group discussions and attending trade group-sponsored education programs, especially programs originated by buy-side organizations. Joining in with buy-side trade association discussions has the added benefit of creating a collective voice in the room with which buy-side entities may exert some influence over the industry's decisions regarding technological innovations, increasing the likelihood that buy-side concerns will be reflected. Exerting influence will be much more difficult once the decisions have been made by the industry and money has been spent on development. In addition, by devoting the time and attention to understand the new technologies, buy-side entities can begin to identify priorities in terms of business, operations, and contractual terms to assist them in negotiating with their sell-side counterparties.

[20] ISDA website, *Protocol Process* (accessed February 2019).

Dispute Resolution with Automated Processes

Dispute resolution processes for smart contracts are yet to be fully developed, so thorough pre-contract diligence by each buy-side entity is required to ensure that the automated provisions in the contracts are consistent with its intent. One of the primary benefits of smart contracts is that they reduce the risk of nonperformance through self-execution. In the event a smart contract function performs as expected, or, at least, as programmed, but nevertheless fails to meet one or more of the parties' expectations, it is not yet fully understood what, if any, extra-contractual remedies may be available to an aggrieved party. In many cases, the aggrieved party may be a buy-side entity that did not participate in the development of the smart contract system and does not fully understand the implications of the system's automated functions.

The more automated a process, the more difficult it may be to unwind and correct errors and resolve disputes with respect to that process. A legal system for resolving disputes will likely include a natural bias towards respecting what the automated contract dictates, absent manifest error or evidence of fraud. In fact, the core virtue of an automated process is that human interpretation is not necessary for the appropriate response if the required pre-condition is satisfied. Against this backdrop, avoiding the dispute in the first place will be the best way to assure the anticipated and desired outcome.

The challenge of dispute resolution under smart contracts is yet another reason why an understanding of the process and embedded technology behind smart contracts is essential for buy-side entities. The early education and participation in industry and trade-association discussions described above are valuable steps towards gaining the needed understanding. Buy-side entities should supplement those steps with an examination of their own businesses.

CONCLUSION

The increasing complexity of operations in the derivatives trading markets over the last decade has imposed upon market participants increased costs and inefficiencies. The industry is responding to these market frictions with the development of technology solutions designed to streamline processes, including documentation processes. The benefits of these technology solutions inure most obviously to larger sell-side firms that have extensive derivatives business lines, large customer bases, and a significant volume of trades. For buy-side entities, the benefits of the new technologies are less clear, as each buy-side entity must assess for itself the potential advantages of increased market efficiency against the disadvantages of its diminished ability, in some cases, to customize trading arrangements. Buy-side entities should start educating themselves now regarding these new technologies and heed lessons learned from past industry standardization initiatives to best prepare for the upcoming changes. The knowledge obtained through this education process will be necessary for buy-side entities to thoughtfully develop the appropriate priorities when negotiating and arranging new trading relationships with sell-side firms in the context of more automated systems and to avoid uncertainties in dispute resolutions. Participation in buy-side efforts around new technologies may also move the industry to a better balance between sell-side and buy-side priorities. The time for buy-side entities to start ascending the learning curve and addressing the buy-side concerns around technological innovations is now. ■