



FINTECH

NOTES

Keeping Pace with Change: Fintech and the Evolution of Commercial Law

José Garrido, Yan Liu, Joseph Sommer, and Juan Sebastián Viancha

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Prepared by José Garrido, Yan Liu, Joseph Sommer, and Juan Sebastián Viancha

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Prepared by José Garrido, Yan Liu, Joseph Sommer, and Juan Sebastián Viancha

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I. Introduction¹

Rapid advances in technology are changing the landscape of the financial sector. Technological innovation promises enormous potential for the transformation of business and financial practices. In business and financial markets, technology transforms how financial services are accessed into a cheaper, faster, and more inclusive experience. For example, the African experience with mobile technology and finance demonstrates how technology can improve a financial system and promote financial inclusion. Nevertheless, technology presents risks, including legal uncertainties. As discussed in the Bali Fintech Agenda (IMF 2018), legal frameworks need to be modernized to help member countries reap the benefits of fintech while mitigating risks. Building a flexible and predictable legal framework that accommodates technological changes according to domestic circumstances can help bolster trust and reliability in financial products. Legal certainty and reliable legal solutions are essential for promoting economic growth and financial stability.

There is a symbiotic relationship between technological revolutions, business practices, and changes in law. Experience shows that some technological innovations lead to the modification of business practices, which, in turn, result in changes in law. But the pace of these changes varies, and legal systems may need time to reflect on the implications of progressive technological changes and develop a consistent, predictable, and flexible response to the new challenges. Fintech² has introduced several breakthroughs, most of which originate in the use of distributed ledger technology (DLT), including smart contracts, tokens, and decentralized autonomous organizations (DAOs), among others. These innovations are expanding throughout numerous business activities in radically different ways, and some of them have raised a discussion on the need to adjust the underlying legal frameworks.

Commercial law may need to be modernized to enable technological innovation to achieve its full potential, produce predictable results, and mitigate risks. The use of new technologies in the core areas of commercial law (for example, registries, contracts, securities, company law, secured transactions, and insolvency) is disrupting the foundations on which it is built, and thus may require some legal changes that would enhance the possibilities of technology, afford adequate protection for market participants, and mitigate risks. Such legal changes, if needed, should address issues such as the transfer of rights and assets, evidence, compliance with formalities, and enforcement. By examining these basic questions, clear and predictable legal rules will make possible the implementation of new business models and practices in complex activities such as banking, investment, payments, and securities. Given the broad coverage of technological innovation and its evolving nature, this note will cover a particular set of technological developments and will analyze its impact on commercial law. It will not advocate legal changes to accommodate all changes since shifting business models and innovations may need more time to settle until a solid legal response is developed. In any event, legal changes should be technology-neutral³ to ensure flexibility and adaptability. Moreover, although technological innovation affects a wide array of legal areas, such as financial law, intellectual property, tax law, payments, and monetary law, this note will focus on the key areas of commercial law as one of the main foundations for business and financial

¹ The views expressed in this note are those of the authors and do not necessarily represent the views of the IMF, its Executive Board, or its management. The note has benefited from the guidance of Rhoda Weeks-Brown and comments by Jess Cheng, Wouter Bossu, and Marianne Bechara.

² Fintech is generally understood as the application of modern digital technologies to financial activities.

³ The term “technology-neutral” refers to nondiscrimination among different technologies (Koops 2006).

activities to highlight the need for legal frameworks to keep up with technological changes, contributing to a debate already underway among stakeholders.⁴

This note explores the interactions between new technologies with key areas of commercial law and potential legal changes to respond to new developments in technology and businesses. Inspired by the Bali Fintech Agenda, this note argues that country authorities need to closely examine the adequacy of their legal frameworks to accommodate the use of new technologies and implement necessary legal reforms so as to reap the benefits of fintech while mitigating risks. Given the cross-border nature of new technologies, international cooperation among all relevant stakeholders is critical. The note is structured as follows: Section II describes the relations between technology, business, and law, Section III discusses the nature and functions of commercial law; Section IV provides a brief overview of developments in fintech; Section V examines the interaction between technology and commercial law; and Section VI concludes with a preliminary agenda for legal reform to accommodate the use of new technologies.

⁴ This note will not cover other aspects related to business activities and finance such as financial and monetary law, or anti-money laundering/combating the financing of terrorism.

II. Business, Technology, and Law

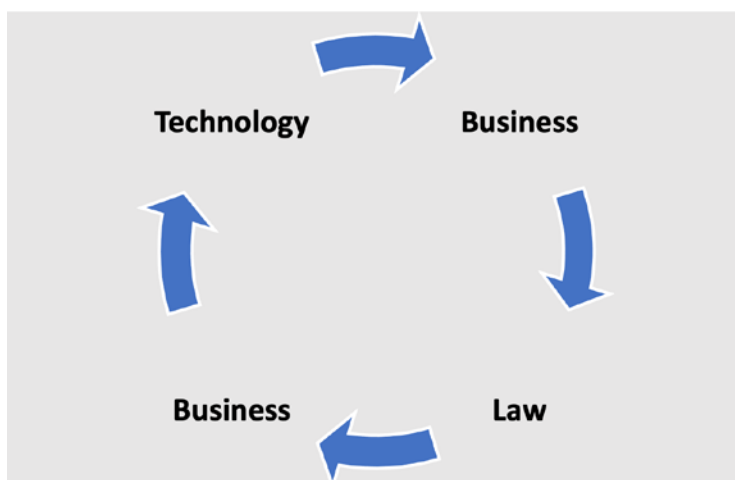
Relations between business, technology, and the law are complex. Throughout history, commercial law has gone hand in hand with major technological and economic changes. The law has enabled economic and industrial development: in the first place, with the commercial revolution of the middle ages (Lopez 1971); then, with the industrial revolution in the 19th century; and finally with the internet revolution in the late twentieth century. These three economic revolutions are closely connected to the existence and evolution of commercial law. But the relations between the law, business practices, and technology are far from linear.

Commercial law offers a framework for the development of business relationships. The legal framework offers *predictability* and *flexibility* as the key advantages for business activities. Business and technology have developed within an *enabling* environment provided by the law: in particular, the law has rewarded innovation (through intellectual property rights such as patents and designs); and legal techniques—such as the public company, bonds, shares, and the securities markets—have supported the mobilization of capital necessary for the development of complex commercial, industrial, and financial activities.

Technology transforms the reality regulated by law. Commercial law contributes to the development of business and technology, but deep transformations come from technological revolutions. The technological transformation of business activities may generate tensions with the existing legal framework. By nature, commercial law is flexible, but technological advancements and the business practices generated around them may be disruptive to some aspects of the legal framework. For instance, the expansion of the internet as a business tool created tensions with laws that were still assuming the existence of written contracts signed by both parties, or, at most, contracts that were the result of exchanged letters or telegrams. A new body of e-commerce law had to be developed to remove barriers that some of the previous requirements of the law were inadvertently creating.

The relationship between technology, business, and the law, can be described as a loop (Figure 1). Changes in technology immediately result in changes in business practices, and these eventually generate changes in the law. The resulting legal framework may enable new business activities, and in time, new technologies may restart the cycle.

Figure 1. Feedback Loop: Business, Technology, and the Law



Source: Authors.

The pace of change in technology, business, and the law is different. Changes in technology are sometimes sudden and revolutionary. The frequency of technological innovations has increased steadily since the industrial revolution. Business models and practices have adapted relatively quickly to technological changes, but the law has typically taken more time to adapt to such changes. Legal changes may enable new developments and allocate gains and risks from innovation, but also repress new conduct that produces negative effects.

III. The Nature and Functions of Commercial Law

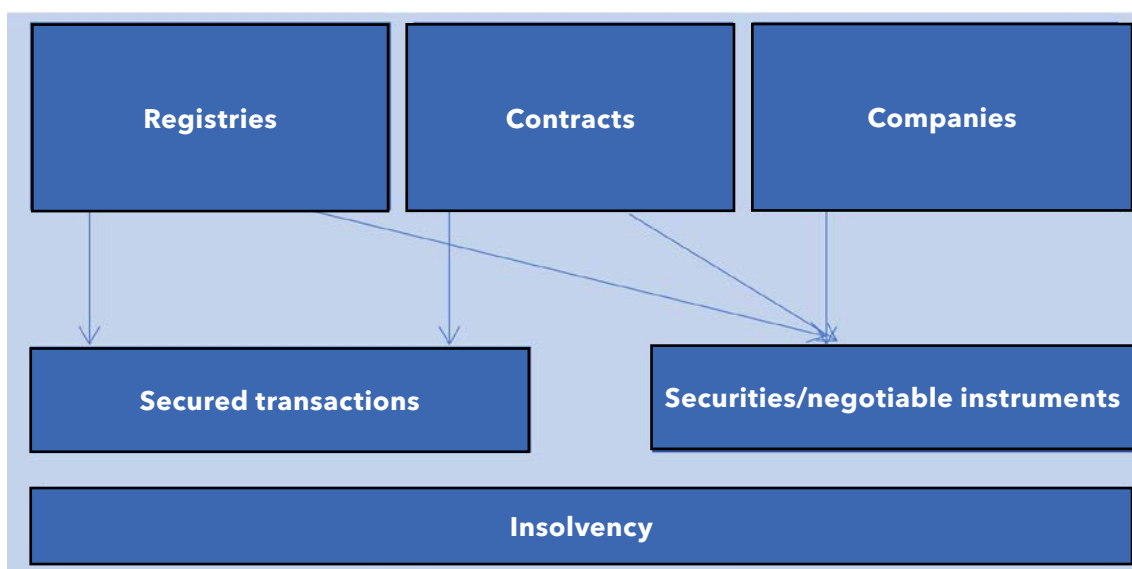
In all legal systems, there is a fundamental distinction between public law and private law. Public law regulates the functioning of the state and subnational authorities, as well as the relations of the state and other public authorities with citizens. The goal of public law is the protection of the public interest. Private law regulates the relationships among natural and legal persons. Private law seeks to balance and protect the interests of all persons, by providing a framework for the relations of persons among themselves. Public law is vertical in nature, while private law is horizontal.

Commercial law is a branch of private law. Commercial law is the area of private law that regulates organized economic activities. It allows people to use the most efficient arrangements for the conduct of economic activities, from simple commerce, based on transportation, agency, and the sale of goods, to complex financial activities, such as banking and insurance. It performs two main functions in regulating economic activities:

- *Enabling function:* The law enables market actors to conduct economic activities by providing the necessary legal tools and techniques. For instance, the law creates instruments such as limited liability companies, transportation and sales contracts, and negotiable instruments, all of which make it possible to operate a trading business.
- *Allocation function:* The law distributes rights and resolves conflicts between people. For example, company law not only enables the undertaking of complex business operations by allowing multiple persons to pool resources, but also needs to resolve the conflicts among all participants in the company (shareholders, managers, directors, and creditors).

Over time, commercial law has created a set of institutions and techniques that cover the relevant aspects of business activities. The organization of matters in commercial law follows a logical structure (Figure 2 and Box 1). Recognizing that the coverage and features of commercial law vary across legal systems (see Flume 2015), this note focuses on those areas of commercial law that are key to the conduct of business and financial activities. A sound commercial law, regardless of legal systems, should be both predictable and flexible with the ability to accommodate all kinds of economic activities within its general framework.

Figure 2. Areas of Commercial Law



Source: Authors.

BOX 1. Key Elements of Commercial Law

- **Registries:** Registries provide legal certainty about the status of merchants, companies, and acts affecting them. In specialized settings, such as securities markets, registries provide certainty on the ownership of securities and the transactions affecting them.
- **Contracts:** Commercial activities are conducted through contracts. Contracts include the sale of goods and transportation, loans, insurance contracts, and intellectual property licenses.
- **Companies:** The creation of companies allows the accumulation of capital resources and the specialization of management. Companies are used in all forms of commercial and financial activities.
- **Securities and Negotiable Instruments:** Since the origins of commercial law, there has been a need for the incorporation of rights to documents to facilitate their circulation in a secure manner and to facilitate payment and credit.
- **Secured Transactions:** The use of movable assets to increase access to credit relies on cost-effective notice-based registries and agile regimes for the recording and enforcement of security interests.
- **Insolvency cuts across all institutions of commercial law:** Credit is the lifeblood of commerce and credit default makes insolvency absolutely necessary to protect the rights of creditors and to facilitate the restructuring of viable enterprises and the liquidation of nonviable enterprises.

Source: Authors.

Commercial law provides the basic legal infrastructure for financial activities. Modern financial activities rely on the existence of a robust commercial law system. Basic banking contracts, such as loans and deposits, are contemplated in commercial legislation. Most financial institutions (banks, insurance companies, and financial intermediaries) rely on company law for their organization and financing. Financial markets have grown based on the development of contracts and securities as fundamental tools in commercial law. Ultimately, commercial law is relevant for the efficient allocation of economic resources, investment, and economic growth. Naturally, financial activities require not only basic commercial law, but a complex layer of supervision and regulation (Cheng 2020).

IV. Overview of Developments in Fintech

Fintech raises a number of legal and regulatory framework questions and challenges. Fintech covers a broad range of technological developments and possesses a unique characteristic: the bundling, unbundling, and rebundling of financial services and products by traditional financial institutions or “challenger” participants. This affects existing legal and regulatory frameworks, including most areas covered by commercial law. This note focuses on the technological developments that are most impactful on business activities, such as DLT, automated contracting, smart contracts, and tokens.

A. Distributed Ledger Technology

DLT, often confused or associated with “blockchain,” is essentially a database (see Box 2).⁵ In general terms, a DLT network is a means used to maintain and share digital records instantaneously across a network of participants through nodes. Regardless of whether the network is intended to serve an existing platform or network or is envisioned to be the center of a trading or custodian platform, a DLT’s main function is to store, manage, and share the digital records of multiple participants through an instantaneous common network where information is recorded and held by each participant in real-time through the network by nodes. DLT has the potential to connect parties directly through “accounts,” which enable them to participate in the platform—and, if desired, to not reveal their identities—without the need or permission of a centralized authority. The database, if properly authenticated, can serve as a registry, although it would be different from a traditional registry kept by a specific person. Instead, the registry is distributed among “nodes.” The nodes collectively maintain and authenticate the registry. However, the legal status of blockchain and DLT is uncertain in most jurisdictions.

BOX 2. Types of Distributed Ledger Technology

- **Public or unpermissioned distributed ledger technology (U-DLT)** is a network that is open to all, with no centralized management and parties can create, validate, and view transactions. U-DLT permits “any two willing parties to transact directly with each other (on the internet) without the need for a trusted third party” (Nakamoto 2008). Anybody can operate as a node. U-DLT relies on technological advances in cryptography to allow the authentication of transactions by strangers.
- **Private DLT** is a permissioned and closed system that is owned by an individual or organization. Only the central owner in charge of the network can read, write, and audit the platform. Review of the transactions and consensus is granted at the discretion of the owner.
- **A consortium or permissioned DLT (P-DLT)** is a permitted and group-owned system, where system governance is vested in a group of companies or individuals. Only members can validate and review transactions, and consensus is achieved through a voting or multi-party consensus algorithm.

Source: Authors

⁵ Technically, “blockchain” is a variety of DLT, which is a broader concept. DLT and blockchain are both decentralized registries. Blockchain is a decentralized database composed by blocks. Although blockchain is a sequence of blocks, distributed ledgers do not require such a chain. A distributed ledger is merely a type of database spread across multiple sites, regions, or participants. All blockchains are distributed ledgers, but not all distributed ledgers are blockchains.

Private and permissioned DLT are similar to existing registries. As in existing registries, the recording of information is subject to a set of enforced rules. Private and permissioned DLT can also use blocks to connect information in the database, but their functioning is completely different from that of unpermissioned DLT. The three types of DLT share the platform's ability to record each transaction and execute without requiring the control or manipulation of each party. This is also known as DLT/blockchain's immutability feature, which occurs when the parties followed the protocol process of the platform to conduct an operation and the platform deems it as final. In the industry's characterization, transactions are deemed transparent and non-repudiable, as any party can audit the information without the possibility of altering or modifying it, but the legal analysis of such transactions may be different (see Section V). Through consensus and autonomy, a distributed network of peers can record information without the need to rely on any centralized operator.

B. Automated Contracting and Smart Contracts

Automated contracting and smart contracts generate new possibilities and risks. Contracts with machine intervention are not new (vending machines are a good example), but with the advent of the internet, electronic commerce entered the mainstream and there are numerous contractual relationships nowadays, including financial services, where a person interacts with a computer system. However, a major new development is that machines can contract with other machines (see Chopra and White 2009). When each party introduces instructions and machines execute the instructions of both parties, there is nothing peculiar (for instance, a smart refrigerator "buying" milk from an internet grocery service). Software codification of complex legal terms, combined with artificial intelligence, weakens the link with human instructions and supplements them through either automated contracting or smart contracts.

Smart contracts are mechanisms for the performance of contractual obligations. Smart contracts presuppose the existence of a contractual understanding or a "meeting of the minds." A smart contract is computer code that, upon the occurrence of a specified condition or conditions, is capable of running automatically according to prespecified functions. The so-called prespecified functions or "code," which is generally stored and processed on a DLT system (see Box 3), is basically "the applicable law" between the participating parties (Lessig 1999).

BOX 3. Characteristics of Smart Contracts

- **Self-executing:** Smart contracts seek to assure performance by using autonomous code. With smart contracts, performance obligations are not written in standard legal language. Rather, these obligations are memorialized using a strict and formal programming language. Smart contract code is executed in a distributed manner by all the nodes supporting the underlying blockchain-based network, without necessarily relying on any intermediary operator.
- **Autonomous:** Because smart contracts are autonomous, promises memorialized in a smart contract are—by default—harder to terminate than those memorialized in a natural-language legal agreement. Because no single party controls a blockchain, there may not be a way to halt the execution of a smart contract after it has been triggered by the relevant parties. Once the wheels of a smart contract are put into motion, the terms embodied in the code will be executed and they cannot be stopped unless the parties have incorporated logic into the smart contract to halt the program's execution.
- **Flexible operation:** Smart contracts are theoretically more dynamic than traditional, paper-based contracts, because they can be constructed to adjust the performance of obligations during the term of an agreement by using a trusted third-party source—commonly referred to as “oracles,” which can be individuals or programs that store and transmit information from the outside world, thereby providing a means for blockchain-based systems to interact with real-world persons and potentially react to external events. For example, oracles can be connected to a data feed from a third party conveying the latest prices in commodity markets to adjust the parties' obligations. An oracle can also be made to convey the insights of human beings or support private dispute resolution and private arbitration systems (sometimes referred to as “judge-as-a-service” or “arbitration-as-a-service”).

Source: Authors.

C. Tokens

Tokens are a new instrument for business activities. The term “token” derives from the traditional meaning of an object that gives the holder the right to a certain asset or service (for instance, a casino token or wardrobe token). Tokens can be explained as lines of code embedded in DLT networks that may serve different purposes. For instance, a token can be used as a digital means of exchange, a digital investment, or a resource. Regardless of the classification, the main functionality of tokens on a DLT is to enable parties to conduct operations, whether these refer to services, goods, or financial instruments, with the token acting as an independent representation of those services, goods, or financial instruments (see Box 4).

BOX 4. The Main Uses of Tokens

- **Payment:** Tokens—regardless of their denomination as payment tokens, crypto assets, virtual currencies, currency tokens, or virtual financial assets, among others—can all share the common function of serving as a means to conduct payments or exchanges in a digital environment, mostly through digital ledger technology systems.
- **Investment:** Through a wide array of tokens, such as asset tokens, investment tokens, equity security tokens, security tokens, digital tokens, or crypto assets, tokens can be structured to serve an investment function, in a similar way to traditional securities or other investment products, including the right to participate in the profits of a business venture, in a digital environment.
- **Utility:** Tokens can perform the function of giving the right to the holder to use a product or demand a service.

Source: Authors.

D. Artificial Intelligence

Artificial intelligence (AI) is a generic term referring to computer systems that can perform functions traditionally associated with human intelligence. The term also encompasses “machine learning” and “deep learning.” Machine learning has a narrower and more specialized meaning: machine learning bypasses the direct programming of automated functions; instead, the machine programs itself. The algorithm improves with experience. The automated system evolves in a multivariate fashion and no simple algorithm can explain the functioning of the system. Deep learning is narrower and refers to a specific area of AI and machine learning that is based on artificial neural networks and deep neural networks, that is, artificial neurons organized in layers that help improve the performance of the system by learning from examples fed to the system.

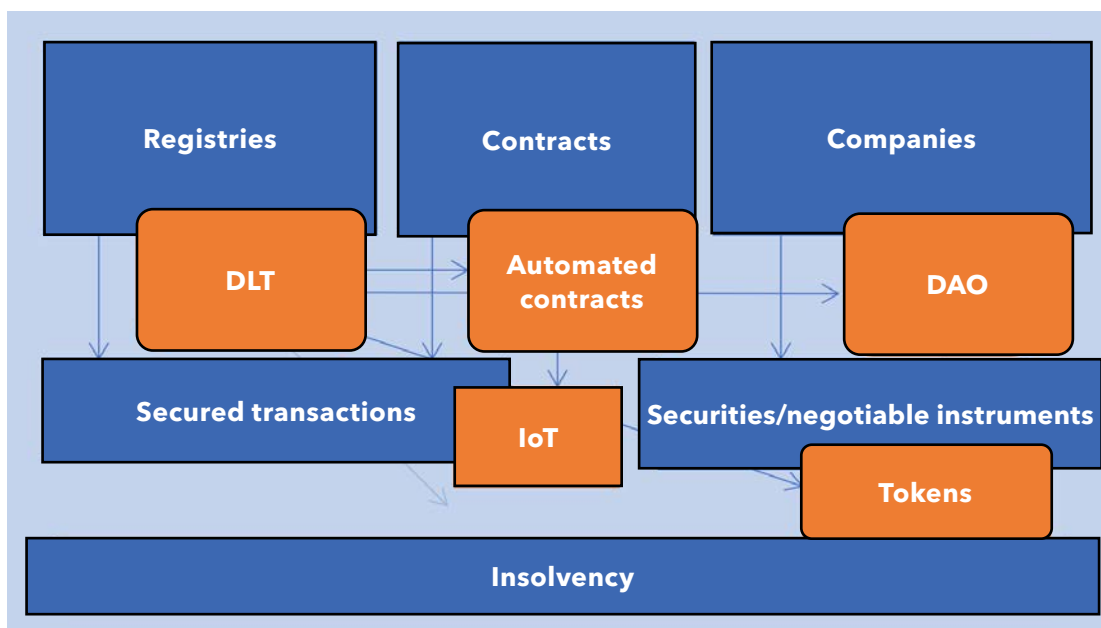
E. Internet of Things

The Internet of Things (IoT) refers to the communication between machines and systems with no human intervention. Some ancillary innovations, such as the “Radio Frequency Identification” (RFID) of objects, increase the commercial possibilities of IoT, as they make it possible to identify and trace inventory without incurring burdensome costs.

V. The Impact of Digital Technology on Commercial Law

Technological innovations are closely interacting with commercial law. Figure 3 illustrates how the new digital technologies—especially, DLT and its associated innovations—correspond with the main areas in commercial law. As indicated, there is a complex connection between business practices and the legal framework: since commercial law is inherently flexible, there is always room for innovative practices within the existing legal framework. Some of the new business practices that have originated with technological breakthroughs may necessitate legal reforms. Others may be adapted within the existing legal frameworks. In addition, the pace of reform of commercial law is slower than that of public law and much slower than the changes in technology. This section explores in detail these interactions and the potential legal changes to respond to technological innovation.

Figure 3. Key Areas of Commercial Law and Recent Technological Developments



Note: DAO = decentralized autonomous organization; DLT = distributed ledger technology; IoT = Internet of Things.

Source: Authors.

A. Registries

Registries are one of the foundational elements of commercial law. Registration was the way that individuals became recognized as merchants. Later, legal systems mandated the registration of companies. Different types of registries provide legal certainty in company law, secured transactions, and securities markets. Registries in traditional commercial law are of a public nature: they are controlled by the state because they represent a “public good” by providing reliable information that is crucial for contracting in the market (informational function) and controlling compliance with rules of acts, which have effects vis-à-vis all market participants (legal function). Some registries can be private (for example, securities registries), but these

registries are subject to the control of the market authority or securities regulator, because of the importance of their functions for the operation of the market.

DLT operates as a registry platform. DLT can be used as a registry, either public or private. Rights and obligations can be created, performed, and extinguished through automated and autonomous coding, within the network and without the involvement of third parties. DLT networks seek to offer an adequate environment where parties can interact and exercise legal rights, thereby giving legal certainty about the precedence of their rights and obligations (see De Filippi and Wright 2018). Regardless of whether the implementation of a DLT network envisions smart contracts, crypto assets, or both, it can serve as a single accounting and reporting system where automatization will entail the creation, execution, management, and liquidation of transactions.

DLT shares some of the features of “registries of title.” Registries of title provide legal certainty over the ownership and encumbrances of high value assets, including real estate, intellectual property, and ships and airplanes. Registries of title function under the principle of a valid and uninterrupted chain of title. The defining characteristic of DLT—especially blockchain—is that the chain of transfers cannot be manipulated or altered without access to encryption keys.⁶ This can be useful to preserve the integrity of the registry records, particularly in cases where the registry function could be vulnerable because of inadequate means or corruption.

DLT could be used to improve other public registries. Commercial registries are different, since they provide essential information for parties interested in engaging in contractual relationships with those included in the registry (companies and merchants). Public authorities also have an interest in accessing information maintained at the registry. DLT can help improve the integrity of the registry databases and ensure that all information is appropriately linked to their corresponding sources. In this case, DLT could be used just as information digital technology, not as a record for the transfer of assets, but it would guarantee the integrity and continuity of registered information.⁷

DLT can accelerate the creation of private registries. In the area of commercial law, the use of private registries for securities soared once securities were dematerialized and computer systems had the capacity to record holdings and transfers of securities in a reliable manner. Later, Bitcoin used blockchain (DLT) to introduce the first private registry of crypto assets. The potential to create, store, manage, exchange, and settle digital assets through DLT gave rise to other crypto and non-crypto private registries. Furthermore, DLT as a registry offers a solution for the problem of reconciliation of decentralized registries: it is difficult to assign preference to a registry when two private registries include the same assets but provide contradictory information on such assets. DLT ensures that information is consistent and coherent even when the data entry points are multiple. DLT avoids “double spending” issues and reflects in real time all changes and transactions from all the parties connected through a quick, safe, and transparent accounting and reporting system. It should be noted that other technologies may provide similar advantages for the organization of private registries.

DLT has its own limitations as a private registry. A fundamental difference between DLT and a registry is that DLT may lack a control mechanism and an authority in charge of its oversight. Registries tend to be connected with the means of transferring property, and with the registration of security interests. There may be different ways of transferring property in different legal systems, but in all cases where assets are registered, the registry will play a key role in the transfer of property and an acquirer of an asset will have full legal protection when the transfer is properly recorded in the registry. Even though in terms of

⁶ For this reason, some countries, like Georgia and Ghana, have moved forward with projects to use DLT in the operation of land registry. See Eder 2019. There are also indirect benefits in the use of DLT for registries, such as the improvement of tax compliance. Those issues relate to what is referred to as “Govtech” and are beyond the scope of this note.

⁷ In the US, Wyoming has reformed its law to allow for the creation of a DLT-based commercial registry.

functionality DLT networks offer a transactional environment for the parties, there is no complete legal certainty and protection. In addition, DLT networks should establish a system to verify creation or representation of off-ledger assets and storage, transfer, and elimination of assets, in- and off-ledger. Without such a system, off-ledger actions and transactions might not be represented in the network, which would lead to uncertainty. In this way, DLT private registries raise fundamental legal questions, including whether transfers made at the registry confer property rights, how to address fraudulent transfers or transfers made under coercion or error, how the liability of users and the registry itself should be addressed, and the way in which the underlying assets or rights represented in the DLT registry comply with substantive law and legal formalities.

Commercial law needs to provide clear and predictable rules for the existence and appropriate functioning of private registries, including DLT. A definition of DLT and other basic terms, such as smart contracts or tokens, is just the first step in integrating DLT with the existing legal system. Ideally, legal systems should also address the following points:

- The use of DLT for the realization of valid legal acts
- DLT as a method for the transfer of property rights
- DLT records as evidence
- Enforceability of rights derived from DLT
- DLT transactions affected by fraud, error, or coercion
- Prohibition or subordination of transfers made outside the registry
- Any necessary public oversight measures

It is possible that the judiciary develops precedent along these lines, especially in common law countries, but that could be a long and uncertain route. Providing legal certainty to maximize the potential of innovation and the protection of participants can be achieved through statutory reforms.

Legal systems are starting to grasp the importance of providing a foundation for DLT technology. Some national legal systems are incorporating definitions of DLT to provide a basis for addressing other legal questions. At the regional level, the EU blockchain strategy envisions the building of an interoperable blockchain.⁸ The national laws of Albania, France, Italy, Liechtenstein, Malta, and Switzerland have incorporated definitions of DLT with different degrees of detail.⁹ In the United States, some states have incorporated legal definitions of terms, such as digital assets, smart contracts, and blockchain. For instance, Wyoming has introduced legislation on digital assets and on open-blockchain tokens.¹⁰ Other states, including Arkansas, California, North Dakota, South Dakota, Utah, and Washington have also incorporated definitions of blockchain technology into their laws. However, although these state laws recognize business practices under DLT, there is no uniform regulation. For instance, although the Illinois Blockchain Technology Act¹¹ recognizes

⁸ See <https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy>.

⁹ For instance, Italy adopted a specific definition of DLT as “IT technologies and protocols using a ledger that is shared, distributed, replicable, simultaneously accessible and structurally decentralized on cryptographic basis, so as to allow the record, validation, updating and storage of both not encrypted and encrypted data which may be verified by each participant and which may not be altered and modified.” Malta used a much broader definition “a database system in which information is recorded, consensually shared, and synchronized across a network of multiple nodes.” Finally, Liechtenstein has established a comprehensive regulation for token-related activities but uses a broad definition that encompasses other potential alternatives (“trustworthy technology”).

¹⁰ Wyoming is addressing the legal effects of different technological developments in business transactions and has amended the Wyoming Uniform Commercial Code to address topics such as (1) a definition of digital assets that utilize blockchain and DLT; (2) the perfection and priority regime of digital assets under blockchain or DLT; (3) special rules for perfection and priority with respect to such assets; and (4) the provision of a framework for banks to act as custodians with respect to such assets.

¹¹ 205 ILCS 730, at <https://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=4030&ChapterID=20>.

the validity of transactions conducted through DLT or blockchain, such as the use of smart contracts, it also imposes limitations for the use of DLT or blockchain in instances where a law requires a record to be displayed or communicated in a certain manner. Since DLT may have to interact with or even depend on existing registry systems to be fully functional, it is important that legal definitions are sufficiently open to allow further innovation in this area.

B. Contract Law

All business activities are conducted through contracts. At the origins of commercial law, contracts focused on the sale of goods, but practice soon evolved to a constellation of different contracts that were able to cover all economic activities, including banking, transportation, and later, securities trading, insurance, and intellectual property. Contract law was transformed by the creation of the internet, and the introduction of AI and smart contracts signals a new transformation. However, the algorithms used to automate contractual relations are not completely predictable in terms of formation, interpretation, performance, and enforcement. This may have serious implications for the stability of financial markets, as there is no certainty and predictability of the transactions. In addition, coding might fall short in terms of regulating unforeseeable or uncertain situations, or typical material adverse scenarios, as they depend in each case on the particularities of the transaction.

Automated contracting is often based on the use of AI and presents issues in the formation, authentication, interpretation, performance, and enforcement of contracts. These issues can be summarized as follows:

- Regarding *formation*, some of the peculiarities of automated contracts are well covered, as the law has adapted in response to technological developments. With the use of digital technology, contracts can be negotiated, entered, and executed through electronic channels, without requiring verbal negotiations or physical signatures. To some extent, the prior consent of the parties on the applicable law and the use of digital channels allows the formation, performance, and enforcement of such agreements. There is a general principle of nondiscrimination between electronic and paper media in contract formation.¹² This is relevant for automated contracts, which tend to be concluded over the internet. Yet, as contracts are acts of legal and natural persons, the challenge with automated contracting is how to link the automated action to the intent of the persons bound by the contract. There are several possible solutions to this problem, but a comprehensive approach would be based on legal rules that connect the automated actions to a specific person or entity (see Kim 2020). The actions of the machine, including tort acts, would be attributable to the person or entity owning or controlling the machine. Cases of error could exist, but sophisticated parties should not be allowed to rely on technological error to avoid obligations.
- *Authentication* refers to the validity of the signature of the contracting parties. Contract law has evolved to incorporate internet technology. Authentication may be assisted by third-party security service providers who need to operate under duties of commercial competence. Authentication ultimately relies on digital technology, thus, the law can allocate the risk of fraud among the parties, but fraud reduction depends on the technology adopted. The law should create incentives for the careful conduct of operations and adoption of anti-fraud measures by the appropriate allocation of risk with

¹² This follows a general principle of nondiscrimination, also observed in the equivalence between electronic and written signatures (for example, UNCITRAL MLEC [1996] and MLES [2001]).

regard to both current technology and expected technological developments. Some legal systems already implicitly recognize this since the adoption of electronic signature statutes.¹³

- Interpretation of contracts is required when contractual terms are not clear. The difference that digital technology has brought about is that nowadays some contracts are drafted in code, at least in part. Contracts are generally drafted in natural language, but they may have annexes in code regulating specific aspects of the contractual relationship. Since code is a language, the issues of interpretation are somewhat similar. Discrepancies between natural language and the code section of the contract can become a frequent problem of interpretation, and it would be useful to include provisions to resolve that conflict. Code tends to be clearer than natural language (it is *hyper-literal*), although it cannot be assumed that code is entirely immune to ambiguities or competing interpretations (Grimmelmann 2019). AI and code can reduce errors in contracts, but, in practice, most contracts are incomplete, and machines have trouble completing these intentional gaps. In the end, disputes over the interpretation of contracts still need to be resolved by the courts.
- *Performance* refers to the actions taken by the parties to comply with their contractual obligations. In contract law, general doctrines such as “good faith” or “fair dealing” aim to prevent the abuse of discretion by one of the contracting parties when contractual terms lack specificity or when unforeseen circumstances arise. If machines perform the contract, it is not easy to apply these doctrines. If a machine has been programmed and controlled by one of the parties, the machine’s conduct can be attributed to that party. The situation is less clear when the machine operates under AI, since it may be more difficult to attribute the actions to a contracting party, and especially to attribute a state of mind or intent, as required by the provisions on good and bad faith under contract law. Mistakes would be easier to attribute to the party who owns or controls the machine.
- *Enforcement* of automated contracts is subject to the same regime as ordinary contracts. Assuming a valid and enforceable contract, the remedies available to the parties should be the same as under an ordinary contract, independent of the fact that the contract was created by machines. There are, however, some technological advances that may increase the use of self-help remedies in automated contracts. Prior consent of the parties and the development of the IoT make it possible to disable equipment or software remotely, without any human or judicial involvement. However, this may also raise the risk of *improper* self-help—or *improper* automated performance—which may lead to litigation, eventually resulting in judicial enforcement.

Smart contracts raise some particular legal issues. Smart contracts entail pure automated performance, in accordance with code (Raskin 2017). Smart contracts are designed to be self-contained, that is, interpretable and performable without reference to the outside world (Cole 2019). There are several notable peculiarities in smart contracts:

- Smart contracts in DLTs rely on special mechanisms for contract formation. Theoretically, a DLT network can create an environment where participants can interact with each other and generate offers. Such offers can be accepted by the parties using a combination of public and private keys, which represent the identity of the parties, consent, and ultimately the “meeting of the minds” required for the formation of a contract. However, contract formation through a DLT network, where parties can

¹³ Under the US Uniform Electronic Transactions Act (UETA) and the federal Electronic Signatures in Global and National Commerce Act (the “E-Sign Act”), a court cannot deny legal effect to an electronic contract (with limited exceptions) if parties manifest an intent to be bound by the agreement. Broad definitions in both the E-Sign Act and the UETA accommodate blockchain technology, smart contracts, and digital signatures generated using public-private key cryptography. The European regime of the eIDAS regulation (electronic identification, authentication and trust services) is open to the use of blockchain technology (see EU Regulation 910/2014 of 23 July 2014).

operate pseudonymously or remain private, can result in failure to comply with legal requirements, such as capacity. For instance, the Federal Supreme Court in Germany has stated that software machines cannot make valid declarations of intent or act as agents, as they lack legal capacity.¹⁴ Moreover, the governing law of the DLT network, in case it exists; the governing law selected by the parties; or the applicable law can affect formation of the contract in unforeseen ways.

- Smart contracts typically involve future performance. Often, performance is triggered by a simple deadline, but when certain actions depend on specified circumstances arising, such contingent events need to be codified. In some cases, the verification of events is also automated (through the so-called oracles described in Box 3, such as through the readings of a contractually specified sensor or through a market index). Eventually, events need to be assessed and verified by persons. These issues are similar to those of ordinary contract performance.
- Smart contracts often involve payments and aspire to total freedom from outside interference. Smart contracts can be performed within a closed system, where payment resides on the system itself and access to information can be fully integrated. For a smart contract to be perfectly self-contained, the payment should be executed with a crypto asset integrated into the contract ecosystem or with the use of escrow accounts to execute automated payments. Nevertheless, if there is a dispute, parties can either renegotiate the underlying arrangement for the smart contract or seek redress from a court or arbitration panel to reverse its effects (interference from outside).
- Smart contracts are not immune to enforcement disputes. Even if a smart contract is considered legally binding—and under a DLT network, contracts are deemed immutable and self-executing—a party could challenge the contract based on the impact of a foreseeable or unforeseeable event; a different interpretation of the contract; or the intent of the parties, resulting in a dispute. For instance, despite the fact that a network has in place standard processes for creating a smart contract in the way of a “template” or “acceptance of terms and conditions,” courts may be reluctant to enforce such an agreement if a party did not receive adequate notice of the terms of the agreement.¹⁵ Although smart contracts can establish “dispute resolution mechanisms,” a party might still seek judicial enforcement through a court.¹⁶ The involvement of third parties, such as courts or arbitrators, could raise personal jurisdiction or choice of law issues, resulting in scenarios where a court might find that there is no valid contract between the parties or no jurisdiction over the parties or the matter.
- Remedies in DLT-related disputes are constrained by the nature of the technology. In all cases where performance is conducted and reflected in a DLT, the problem is that it is not possible to go back to the preexisting state of affairs. In this way, it should be possible to order the recipient to make a symmetrical reverse transfer in favor of the original holder of the asset in the blockchain, but if there have been multiple transfers, the only possible remedy may be awarding damages to the affected party.

Contract law may need some adjustments to adapt to new technological innovations. Rules need to be established to connect the actions of machines to legal or natural persons to provide legal certainty to automated contracting. Smart contracts need to be integrated into the general legal framework as special mechanisms for performance (see Werbach and Cornell 2017). This should include a legal definition of smart contracts as well as special rules to recognize the authentication mechanisms embedded in DLT and the resolution of disputes in the case of DLT-related smart contracts. Adaptation of contract law is still in its early

¹⁴ BGH, judgment of 16 October 2012 – X ZR 37/12.

¹⁵ *Nicosia v. Amazon.com, Inc.*, 834 F.3d 220,237-38(2d Cir.2016).

¹⁶ In *Robertson v. Persons Unknown*, an English court granted an asset preservation order in a fraud case involving Bitcoin. See case number CL-2019-000444.

stages; a significant development is the enactment of rules that consider that DLT-based contracts fulfill the requirement of contracts to be “in writing” and that smart contracts are legally enforceable.¹⁷

C. Securities and Negotiable Instruments

The law of payments was transformed by intermediation but is being transformed now by disintermediation. Payments evolved from bilateral transactions for the purchase of goods or services to sophisticated and highly intermediated environments with bills of exchange, checks, electronic fund transfers, and credit and debit cards, among others. Tokens can codify payment features and functions and lead to disintermediation of payment services since all payment actions can be programmed and performed in a software system.¹⁸

The law of securities and documents of title has been transformed to keep pace with dematerialization. Traditionally, both securities and negotiable instruments (including documents of title) were tangible, namely paper documents that incorporated rights (see Rogers 1990). With the possibility of digitalization of these documents, the law created the category of “transferable records,” which are electronic records that entitle the holder to exercise a right. Transferable records helped adapt the law to the new reality of paperless documents. But it is not clear how to apply the negotiable instruments law without the concept of possession since there is no physical reality in a transferable record. “Possession” was translated into the realm of electronic records by using the concept of “control,” which attributes an electronic record to a specific person. For control to be operational, the electronic record needs to be unique and identifiable as unique, and contain the necessary information to define the rights included in it.

The concept of control of electronic records has not been legally defined. Generally, electronic records are linked to a particular system that provides control (for instance, a securities registry or depository; or a clearing house for negotiable instruments). These systems operate through rule sets, but they could also operate on DLT, especially through permissioned DLT.

The use of tokens requires additional legal changes. A fundamental legal rule needs to establish that the holder of a token has the right to receive the performance of an obligation from the issuer. There has been abundant debate on the typology of tokens (see Allen and others 2020) and some consensus about their classification in three categories: security tokens, utility tokens, and payment/exchange tokens (often referred to as cryptocurrencies, which are beyond the scope of this note).¹⁹ This classification is functional, rather than legal, and may conflict with existing legal classifications. Utility tokens provide a right to receive a good or service, while security tokens can provide the same rights as traditional securities (bonds, shares, or warrants). Although some countries have advanced in developing a classification of tokens, for instance by separating financial instruments²⁰ from asset-referenced tokens, e-money tokens, and other crypto assets (as proposed by the EU Markets in Crypto Assets Directive [MICA]), the inherent flexibility in token design might overcome this classification.

¹⁷ For instance, in the US, Arizona allows the use of smart contracts in commerce and prevents a smart contract from being denied of legal effect, validity, or enforceability solely because it is a smart contract. Following this approach, Illinois recognizes the validity of smart contracts and blockchain-based records and signatures and allows a smart contract to be denied legal effect if the underlying DLT or blockchain does not permit a record of the transaction to be retained and accurately reproduced for all parties entitled a copy of the contract or record.

¹⁸ This section does not focus on the law of payment, only on the legal distinction between utility tokens, payment tokens, and security tokens.

¹⁹ In essence, cryptocurrencies are tokens that do not provide any right to the holder, but users may agree to exchange goods or services against them on a voluntary basis and may be necessary for the DLT network to operate, as they are used as an “internal unit of value” that compensates users for their contributions. On cryptocurrencies, see He and others 2016 and Adrian and Mancini Griffoli 2019. On the broader category of crypto assets, see Cuervo and others 2019. In addition, other examples such as stablecoins and Central Bank Digital Currency will not be addressed in this note.

²⁰ As per the EU proposal as of the date of this note, MICA will not apply if a crypto asset constitutes a financial instrument, e-money (other than an e-money token), deposits, structured deposits, and securitization.

It is imperative to legally distinguish security tokens from utility and payment tokens. Under commercial law, different instruments incorporating rights can perform multiple functions (for instance, bills of exchange and warehouse receipts for delivery and even pledging of goods can be used for financing or payment purposes). The use of these instruments merely requires the existence of some basic rules and the consent of the parties as to their use. However, tokenization introduces enormous flexibility in the design of instruments (see Voshmgir 2020), so that utility and payment functions may be combined in a token and can even resemble a security. A utility token designed for the purchase of goods or services on a network could be classified as a security subsequently due to the actions of participants and other circumstances.²¹ It is crucial that a clear legal distinction exists for securities. If an instrument is classified as a security, it automatically attracts the application of a whole body of law, including registration processes and liability provisions.

Security tokens need to be integrated within securities law. Tokens are not inherently exempted from securities laws. The flexibility and automatization of a DLT network to issue a token can lead to a recharacterization process of the token into a security, as some securities laws are flexible rather than static. If a token purports to grant the rights of a security, the issuer will need to follow all the requirements of the legal regime, starting with registration and prospectus requirements. The wave of Initial Coin Offerings in 2018 attracted wild speculation and blurred the lines between categories of tokens. Moreover, recent cases such as *SEC v. Telegram*²² or *SEC v. KIK*²³ demonstrate that the notions of utility of a token (usefulness of a token) or its use as a means of payment are flexible concepts that may not prevent the classification of tokens as securities. However, in other cases involving tokens, such as *Turnkey Jet Inc.*, tokens “immediately usable for their intended functionality (purchasing air charter services) at the time they were sold” were not classified as a security as explained by the SEC.²⁴ The flexibility of DLT networks to issue tokens that can incorporate any type of rights can lead to uncertainty and unpredictability.

It is accepted that if a token seeks to replicate a security, like a share or a bond, it will be subject to securities law. In practice this may mean a prohibition on the issuance of the security in the form of a token because most legal systems are not prepared to accept this form of representation of securities. For this reason, countries seeking to allow the use of tokens as securities need to incorporate enabling provisions in their laws and pay special attention to the cross-border aspects of allowing the use of tokens as securities. For instance, if a token is deemed as a security, an offering of tokens could be deemed as a public offering of securities. In addition, countries will need to address issues of transfer and pledges of tokenized securities, as well as their private international law regime, indicating the applicable law for token transactions. Nevertheless, even if tokens are classified by local authorities as securities, it will be challenging to enforce securities regulation, since transactions are virtual and could fall outside the territorial reach of a court.²⁵ An additional problem is supervision: the securities and market supervisors may access the ledgers to check information about transactions, but a decentralized ledger is in reality outside the jurisdictional territory of the supervisor, and, as a decentralized system, is not responsive to supervisory orders (for instance, a suspension in trading is practically impossible to enforce).

²¹ According to the US Securities and Exchange Commission’s (SEC) “Framework for ‘Investment Contract’ Analysis of Digital Assets” (2019), even if the digital asset can be used to purchase goods or services on a network, it may be subject to securities law if, among other factors, the following are present: the digital asset is offered or sold to purchasers at a discount to the value of the goods or services; the digital asset is offered or sold to purchasers in quantities that exceed reasonable use; and/or there are limited or no restrictions on reselling those digital assets, particularly where there are continuing efforts to increase the value of the digital assets or where there is facilitation of a secondary market.

²² *Securities and Exchange Commission v. Telegram Group Inc. et al.* 19-cv-09439-PKC (S.D.N.Y. Oct. 11, 2019).

²³ *Securities and Exchange Commission v. Kik Interactive Inc.*, 19-cv-05244-AKH (S.D.N.Y. June 4, 2019).

²⁴ See No-action letter by the SEC Division of Corporation Finance (Apr. 3, 2019).

²⁵ In a recent case, the courts declined to apply US securities law to a security token, as there was no domestic transaction, since the tokens were not listed on a domestic exchange and there were no domestic off-exchange purchases. See *Barron v. Helbiz Inc.*, Case No. 21-00278 (2d Cir.).

It is also important to establish that tokens can be property or, at least, that they can be subject to exclusive rights of the holder. Tokens can be treated as property under the law—for instance a form of intangible property under English law. In some legal systems, tokens may fail to be recognized as property (for example, Germany or Japan), especially when they represent “rights over rights.” In such legal systems, it would be convenient to provide a specific legal treatment that recognizes the exclusive rights of the holder, including the right to transfer the token by voluntary transmission or inheritance, and the treatment of the token in insolvency (see section F). The comprehensive reforms in Switzerland and Liechtenstein are examples of the integration of tokens into the fabric of their commercial law.

Legal certainty needs to underpin the use of tokens. A fundamental legal rule establishing the legal nature of tokens is necessary for the protection of users and the development of markets, if a country wishes to promote such development. Such legal rule should at least treat tokens as an asset that can be owned and transferred in accordance with legal requirements.

Utility tokens raise some specific legal issues. Utility tokens can be non-fungible and perform similar functions as documents of title. In addition, some utility tokens can work in perfect isolation from material reality. For instance, a token that provides the holder with access to the computing capacity of a network will be self-enforcing, based on the smart contract architecture. However, the key problem lies in the fact that numerous tokens will require an interaction with the world outside the blockchain to grant holders the right to which they are entitled. The blockchain can ensure the integrity of the information included in it and the integrity of the chain of transfers, but the blockchain cannot guarantee the existence of an asset outside itself or the right to receive that asset. For instance, a token that gives its holder the right to receive a diamond of a certain quality cannot guarantee that the diamond exists in reality and cannot ensure that the holder of the token will receive the diamond when promised.

There must be a gateway with the physical reality. This includes entities that certify the existence of assets and their quality and, most importantly, mechanisms to ensure that the holder receives the asset or service promised by the issuer. In this regard, some basic provisions in the law are necessary, for instance, to enable courts to recognize the validity of DLT records and their use to claim enforcement of the issuers promises. In this regard, Liechtenstein has created a system where any asset or right can be tokenized under a system that relies on “physical validators” that ensure the correspondence between the tokens and physical reality.

D. Company Law

Companies possibly represent the greatest contribution of commercial law to economic development, but new technologies can affect existing legal regimes. Company law provides a sophisticated set of legal tools to protect the rights of shareholders and creditors of the company, while offering flexibility and reliability for the conduct of business activities. Technological innovation poses challenges to company law. As indicated before, tokens can take the form of “security tokens” and perform the functions of shares and bonds in a company. This would affect the representation of the securities, with the implications described previously. Several legal systems have already enabled the tokenization of corporate securities (France, Switzerland, and in the United States, Wyoming). A number of US states allow the use of DLT to maintain corporate registries of shares (Delaware, Kansas, Maryland, Nevada, North Dakota, Vermont²⁶). However, the use of DLT beyond the tokenization of securities may require other changes to company law.

The experience with the DAO in 2017 illustrates the complexity surrounding the treatment of DLT and tokens in company law. A DAO was created with the purpose of allowing developers to present projects to the members of the organization and potentially receive financing for those projects. Token holders could vote on the plans and had rights to receive payments from successful projects. However, the DAO code was

²⁶ In Vermont, a so-called blockchain-based limited liability company may provide for its governance, in whole or in part, the use of blockchain technology—for instance, the use of smart contracts to administer voting procedures.

hacked, causing substantial losses (see Kolber 2018). In addition, the US SEC established that the project entailed an unregistered offering of securities and therefore violated securities law.²⁷ The DAO proved to be extremely risky as an entity to raise capital from the public. A different use of DAOs would be to structure small business organizations. For instance, Wyoming (2021) has adopted a law that allows private companies to be organized as DAOs and be “algorithmically managed” by smart contracts. Although DAOs have introduced an innovative digital environment to create digital companies, raise capital, and ultimately manage a corporation, the integration of DAOs into current company law frameworks requires careful consideration of the risks involved, particularly for larger companies.

E. Secured Transactions

Secured transactions law—which sits at the crossroads of contract and property law—could also be impacted by technological developments. The tokenization of securities and other assets requires rules that allow the creation of security interests over tokens. The new regime can be based on the template of dematerialized regimes as in, for example, Liechtenstein and Wyoming.

Modern secured transaction regimes are based on the effective operation of registries. However, registries for secured transactions over movable assets are extremely different from traditional registries of title. In fact, these are “notice-based” registries: they do not establish title over movable assets and their effect on transfer of assets outside the scope of the registry is limited. Notice-based registries are simple to operate, have already integrated internet capabilities, and would not benefit significantly from adopting DLT. The real change for secured transactions regimes may come from IoT technologies and radio-frequency tagging (RFID) (see Mooney 2018 and Bradley 2019). One of the weaknesses of modern secured transaction regimes, particularly in developing countries, is lack of trust. Security interests over inventory, raw materials, and other movable goods are under-utilized because creditors do not have any certainty that the assets are going to be available at the time of enforcement. The possibility of tagging assets at a very low cost would reinforce creditor rights and expand access to credit, but the technology needs to be integrated into the legal framework.

F. Insolvency

Insolvency cuts across all areas of commercial law and plays a prominent role in the development of new technologies and business practices.²⁸ Insolvency refers to all situations where a person is unable to fulfill his or her obligations as they fall due. From this broad point of view, new organizations established on the basis of technological developments, such as DAOs, can be equally insolvent and should be subject to insolvency procedures. It is possible that these organizations can include rules applicable to insolvency, which would simplify the liquidation and distribution of losses among participants. However, if tokens are involved in a bankruptcy proceeding before a bankruptcy court, applicable rules would be the same as for a nondigital organization. For courts, the main challenge would be the classification of the token in recovery actions. For instance, if the token is deemed as currency, the recovery could equal the amount transferred, but if it is deemed as a commodity, a set of options would be available, such as the return of the tokens or the recovery of the value of the property at the time of the transfer.²⁹

The main insolvency problems relate to the legal position of the token holders. Since tokens could incorporate different rights, the token holders’ position depends on the incorporated rights. For instance, security tokens could be treated in the same way as shares in the insolvency of the organization, or security

²⁷ SEC Release No. 81207, “Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO” (July 25, 2017), <https://www.sec.gov/litigation/investreport/34-81207.pdf>.

²⁸ Not all legal systems include or classify insolvency as an area of commercial law.

²⁹ *In re Hashfast Techs, LLC*, No. 14-30725 (Bankr. N.D. Cal. Feb. 2, 2016).

tokens giving rights to a stream of cash could be treated like bonds, allowing the holders to submit their claims in an insolvency process. However, the position of utility token and cryptocurrency holders is less clear. Some court cases have analyzed the claims token holders in the event of the insolvency of intermediaries or custodians (so-called “wallet providers”). The critical question is whether the users have a right to recover their tokens (that is, a real or in rem right) or if they just have a credit right (that is, a personal right to receive the value of the tokens they deposited). This is a traditional problem in relations between banks, securities intermediaries, and clients. In the event of insolvency, the distinction between in rem and personal rights is crucial. If the relationship between the token holder and the intermediary is merely personal, the holder only has an unsecured claim in the insolvency of the intermediary. In this regard, courts are taking different approaches.³⁰ A basic legal rule establishing the legal nature of crypto assets, at least as assets that can be owned and transferred according to legal requirements, is necessary for the protection of users in the context of insolvency and in the development of markets.

Utility tokens also need to be analyzed in the insolvency context. A utility token can grant the holder any kind of right over an asset or a right to receive a service. If a token includes the right to receive a service, it could be affected by the insolvency of the issuer in the same way as any other contractual relationship (for instance, a right to use a computer network). In practice, if the contract cannot be performed due to the insolvency of the issuer, the holder will have a claim for damages. For tokens that provide a right over assets, there may be multiple situations. Because there is no immediate connection between the token and physical assets, this may impede the user’s ability to assert a right in rem over the asset, unless there is a specific legal rule to that effect. Otherwise, users of the tokens have only a personal right against the issuer, even in cases where tokens identify specific assets. In the case that a real right could be asserted, token holders would have to share *pari passu* if assets are commingled and cannot be matched with individual tokens.

Innovations in secured transactions can also impact insolvency regimes. The possibility of using IoT technology for collateral location and tracing can increase the appeal of secured financing. However, this will also increase the need to resolve conflicts within insolvency among creditors with different claims over the collateral, for instance, a secured creditor with a claim over raw materials and the claim of another creditor who has provided additional materials or services to transform those materials. It is also necessary to resolve the conflicts between traditional security interests and the rights of token holders over assets that are subject to a security interest.

³⁰ In the Japanese case of the *Mt. Gox* bankruptcy, the court held that the holders of Bitcoins deposited in Mt. Gox, a Bitcoin exchange, could only claim a personal right and were not entitled to receive Bitcoins, which are not a physical asset (see https://www.law.ox.ac.uk/sites/files/oxlaw/mtgox_judgment_final.pdf), while in the New Zealand case of *Roscoe v. Cryptopia, Ltd.* (in liquidation) [2020] NZHC 728, the court held that cryptocurrencies are property and therefore that the exchange was a trustee for the token held in its platform. In a recent Canadian case (see *Re Quadriga Fintech Solutions Corp et al.* (1 March 2021), Toronto CV-19-627184-00CL (31-2560674), CV-19-627185-00CL (31-2560984), and CV-19-627186-00CL (31-2560986) (Ont Sup Ct [Comm List])), the court considered that cryptocurrencies are property, but claims denominated in cryptocurrency needed to be converted to Canadian dollars.

VI. Conclusion: A Preliminary Agenda for Legal Change

The relationship between technology, business practices, and the law is complex. In the course of history, major technological and economic revolutions have been supported by the evolution of commercial law, which provides enabling frameworks for the conduct of new business activities and resolves conflicts associated with them.

The “fintech revolution” interacts with the fundamental areas of commercial law. Rapid and massive technological changes have led to the emergence and growth of new business models, activities, and market participants as well as to the adaptation of new technologies by traditional market participants. While the coverage of commercial law varies among legal systems, key areas, such as registries, contracts, securities, and documents of title, secured transactions, company law, and insolvency, are all connected to these sweeping changes. In particular, as highlighted by this note, DLT raises multiple issues in its connection with commercial law and involves new concepts of digital registries, smart contracts, and new forms of digital property (tokens), and even new forms of organization (for example, DAO). It should be recognized that fintech covers a broad array of technological advances that affect legal areas beyond commercial law, which requires careful analysis.

Commercial law needs to keep pace with technological developments. In most legal systems, the application of new technologies to business practices and new entities is operating nationally and internationally in a legal vacuum. This creates legal uncertainty and generates unacceptable levels of risk for consumers and investors, which, in turn, could lead to risks for financial stability. Predictable, clear, and technology-neutral legal rules are crucial for the conduct of new business activities, enabling countries, irrespective of their current levels of economic development, to reap the benefits of transformative changes in finance and business while mitigating risks.

A legal agenda could be considered to accommodate the use of new technologies. This agenda, focusing on commercial law, should leverage ongoing national reform efforts, the work of international organizations, collaboration with the private sector, and international cooperation, given the cross-border use of many of the new technologies. Since sound legal frameworks contribute to economic growth and financial stability, the IMF has an important role to play in assisting countries to develop this agenda in close collaboration with all stakeholders. This agenda, which will require significant analysis and careful policy consideration, should be guided by the following overarching principles:

- *Legal certainty*: In the face of sweeping technological changes, legal certainty must be the paramount objective to allow the development of business models with the proper protection of all participants.
- *Technology neutrality*: Legal regimes should not favor a specific technology and prevent the development of a new technology. While maintaining an open door to the adoption of new technologies, authorities need to monitor technological developments and assess the underlying legal issues of such technological developments.
- *Targeted legal intervention*: A complete overhaul of the legal system is not necessary or desirable. Amendments to laws should be selective, targeting issues where there is friction between the law and new technologies.
- *Cross-border regulation*: Effective regulation would need to consider the cross-border operation of new technologies and the need for collaboration across jurisdictions.

In particular, the agenda should at least address the following issues:

- Introduce clear and comprehensive definitions and functions of new digital technologies such as DLT, smart contracts, and tokens.
- Recognize the legal value of the use of new digital technologies. This requires rules recognizing the validity of transfers in DLT, the use of DLT as evidence, as well as the support of laws for the enforcement of legal entitlements derived from DLT. The issues of errors and fraud in transfers, as well as remedies in cases of unlawful transfers, also need to be addressed.
- Recognize the use of smart contracts and automated contracting, resolving issues of attribution of responsibility, performance, and enforcement, among others.
- Establish a clear definition of security tokens to provide legal certainty in the development of economic activities.
- Enact rules that establish connection mechanisms between tokens and physical reality to ensure that tokens confer reliable and enforceable rights.
- Enabling the use of tokens as shares in companies could be the first step for the possibility of creating DAOs.
- The law of secured transactions can incorporate the use of technologies derived from the IoT, increasing access to credit and the enforceability of secured loans.
- Developments in insolvency will depend on innovation in all the other areas of commercial law. Defining the position of token holders in insolvency is essential for providing legal certainty to participants in new business models.

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