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BLOCKCHAIN AND SMART CONTRACTS

WHAT CHANGES LIE AHEAD FOR BANKING AND FINANCIAL LAW?

di Lucio Casalini*

Banking and Financial Law are radically changing thanks to new technologies. In this paper, I try to offer a definition of blockchain and smart contracts, looking at the main features of these new tools and analyzing the recent action by the Italian legislator in order to define and regulate these new technologies, in the European context of reference.

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1. Introduction

Banking and Financial Law are radically changing thanks to new technologies. Technological innovations continue to have a strong impact, not only on the society and economy in general, but also on the legal and financial world[1].
States are challenged to regulate technological innovations quickly and efficiently. This is not an easy task, considering the fact that technologies develop fast and they don't suffer the role of the State regulation, but they themselves want to govern the dynamics and relationships between subjects.
Big data, cloud computing, robotics, artificial intelligence and machine learning systems, are just some examples of this ongoing revolution. In the field of banking and finance law, the distributed ledger technologies represents the real innovation. *Blockchain* is certainly the best example and *smart contracts* are a particular *blockchain* application to manage automated exchanges, for commercial agreements, with increasingly reduced transaction costs.
In this paper, I try to offer a definition of *blockchain* and *smart contracts*, looking at the main features of these new tools. Then, I analyze the recent action by the Italian legislator in order to define and regulate these new technologies.

2. European frame and Italian law

The first question is whether the new technologies are subject to the regulatory framework already in force in financial matters inside the European context. Indeed, the European Securities and Market Authority (ESMA[2]) has stated that the Distributed Ledger Technologies cannot constitute a pretext for not respecting the sector regulations to safeguard the proper functioning of the financial market.
Market operators wishing to invest in these technologies must comply with the current regulatory framework, although this has been created before the development of the *blockchain* and its applications[3]. As indicated by ESMA, at European level the number of directives and regulations is large and includes, for instance, CSDR Regulation (Reg. UE 909/2014) and MiFID II Directive (Dir. 2014/65/UE). According to ESMA, it is still early to issue regulatory measures

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[1] First analyzes from J.L. BOWER, C.M. CHRISTENSEN, *Disruptive Technologies: Catching the Wave*, in *Harvard Business Review*, 1995, 43 ss. Also recommended L. Lessig, *Code and Other Laws of Cyberspace. Version 2.0*, Basic Books, 2006.

[2] ESMA is an independent EU Authority that contributes to safeguarding the stability of the European Union's financial system by enhancing the protection of investors and promoting stable and orderly financial markets. ESMA achieves its mission and objectives through four activities: i) assessing risks to investors, markets and financial stability; ii) completing a single rulebook for EU financial markets; iii) promoting supervisory convergence; iv) directly supervising specific financial entities. More information at https://www.esma.europa.eu

[3] ESMA, *The Distributed Ledger Technology Applied to Securities Markets*, ESMA 50-1121423017-285, 2017, available at https://www.esma.europa.eu/sites/default/files/library/dlt_report_-_esma50-1121423017-285.pdf.

in this initial phase, not being able to fully forecast the benefits and risks about these new technologies.
However if the European legislator has taken a position of prudent expectation, the Italian one, among the first European Countries, has tried to legislate *in subjecta materia*.
The effort of the interpreter to frame, in traditional juridical categories, what emerges from the powerful technological advances in the modern social context is not easy and clashes, first of all, with linguistic problems.
The Italian legislator usually looks at the general discipline of contract and transcription, but in this new context he needs to use a different technical language, characterized by *anglicisms* and sophisticated programming alphabet. In other words, a valid and effective legislative definition of *blockchain* and *smart contract* cannot be configured without knowledge about computer and engineering sciences. The full comprehension, in order to govern and facilitate their enormous potential, needs the analysis of their internal processes.
The decree law n. 135/2018, so-called "Simplifications Decree", converted with law n. 12/2019 on 11th February 2019[4], in an attempt to offer a first shy definition of *blockchain* and *smart contract*, makes these semantic problems plastically clear.
Paragraph 1 of art. 8-ter defines the *blockchain* (literally "chain of blocks") as «the technologies and computer protocols that use a shared, distributed, replicable register, accessible simultaneously, architecturally decentralized on cryptographic basis, such as to allow registration, validation, updating and archiving of data both in clear and further protected by cryptography, verifiable by each participant, not alterable and not modifiable».
The following paragraph 2 of the same art. 8-ter offers a definition of *smart contract*, such as «a computer program that operates on blockchain technologies and whose execution automatically binds two or more parts on the basis of predefined effects».
Prima facie, from the combination of these two paragraphs, the connection between the two technologies is clear and in particular the relationship of close dependence of *smart contracts* on the *blockchain*, so that the former can work. Certainly, it is not easy to define these technologies, but suddenly we notice that smart contracts are not contracts, or agreements, but rather «a computer program», a software for the correct use of *blockchain*.[5] Nevertheless, the first legislative definition was widely desired and expected. The legislator's trouble in regulating such phenomena and the difficulties of the interpreters to bring it into the traditional categories is well known.

3. Defining *Blockchain* and *Smart Contracts*

[4] No surprise for the choice of *sedes materiae:* the inclusion of these rules in a provision that aims to simplify and de-bureaucratize the Country.
[5] As noted J.I.H. HSIAO, *Smart Contract on the Blockchain. Paradigm Shift for Contract Law*, in *US-China Law Review*, p. 694: «Smart Contract is based on a binary logic that does not appear in all real-life contract cases».

The application of technological innovations to financial processes and products impacts economic structures, such as markets and financial intermediaries. For instance, we can see the creation of new services and new opportunities for subjects previously excluded from the financial markets, as well as a possible change in the relationship between customers and operators offering financial services, due to the multiplication of the channels of direct brokerage[6].
We are in the FinTech world (Finance and Technology)[7], where the potentialities offered by the applications of the *distributed ledger technologies* (DLTs), among which the best known is the *blockchain*, are particularly important[8]. Moreover, it is thanks to the *blockchain* that the transition from the "information society" - which allowed the exchange of information on the basis of the TCP / IP protocol - to the "value society" - based on value transfers through DLTs – to be possible. In other words, the *blockchain* is driving the transition from the "Internet of Information" to the "Internet of Value", in which every type of asset - not just money, but also real estate and mobile, as well as intellectual property - can be stored , transferred and managed in a decentralized manner, or without intermediaries[9].
So, first of all, we must try to understand what *blockchain* and *smart contracts* are and their main features. The first one could be defined as a technology that allows the creation and management of a considerable distributed database for the execution of transactions that can be shared between multiple nodes of a **network**. In other words, it is a database structured in blocks which, in turn, contain multiple transactions.
Each block consists of very high-capacity computational machines that are rewarded for solving a mathematical problem by paying a sum paid in crypto money. The resolution of the problem represents the requirement for the validation of the transaction that you want to insert in the *blockchain*. The blocks are connected to each other in a network so that each transaction initiated must

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[6] G. D'AGOSTINO, P. MANUFÒ (a cura di), *Prefazione alla collana dedicata al FinTech*, CONSOB, 2018, p. VI; C. SCHENA, A. TANDA, C. ARLOTTA, G. POTENZA, *Opportunità e rischi per l'industria finanziaria nell'era digitale*, CONSOB, 2018, p. 8.

[7] As explained in D.W. ARNER, J. BARBERIS, R.P. BUCKLEY, *The Evolution of Fintech: New Post-Crisis Paradigm*, in *Georgetown Journal of International Law*, 47, 2016, p. 1271, «The interlinkage of finance and technology has a long history and has evolved over three distinct eras. FinTech 1.0, from 1866 to 1987, was the first period of financial globalization supported by technological infrastructure such as transatlantic transmission cables. This was followed by FinTech 2.0, from 1987-2008, during which financial services firms increasingly digitized their processes. Since 2008 a new era of FinTech has emerged in both the developed and developing world. This era is defined not by the financial products or services delivered but by who delivers them. This latest evolution of FinTech, led by start-ups, poses challenges for regulators and market participants alike, particularly in balancing the potential benefits of innovation with the possible risks of new approaches».

[8] M. CAVALLO, M.L. MONTAGANI, *L'industria finanziaria tra fintech e techfin: prime riflessioni su blockchain e smart contract*, in *La rivoluzione digitale nei servizi finanziari tra innovazione, diritti e concorrenza*, Zanichelli, 2019

[9] A. TAPSCOTT, D. TAPSCOTT, *Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World*, Penguin Books, 2016

be validated through the resolution of a rather complex mathematical algorithm by the other blocks.
In this way, *blockchain* is made up of a chain of blocks each containing multiple transactions. The solution for all transactions is entrusted to the nodes, which must control and approve all transactions by creating a network that shares the archive of the entire *blockchain* and therefore of all blocks with all transactions. Each block is an archive for all transactions, including the previous ones, which cannot be modified except with the approval of the network nodes.
Thus, transactions are **unchangeable**. It can also be stated that the *blockchain* is a **distributed and decentralized database**, as it is not a single individual who can claim exclusive rights, because the *blockchain* is spread all over the world. Each member of the *blockchain* has access to the entire reference database and its complete chronology, but nobody can control data or information. Finally, each party can carefully check the registers of the other transactional parts, **without an intermediary**.
Instead, *smart contracts* are computerized transaction protocols that automatically execute the terms of a contract. In other words, they are agreements translated into computer *code* that exploit the decentralized register system - *blockchain* - for the management of trade or other relationships[10].
Therefore, a smart contract does not correspond to a contract in legal terms[11], rather to the software (or information protocol) developed for the execution of the contract. Essentially, once the parties agree the terms and conditions of the contract, these are written in the form of code and added as a block in the *blockchain*, thus becoming verifiable, immutable and irrevocable. When the terms set in the agreement are satisfy (according to the logic *if-then*), the smart contract is executed automatically, through the transfer of tokens mutually accepted by the parties as part of the exchange[12].
Finally, smart contract is a computerized transaction protocol that executes the terms of a contract. The general objectives of smart contract design are to satisfy common contractual conditions (such as payment terms, liens, confidentiality, and even enforcement), minimize exceptions both malicious and accidental, and minimize the need for trusted intermediaries. Related economic goals include lowering fraud loss, arbitration and enforcement costs, and other transaction costs[13].
Many criticisms have been raised against *smart contracts*. Some authors exclude the possibility that *smart contracts* are considered contracts, or that they can be

[10] N. SZABO, *Smart contract*, 1994, available at http://www.fon.hum.uva.nl
[11] For the Italian Civil Code, art. 1321, «*contract is the agreement of two or more parties to establish, regulate or extinguish a patrimonial legal relationship among them*» (translation is mine). Contract Law can be classified, as usual in Civil Law systems, as part of a general law of obligations, in particular as a source.
[12] R. O'SHIELDS, *Smart contract: Legal Agreements for the Blockchain*, in *North Carolina Banking Institute Journal*, 2017, p. 177 ss.
[13] N. SZABO, *Smart contract*, op. cit., in which the author define smart contract and features in this way.

substituted or replaced[14]. Other authors point to the very high costs of these new technologies[15].
However, the limits must not minimize the potential offered by smart contracts, which remain very promising, especially in a context where the main activities are mathematically representable, such as banking and financial activities.

4. The main features of these new technologies

There are other important features, well described by the *Harvard Business Review*[16], with interesting analysis on the subject, especially from U.S. specialized literature.
Below are the main points of interest[17]:
- Peer-to-peer transmission in the absence of intermediaries. There are no intermediaries and the transaction takes place from individual to individual[18], that is directly between the parties instead of through a central node. Each node stores and forwards the information to all other nodes. There are no intermediaries, central authorities, bureaucracy, an active and regulatory role for States or administrations set up for this purpose.
- Transparency and identity. Transactions take place through alphanumeric addresses and the holder can choose whether to remain anonymous or reveal his identity.
- Irreversibility of recorded transactions. Once a transaction is entered into the database and the accounts are updated, the transaction log cannot be changed since it is linked to each previous transaction log. The complexity of the algorithms and the computational technique have the objective to guarantee that the registration in the database is chronologically ordered, permanent and available for all the other users in the network. Cyber-attacks are substantially

[14] «Smart contract are neither extremely smart nor contracts», in G. Hileman, M. Rauchs, *Global blockchain benchmarking study*, in *Cambridge Centre for Alternative Finance*, 2017, p. 57.
[15] J.M. SKLAROFF, *Smart contract and the Cost of Inflexibility*, in *University of Pennsylvania Law Review*, 2017, p. 262 ss.: «Technology cannot replace what is fundamentally a human activity. Smart contracting certainly proposes exciting new changes to the way transactions might take place [...]. But a full-scale smart contracting revolution would introduce costs to be more extreme and intractable than the ones it seeks to solve».
[16] M. IANSITI, K.R. LAKHANI, *The truth about Blockchain*, Harvard Business Review (January - February 2017)
[17] S. MORABITO, *L'applicabilità della blockchain nel diritto dell'arte*, available at www.businessjus.com/wp-content/uploads/2018/09/180912-Lapplicabilità-della-blockchain-nel-diritto-dellarte.pdf
[18] Here is the reason why it is called peer-to-peer (P2P): peer-to-peer computing or networking is a distributed application architecture that partitions tasks or workloads between peers. Peers are equally privileged, equipotent participants in the application. They are said to form a peer-to-peer network of nodes. On this point see K. FANNING, D.P. CENTERS, *Blockchain and its coming impact on financial services*, in *Journal of Corporate Accounting & Finance*, 2016, p. 53 ss.

prevented because, in order to change a single data, it would be necessary to change the entire *chain* of transactions distributed through the network.
- **Computational logic**. The main features of the blockchain allow users to configure algorithms and rules that automatically activate operations between nodes. *Ethereum* is one of the main example of computational logics, used mostly for the realization of *smart contracts*[19].

5. Conclusion

As of today, there are advantages and risks connected to the adoption of the *blockchain* and *smart contracts* in the financial sector. Reliability, efficiency and safety make *blockchain* technology very promising in the financial sector[20]. The decentralization and impossibility to modify what has been previously recorded to avoid errors and manipulation increases not only the security of the network but also the reliability of the information recorded.
Finally, although all the transactions are transparent and the time in which they were carried out is certain, the *blockchain* does not require users to register and an *ex-ante* control, thus offering a high level of anonymity[21]. In the future, it will be interesting to observe and analyze the function of intermediation based on a trust relationship. One of the most important observations will be to see if the conclusion of financial transactions will continue to require the interposition of a financial intermediary that guarantees the reliability of the system, or if marketplaces and technology will be sufficient enough to put customers in direct contact with each other and allow them to satisfy their interests (disintermediation).
Without becoming prematurely enthusiastic, one must be cautious and observe these technological developments closely. In particular, it is fundamental to observe the decisions about the regulations that will be taken in Europe and the consequences, at the application level, of the measures already adopted in Italy.

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[19] *Ethereum Blockchain* is composed of multiple nodes. Each machine connected to the *blockchain* contains an exact copy of all the blocks, from the first to the last created, so everyone has the exact replica of the entire updated *blockchain*. *Ethereum blockchain* is characterized by the possibility of creating *Smart Contracts*. They are digital contracts that developers can program and publish on the *Ethereum* network. After publication, a *smart contract* can no longer be changed and its code remains unchanging, guaranteeing security in its execution and on the results it produces. This immutability opens up many uses of smart contracts to make agreements between companies and individuals more transparent and secure, especially in the case of supply chains. Each write operation requires a cryptocurrency cost to avoid congesting the network. However, a decentralized and distributed structure like this, in which everyone has the exact copy of the data, from the first to the last block, leaves open several legal questions.
[20] R.T. SVIKHART, *Blockchain's Big Hurdle*, in *Stanford Law Review Online*, 2017, p. 100 ss. For the technical aspects of the *blockchain* see also M. SWAN, *Blockchain: Blueprint for a New Economy*, O'Reilly Media, 2015.
[21] P. CUCCURU, *Blockchain ed automazione contrattuale. Riflessioni sugli smart contract*, in *La Nuova Giurisprudenza Civile Commentata*, 2017, p. 107 ss.