A Digital Revolution in International Trade? The International Legal Framework for Blockchain Technologies, Virtual Currencies and Smart Contracts: Challenges and Opportunities

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A. Introduction and definition of the key notions

This work investigates the legal dimension of the ongoing "blockchain revolution"[1]. In particular, it tries to understand to what extent this potentially breakthrough technology also implies a legal revolution: do blockchain technologies, virtual currencies and smart contracts require new legal avenues to be developed, or is it instead appropriate to simply adapt existing legal categories to the new reality? In either case, how are and should they be regulated?

A specific object of inquiry in this regard is the role of Uncitral and its potentially crucial contribution it can provide to the creation of a worldwide legal environment that is suitable for the development of blockchain-based applications, contracts, businesses, and so forth.

After drawing a background picture of how such innovations could revolutionize the world of international trade (B.), the article gives an overview of the state of the art of the legal context in which they have currently been framed (C.), then moving on to focus on the specific issue of how Uncitral could helpfully intervene in their development (D.). Finally, some conclusive remarks are offered (E.).

Before starting the actual analysis, though, I believe it is necessary to devote some space to defining the most relevant notions used in this work, i.e. virtual currencies, Blockchain and distributed ledger technology, and (decentralized) smart contracts.

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[1] For a definition and explanation of the term 'blockchain', *see* slightly below in the body of the article.

Virtual Currencies

Even if a universally-accepted definition is missing, the so-called virtual currencies (often also referred to as cryptocurrencies[2]) have recently been defined:

- by the International Monetary Fund, as "digital representations of value, issued by private developers and denominated in their own unit of account"[3];

- by the European Central Bank, as "a digital representation of value, not issued by a central bank, credit institution or e-money institution, which, in some circumstances, can be used as an alternative to money"[4] and "a digital representation of value that is neither issued by a central bank or a public authority, nor attached to a legally established currency, which does not possess the legal status of currency or money, but is accepted by natural or legal persons, as a means of exchange and possibly also for other purposes, which can be transferred, stored or traded electronically"[5];

- by other European Union institutions, as "a digital representation of value that is neither issued by a central bank or a public authority, nor necessarily attached to a fiat currency, but is accepted by natural or legal persons as a means of payment and can be transferred, stored or traded electronically"[6];

- by the Financial Action Task Force (FAFT), as "digital representation of value that can be digitally traded and functions as (1) a medium of exchange; and/or (2) a unit of account; and/or (3) a store of value, but does not have legal tender status (i.e., when tendered to a creditor, is a valid and legal offer of payment) in any jurisdiction. It is not issued nor guaranteed by any jurisdiction, and fulfils the above functions only by agreement within the community of users of the virtual currency"[7];

- by the Superintendent of Financial Services of the State of New York, as "any type of digital unit that is used as a medium of exchange or a form of digitally stored value. Virtual currency shall be broadly construed to include digital units of

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[2] A brief note on terminology is needed: both "virtual" and "crypto" currencies are "digital currencies"; in fact, as the Financial Action Task Force (FATF) clarified: "Digital currency can mean a digital representation of either virtual currency (non-fiat) or e-money (fiat) and thus is often used interchangeably with the term 'virtual currency'" (*See* FATF, *Virtual Currencies Key Definitions and Potential AML/CFT Risks*, FATF REPORT, June 2014, p. 4). The difference between the two is that (only) the latter is a virtual currency in which the relevant information is carried with encryption protection. However, the terms are often used as synonyms.

[3] IMF, *Virtual Currencies and Beyond: Initial Considerations*, IMF Staff Discussion Note – SDN/16/03, January 2016, p. 7.

[4] ECB, *Virtual currency schemes – a further analysis*, 2015, p. 33.

[5] *Opinion of the European Central Bank of 12 October 2016 on a proposal for a directive of the European Parliament and of the Council amending Directive (EU) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing and amending Directive 2009/101/EC*, (CON/2016/49), p. 7.

[6] *Proposal for a Directive of the European Parliament and of the Council amending Directive (EU) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing and amending Directive 2009/101/EC* - 2016/0208 (COD).

[7] FATF, *Virtual Currencies Key Definitions and Potential AML/CFT Risks*, FATF REPORT, June 2014, p. 4.

exchange that: have a centralized repository or administrator; are decentralized and have no centralized repository or administrator; or may be created or obtained by computing or manufacturing effort"[8].

The most prominent example of such currencies is most certainly the Bitcoin[9], that legal scholarship has started to carefully investigate[10].

Blockchain and distributed ledger[11] technology

An arguably appropriate definition, provided by the ECB, describes the blockchain as "the ledger (book of records) of all transactions, grouped in blocks, made with a (decentralised) virtual currency scheme"[12].

Virtual currencies are usually (and Bitcoin is the first example) based on the distributed ledger technology (DLT)[13], i.e. a technology that, through computing and cryptography, has made possible to keep and validate multiple copies of a central ledger (a sort of distributed database) across an IT network; each ledger keeps a copy of the digital database of all the transactions ever happened (a transactions record), which is formed by a lot of blocks of encrypted electronic records, linked together and disseminated through a dense IT peer-to-peer network.

Anyone can check the database, but no one is able to modify it; thus, "this technology, in principle, enables a decentralised, rapid, resilient and rather secure means of recording any sort of transaction together with the history of previous transactions in a 'distributed ledger'". This scheme, originated with Bitcoin[14], commonly known as "blockchain technology", is often based on open source software, publicly available. To sum up, "a block chain is a type of database that takes a number of records and puts them in a block (rather like collating them on to a single sheet of paper). Each block is then 'chained' to the next block, using a

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[8] But: "Virtual currency shall not be construed to include any of the following: (1) digital units that:
(i) are used solely within online gaming platforms; (ii) have no market or application outside of those gaming platforms; (iii) cannot be converted into, or redeemed for, fiat currency or virtual currency; and (iv) may or may not be redeemable for real-world goods, services, discounts, or purchases; (2) digital units that can be redeemed for goods, services, discounts, or purchases as part of a customer affinity or rewards program with the issuer and/or other designated merchants or can be redeemed for digital units in another customer affinity or rewards program, but cannot be converted into, or redeemed for, fiat currency or virtual currency; or (3) digital units used as part of prepaid cards": 23 CRR-NY 200.2 NY-CRR, Official Compilation of Codes, Rules and Regulations of the State of New York.

[9] Launched in 2008 by Nakamoto: Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*, (2008); for useful background materials, *see also* http://www.projectbitcoin.com/ and https://bitcoin.org/en/.

[10] To be sure, literature exists mostly on smart contracts: *see below*, note 17.

[11] Another brief note on terminology is needed here: the terms blockchain (or block chain) and distributed/shared ledger are often used interchangeably.

[12] ECB, *Virtual currency schemes – a further analysis*, 2015, p. 33.

[13] BIS, *CPMI report on digital currencies*, November 2015, pp. 5 ff.; *available at* http://www.bis.org/cpmi/publ/d137.pdf; *see also* IMF, *Virtual Currencies and Beyond: Initial Considerations*, IMF Staff Discussion Note – SDN/16/03, January 2016, pp. 18 ff.

[14] *See* Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System* (2008).

cryptographic signature. This allows block chains to be used like a ledger, which can be shared and corroborated by anyone with the appropriate permissions"[15].

The importance of blockchain technologies has been underlined also by the IMF, that recognizing the possible benefits of virtual currencies (i.e. increasing speed and efficiency in making payments and transfers), stated: "the distributed ledger technology underlying some VC schemes offers benefits that go well beyond VCs themselves"[16].

(Decentralized) smart contracts[17]

Already more than 20 years ago, Szabo defined smart contracts as "*a computerized protocol that executes the terms of a contract*"[18]; in other words, a smart contract is a contract written in computer language which is automatically executed by a machine.

Therefore, by applying the blockchain technology to smart contracts, they would be not only self-executing and self-enforcing, without any need for intermediaries but, in addition, every transaction would be automatically recorded in the distributed database. Thus, blockchain-based smart contracts[19] may be referred to as "decentralized smart contracts", given the absence of a central database/register.

B. International Trade: Virtual Currencies, Smart Contracts and Blockchain

International trade might be severely affected by such new technologies for a number of reasons: firstly, a lot of companies are starting to accept payments in

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[15] *Distributed Ledger Technology: beyond block chain*, a report by the UK Government Chief Scientific Adviser, 2016, p. 17.

[16] *Virtual Currencies and Beyond: Initial Considerations*, IMF Staff Discussion Note – SDN/16/03, January 2016, p. 35.

[17] *See* Perugini, M. L. & Dal Checco, P., *Smart Contracts: A Preliminary Evaluation*, December 2015. *Available at*: https://ssrn.com/abstract=2729548; Raskin, Max, *The Law of Smart Contracts*, (September 22, 2016), Georgetown Technology Review, Forthcoming. *Available at*: https://ssrn.com/abstract=2842258; Savelyev, A., *Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law*, Higher School of Economics Research Paper No. WP BRP 71/LAW/2016, 2016. *Available at* SSRN: https://ssrn.com/abstract=2885241.

[18] Szabo, N., *Smart Contracts*, 1994, unpublished (the original document is unavailable on the Author's website, but the definition was referred to in other later publications); Szabo, N., *Formalizing and Securing Relationships on Public Networks*, First Monday, [S.l.], 1997. *Available at*: http://ojphi.org/ojs/index.php/fm/article/view/548/469; Szabo, N., The *Idea of Smart Contracts*, 1997; *available at*: http://szabo.best.vwh.net/idea.html; Szabo, N., Secure *Property Titles with Owner Authority*, 1998; *see also* Mark S. Miller, *Computer Security as the Future of Law*, 1997. *Available at* http://www.caplet.com/security/futurelaw/.

[19] It is worth pointing out that the notion of 'smart contracts' could encompass any automatically-executed machine-based agreement (such as purchasing a snack from a vending machine), whereas blockchain-based smart contracts are a much narrower notion (some analogies between the two might still be usefully applied, as will be pointed out in Part D.).

Bitcoin (and other virtual currencies) all over the world[20]; secondly, blockchain technologies may allow significant cost savings[21], and potential applications to everyday business are on their way[22]; lastly, what if instead of paper contracts, some businesses started to use smart contracts[23]?

Moreover, what appears to be more appealing is that smart contracts are automatically enforced without any need for a third party[24]; the reduction of transaction and litigation costs for undertakings may be massive.

In other words, while traditional currencies require a central system of administration/central registry, virtual currencies do not, being decentralized by nature and self-executed by a software[25]. The same may be said with regard to smart contracts: if they are self-executed, there is no need for a central third party (*i.e.* judges, arbitrators) to administer them: there is (at least in theory[26]) no way of breaching them[27].

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[20] *E.g.* EY Switzerland: http://www.ey.com/Publication/vwLUAssets/ey-news-release-switzerland-accepts-bitcoins-for-payment-of-its-services/$FILE/ey-news-release-switzerland-accepts-bitcoins-for-payment-of-its-services.pdf.

[21] Investigating the possible advantages of the technology goes far beyond the purposes of this paper; I will just observe that businesses may consider adopting this technology for many different reasons (*e.g.* immutability, digitization, automation, paperless processes, rapidity, absence of middle-man, etc.).

[22] *See e.g.* the R3 project: "R3 is a financial innovation firm that leads a consortium partnership with over 50 of the world's leading financial institutions. We work together to design and deliver advanced distributed ledger technologies to the global financial markets" (http://www.r3cev.com/about/). In addition, as mentioned below in the article, the first blockchain-related patents are being filed.

[23] The advantages and disadvantages of using smart contracts instead of a traditional paper contract should be evaluated on a case by case analysis, keeping in mind the objectives of each single agreement and the peculiarity of the situation. In any case, it has been observed that "it is quite possible to expect that at some moment of time Smart contracts will become routine technology, like Internet itself in 90s years of the last century" (Savelyev, A., *Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law*, Higher School of Economics Research Paper No. WP BRP 71/LAW/2016, 2016, p. 20).

[24] Savelyev, A., *Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law*, Higher School of Economics Research Paper No. WP BRP 71/LAW/2016, 2016, p. 18: "There is no need to seek for enforcement of Smart contract by addressing the claims to third party – judiciary or other enforcement agency. And it is one of the main "selling points" of this contractual form".

[25] IMF, *Virtual Currencies and Beyond: Initial Considerations*, IMF Staff Discussion Note – SDN/16/03, January 2016, p. 6.

[26] But, in practice, huge scandals have already made the deadlines, such as the "DAO case", speaking of which it has been said that "to date, the largest application of this kind of thinking has been the creation of a decentralized autonomous organization or DAO in 2016. The idea was to create an investing entity that would not be controlled by any one individual, but by shareholders voting based on their stakes on a blockchain. The entity was funded with $150 million. Soon after this money was raised, about $40 million of those funds were diverted from the organization, using part of the code that no one had anticipated" (Raskin, M., *The Law of Smart Contracts*, (September 22, 2016), Georgetown Technology Review, Forthcoming. *Available at*: https://ssrn.com/abstract=2842258, p. 36) and that "recent example with the hack attack on Ethereum DAO in June 2016 shows that certain mechanism of reaching a consensus between the parties to Smart contract on certain unexpected (non-programed) events is necessary" (Savelyev,

We can imagine a scenario in which two enterprises, through a (decentralized) smart contract, define and regulate their business relations and payment obligations so that they are automatically executed via Bitcoin. Platforms to draft and use smart contracts in everyday life already exist; the best-known example is Ethereum, "a decentralized platform that runs smart contracts: applications that run exactly as programmed without any possibility of downtime, censorship, fraud or third party interference. These apps run on a custom built blockchain, an enormously powerful shared global infrastructure that can move value around and represent the ownership of property. This enables developers to create markets, store registries of debts or promises, move funds in accordance with instructions given long in the past (like a will or a futures contract) and many other things that have not been invented yet, all without a middle man or counterparty risk"[28].

Going back to the opening point of this paragraph, it seems rather likely that international trade will be affected by virtual currencies, blockchain technologies and smart contracts. In any case, what is needed is at least a study-and-watch approach[29] to be ready when and if such innovations will come into the game of international trade. A similar position has been expressed, among the others[30], by the Bank for International Settlements, which recognized that "digital currencies and distributed ledgers are an innovation that could have a range of impacts on many areas, especially on payment systems and services. These impacts could include the disruption of existing business models and systems, as well as the emergence of new financial, economic and social interactions and linkages"[31] and concluded by saying that "central banks could consider – as a potential policy response to these developments – investigating the potential uses of distributed ledgers in payment systems or other types of FMIs"[32]. The same applies to authorities, institutions, and more generally to States' Legislatures. The IMF for instance has even proposed some principles which could guide national authorities in further developing their regulatory responses to virtual currencies[33].

A., *Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law*, Higher School of Economics Research Paper No. WP BRP 71/LAW/2016, 2016, pp. 22-23).

[27] Savelyev, A., *Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law*, Higher School of Economics Research Paper No. WP BRP 71/LAW/2016, 2016, p. 18: "*Smart contract cannot be breached by a party to it*".

[28] https://www.ethereum.org/.

[29] The same approach has been adopted by the ECB; see *Virtual currency schemes – a further analysis*, ECB, 2015, p. 33.

[30] *See e.g.* the *Special Address of CFTC Commissioner J. Christopher Giancarlo Before the Depository Trust & Clearing Corporation 2016 Blockchain Symposium* in which it was highlighted "The Need for a "Do No Harm" Regulatory Approach to Distributed Ledger Technology".

[31] BIS, *CPMI report on digital currencies*, November 2015, *available at* http://www.bis.org/cpmi/publ/d137.pdf p. 17.

[32] BIS, *CPMI report on digital currencies*, November 2015, *available at* http://www.bis.org/cpmi/publ/d137.pdf p. 18.

[33] IMF, *Virtual Currencies and Beyond: Initial Considerations*, IMF Staff Discussion Note – SDN/16/03, January 2016, pp. 35 ff.

What is missing, however, are some recommendations on how to take advantages of blockchain in doing business, especially how to accept payment in virtual currencies minimizing legal risks and how to write and use a legally binding smart contracts and what consequences arise from it.

With specific regard to international trade, moreover, it has recently been launched an interesting project called "Incochain", that is to say, incoterms translated into decentralized smart contracts. According to the description of the project, "Incochain is a project that is creating smart contracts for world trade. The combination of existing incoterms, or standardized international commercial terms, smart contracts and blockchain technology is where we are taking the industry - to completely paperless and mobile applications. Be it import or export, air, ocean, rail, or trucking, there is a lot of paperwork. This project clearly defines the obligations and risks of buyers and sellers and offers a dashboard system in a decentralized manner yet it can be utilized cross sector, be it international and maritime law, cargo insurance, banking and accounting, customs and government (including duties and taxes), warehousing, and transportation sectors"[34].

Virtual currencies, blockchain technologies and smart contracts are already being experienced in international trade, even if in their embryonic form. But what about the legal issues they raise?

C. The Current Legal Framework

To be sure, an international legal framework tailored on virtual currencies and blockchain technologies and applications does not exist[35]; however, at national/regional level, some legal systems (*e.g.* the State of New York in the US[36]) have adopted a regulation on the subject matter, while others (*e.g.* the EU[37]) are willing to do that, but currently it is not possible to predict when, if and to what extent such regulations will ever be adopted[38].

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[34] https://hack.ether.camp/public/incochain.

[35] For an exhaustive picture of the current legal framework all over the world, *see* Tasca, P., *Digital Currencies: Principles, Trends, Opportunities, and Risks,* Deutsche Bundesbank and ECUREX Research, ECUREX Research Working Paper, 7th of September 2015 (version: October 2015), pp. 43 ff.

[36] I refer to the Virtual Currencies regulation: *Official Compilation of Codes, Rules and Regulations of the State of New York, Title 23. Financial Services, chapter I. Regulations of the Superintendent of Financial Services, Part 200. Virtual Currencies*. *Available at*: https://govt.westlaw.com/nycrr/Browse/Home/NewYork/NewYorkCodesRulesandRegulations?guid=I7444ce80169611e594630000845b8d3e&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default).

[37] *See* the *Proposal for a Directive of the European Parliament and of the Council amending Directive (EU) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing and amending Directive 2009/101/EC*.

[38] Scheinert, C., *Virtual currencies, Challenges following their introduction*, EPRS | European Parliamentary Research Service, Members' Research Service, PE 579.110, 2016, p.10: "It is too early to assess the possible impact of the forthcoming EU legislation on virtual currencies, but there is little doubt that it will be profound. Whether it will affect the growth of the emerging

This may be due in part to the complexity of these technologies, and mostly to the more general inability of modern States' legislative process to follow the rapid evolution of technology. Moreover, some Institutions/Authorities expressed a fear to stifle innovation, and favoured an approach of precautionary monitoring, rather than pre-emptive regulation[39]. In any case, it shall be pointed out that a trend is emerging: in the US, digital currencies are usually classified as commodities[40], while in the EU[41], at least at national level, they are often classified as units of account[42].

In addition, it has been observed that, even if "there is currently no EU legislation on virtual currencies", this "does not mean they are completely unregulated in Member States. Rather, patchworks of national legislation, compatible to a varying degree, exist in some Member States, while others have no legislation at all", and that "in many Member States, nothing more than a series of opinions and warnings has been issued by central banks or regulators"[43].

With regard to the blockchain, it must be said that, being a (neutral) technology, it seems much more reasonable to wait and regulate the possible uses of it, rather than the technology itself, paying attention, once again, not to stifle innovation. As of today, it seems that no national, regional or international regulation exists. Nonetheless, the topic is clearly under consideration at the legislative/regulatory level: as it has been said, "today is all about blockchain brainstorming"[44].

As regards the need for a specific regulation, it has been noticed that "the growing interest in blockchain technology, independent from a VC scheme, a priori raises

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virtual currency industry, or provide it with a more stable regulatory framework, thus increasing its acceptance as money and eventually allowing it to become mainstream, is an open question".

[39] *See for example* Committee on Economic and Monetary Affairs, *Report on Virtual Currencies*, (2016/2007(INI)), 3.5.2016; the IMF recommended that *"regulatory responses should be commensurate to the risks without stifling innovation"* (IMF, *Virtual Currencies and Beyond: Initial Considerations*, IMF Staff Discussion Note – SDN/16/03, January 2016, p. 35); also the New York Department of Financial Services has clarified that there is a need to "strike an appropriate balance that helps protect consumers and root out illegal activity, without stifling beneficial innovation" (http://www.dfs.ny.gov/about/press/pr1407171.htm); and the UK HM Treasury has stated that: "regulatory requirements must be proportionate to the risk posed, to avoid unnecessarily stifling competition and innovation in a nascent industry" (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/414040/digital_currencies_response_to_call_for_informati on_final_changes.pdf).

[40] *See* CFTC press release at: http://www.cftc.gov/PressRoom/PressReleases/pr7231-15.

[41] *See* the annex to ECB, *Virtual currency schemes – a further analysis*, 2015 pp. 34 ff.

[42] *See* Tasca, P., *Digital Currencies: Principles, Trends, Opportunities, and Risks*, Deutsche Bundesbank and ECUREX Research, ECUREX Research Working Paper, 7th of September 2015 (version: October 2015), p. 56. *See* the annex to ECB, *Virtual currency schemes – a further analysis*, 2015 pp. 34 ff.

[43] Scheinert, C., *Virtual currencies, Challenges following their introduction*, EPRS | European Parliamentary Research Service, Members' Research Service, PE 579.110, 2016, p. 7.

[44] *Digital Transformation in Government and Blockchain Technology*, speech delivered by Minister for Cabinet Office Matt Hancock at D Digital Catapult, Kings Cross, London on the 26th April 2016. *Available at*: https://www.gov.uk/government/speeches/digital-transformation-in-government-and-blockchain-technology.

fewer policy concerns, because the technology would be used in a closed system administered by regulated financial institutions"[45].

However, "bitcoin may have triggered something which goes well beyond virtual currencies. Although the blockchain technology was initially meant to implement Bitcoin's currency business model, it now seems to be emerging as a promising means to achieve a number of other goals. Blockchain technology could find its way into the mainstream financial markets. The technology may be used in a variety of application where data have to be transmitted without risk of corruption. The handicap for Blockchain technology might be that it first appeared in the particularly sensitive and highly regulated field of currencies, having attracted the regulators' attention while still at an immature stage, and with its potential not fully understood"[46].

Therefore, it is indeed possible that a regulation on virtual currencies indirectly provides some rules related to the blockchain technologies, and this may well have negative effects on the blockchain[47]. No doubt that the technology is at the center of the stage (for instance, Bank of America recently filed 15 blockchain-related patents[48]) and, as a consequence, careful steps must be taken.

Speaking of smart contracts, their legal status is totally "unclear"[49], and very little has been written with this regard[50]; I will try to address some potential issues in part D. However, the fact that there is no specific regulation on such issues does clearly not mean that current laws and general principles of law may not be applicable to them, or that they are unregulated at all: virtual currencies may well be considered as any other currency, and/or as means of exchange, while the blockchain and smart contracts are indeed pieces of software[51]. To be sure, in the absence of specific regulations, these technologies must be regulated by existing laws[52].

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[45] IMF, *Virtual Currencies and Beyond: Initial Considerations*, IMF Staff Discussion Note – SDN/16/03, January 2016, p. 24.

[46] Scheinert, C., *Virtual currencies, Challenges following their introduction*, EPRS | European Parliamentary Research Service, Members' Research Service, PE 579.110, 2016, p. 10.

[47] Scheinert, C., *Virtual currencies, Challenges following their introduction*, EPRS | European Parliamentary Research Service, Members' Research Service, PE 579.110, 2016, p. 10, note 7.

[48] Scheinert, C., *Virtual currencies, Challenges following their introduction*, EPRS | European Parliamentary Research Service, Members' Research Service, PE 579.110, 2016, p. 10, note 9.

[49] *Virtual Currencies and Beyond: Initial Considerations*, IMF Staff Discussion Note – SDN/16/03, January 2016, p. 23.

[50] See Perugini, M. L. & Dal Checco, P., *Smart Contracts: A Preliminary Evaluation*, December 2015; Raskin, Max, *The Law of Smart Contracts*, (September 22, 2016), Georgetown Technology Review, Forthcoming. *Available at*: https://ssrn.com/abstract=2842258; Savelyev, A., *Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law*, Higher School of Economics Research Paper No. WP BRP 71/LAW/2016, 2016. *Available at* SSRN: https://ssrn.com/abstract=2885241.

[51] Savelyev, A., *Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law*, Higher School of Economics Research Paper No. WP BRP 71/LAW/2016, 2016, p. 20: "it is possible to argue that each Smart contract by its legal nature is also a computer program in a meaning of IP law".

[52] *See e.g.* Tasca, P., *Digital Currencies: Principles, Trends, Opportunities, and Risks*, Deutsche Bundesbank and ECUREX Research, ECUREX Research Working Paper, 7th of September 2015

For example, the ECJ made clear, applying the relevant provisions of the existing European VAT Directive, that the exchange of traditional currencies for units of the 'bitcoin' virtual currency is exempt from VAT[53].

In the US, Judge Teresa Pooler wrote that "the Florida Legislature may choose to adopt statutes regulating virtual currency in the future. At this time, however, attempting to fit the sale of Bitcoin into a statutory scheme regulating money service business is like fitting a square peg in a round hole" and stated that the sale of bitcoin does not constitute a "money service business" in a case regarding unauthorized money transmission and money laundering[54]. However, in another case[55], it was reached the (opposite) conclusion that Bitcoins qualify as money since they "are funds within the plain meaning of that term [and] can be accepted as a payment for goods and services or bought directly from an exchange with a bank account. They therefore function as pecuniary resources and are used as a medium of exchange and a means of payment"[56].

It should be noticed, however, that most of the policymakers', central banks', authorities' (and judges') concerns[57] have until now regarded almost exclusively monetary policies[58], financial aspects[59], or issues related to public law and tax law[60], with a particular focus on money laundering and financing of terroristic activities[61], while a lot of practical issues concerning substantive private/trade law

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(version: October 2015), p. 26: "*The general orientation is to adopt the current legislation already in place in order to deal with digital currencies in Europe*".

[53] Case C-264/14.

[54] Case n. F14-2923, Criminal Division, section 13 of the 11th Judicial Circuit in and for Miami-Dade County, Florida. See also http://www.coindesk.com/court-reject-bitcoin-money-florida-espinoza-trial/.

[55] *See U.S. v Murgio et al*, U.S. District Court, Southern District of New York, No. 15-cr-00769.

[56] *See* http://www.reuters.com/article/us-jpmorgan-cyber-bitcoin-idUSKCN11P2DE.

[57] For a general overview, *see* the chart *at* p. 52 in Tasca, P., *Digital Currencies: Principles, Trends, Opportunities, and Risks*, Deutsche Bundesbank and ECUREX Research, ECUREX Research Working Paper, 7th of September 2015 (version: October 2015).

[58] *See for example* BIS, *CPMI report on digital currencies*, November 2015, *available at* http://www.bis.org/cpmi/publ/d137.pdf, which concluded at p. 21 that "There could also be potential effects on monetary policy or financial stability"; Scheinert, C., *Virtual currencies, Challenges following their introduction*, EPRS | European Parliamentary Research Service, Members' Research Service, PE 579.110, 2016, pp 4 ff.; *see also* IMF, *Virtual Currencies and Beyond: Initial Considerations*, IMF Staff Discussion Note – SDN/16/03, January 2016, pp. 33 ff.; finally, *see* ECB, *Virtual currency schemes – a further analysis*, ECB, 2015, p. 32.

[59] See for example *CPMI report on digital currencies*, BIS, November 2015, *available at* http://www.bis.org/cpmi/publ/d137.pdf in which it is concluded (p. 21) that "There could also be potential effects on monetary policy or financial stability"; Scheinert, C., *Virtual currencies, Challenges following their introduction*, EPRS | European Parliamentary Research Service, Members' Research Service, PE 579.110, 2016, pp 4 ff.; see also *Virtual Currencies and Beyond: Initial Considerations*, IMF Staff Discussion Note – SDN/16/03, January 2016, pp. 31 ff.; finally *see* ECB, *Virtual currency schemes – a further analysis*, 2015, p. 32.

[60] *See* IMF, *Virtual Currencies and Beyond: Initial Considerations*, IMF Staff Discussion Note – SDN/16/03, January 2016, pp. 30 ff.

[61] *See* for example the UK national risk assessment (*available at*: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/468210/UK_NRA_October_2015_final_web.pdf), where it has been written that "The money laundering risk

have been left unanalyzed and unanswered, apart from some analysis on consumer protection[62]; I move on to consider such issues in the next paragraph.

D. Legal Questions Related to the Substantive Private Law Governing International Trade. The Role of Uncitral

The technologies discussed through this paper may become relevant in the future of international trade but, as already mentioned, while from a public law point of view a lot of analysis has already been carried out, it seems that, as far as commercial law is concerned, a lot of questions still need to be answered.

This paragraph will briefly outline and address some legal questions that may arise using this technology in this respect, how such questions may be resolved on the basis of the current legislation, and how they should be addressed by policy makers.

The first problem is related to the legal status of virtual currencies: in fact, as already mentioned, some legal systems have already legislated on this field, a lot of authorities have given their opinion, and the EU is evaluating if, when and how to legislate.

However, with regard to contract law, the provision to accept payments in virtual currencies may be dealt with through an *ad hoc* provision in a commercial agreement; with regard to problems arising from their legal status, in absence of a specific regulation, authorities will likely (try to) apply the current legislation.

Real troubles for businesses come with what I referred to in paragraph A. as "decentralized smart contracts", *i.e.*, smart contracts based on blockchain technologies, which automatically execute any given contract, providing a proof of that performance in the distributed ledger.

In this regard, the first thing to notice is that, "using the blockchain functions imposes some technical limits: as a matter of facts, indirect e-commerce performances are not digitally executable. Therefore, the scheme is not covering any agreement regarding goods or services that, even though purchased on the Internet, have a material consistence or are to be performed in the real world, like a book delivery or a maintenance service"[63].

This is due to the dichotomy between real and virtual world: let us imagine that, through a smart contract, A buys and object from B (who regularly pays the agreed price), but thereafter C steals the real good from A; at this point, on the

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associated with digital currencies is low, though if the use of digital currencies was to become more prevalent in the UK this risk could rise", or the *Europol Report on the Changes in the Modus Operandi of Is in Terrorist Attacks* (*available at*: https://www.europol.europa.eu/sites/default/files/publications/changes_in_modus_operandi_of_is_in_terrorist_attacks.pdf), where they investigated the possible use of Bitcoin by terrorist to finance their activities.

[62] *See* IMF, *Virtual Currencies and Beyond: Initial Considerations*, IMF Staff Discussion Note – SDN/16/03, January 2016, pp. 28 ff.

[63] Perugini, M. L. & Dal Checco, P., *Smart Contracts: A Preliminary Evaluation,* December 2015, p. 10.

blockchain there is no way to change the status of owner of A, who may well sell his virtual "title" to D, who will never physically possesses the good which has bought but, at the same time, will never be able to stop the payment automatically executed by the smart contract. This is why it seems possible to argue that smart contracts may function only with digital goods and digital inputs[64]. Nonetheless, even if such limitation had to be applied, smart contracts would still be applicable to a lot of goods of the modern era. But what is the legal nature of smart contracts?

On the one hand, some have recently argued that a "smart contract can be regarded as a legally-binding agreement"[65]; on the other, it has been said that "smart contracts are simply a new form of preemptive self-help"[66].

With regard to the idea that smart contracts are themselves autonomous and self-sufficient legally-binding agreements, it shall be noticed that in fact they will almost always represent the translation of part of an already reached agreement into digital code: this is because they simply perform automatically the contract but they can enforce only provisions that may be executed in the digital world. In this regard, it has been said that using smart contracts "there is no need in conflict of laws provisions, since there are no collisions of various legal systems. Mathematics is universal human language. Thus, Smart contracts are truly transnational and executed uniformly regardless of the differences in national laws"[67], and even that smart contracts do not create a proper obligation in its legal meaning[68].

Such conclusion, though, seems difficult for me to be agreed upon. Firstly, even considering smart contracts as legally-binding agreements, they would *a fortiori* be subject to contract law, and it is clear that the applicable law will have a strong influence on them; for example, with regard to illegality and unconscionability, every country has its own peculiar rules, and a contract may well be valid in one place and null and void in another one.

Moreover, smart contracts do clearly create obligations which stand independently from the digital code of the smart contracts: if for example there is a bug in a smart contract between A and B, and A has undertaken to transfer her property in exchange for an agreed sum of money to B, she would still be obliged to transfer her property to B even if the smart contract does not work (similarly, if a vending

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[64] Perugini, M. L. & Dal Checco, P., *Smart Contracts: A Preliminary Evaluation,* December 2015, pp. 10 ff.

[65] Savelyev, A., *Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law*, Higher School of Economics Research Paper No. WP BRP 71/LAW/2016, 2016, p. 10 and ff.

[66] Raskin, M., *The Law of Smart Contracts*, (September 22, 2016), Georgetown Technology Review, Forthcoming, abstract. *Available at*: https://ssrn.com/abstract=2842258.

[67] Savelyev, A., *Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law*, Higher School of Economics Research Paper No. WP BRP 71/LAW/2016, 2016, p. 21.

[68] Savelyev, A., *Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law*, Higher School of Economics Research Paper No. WP BRP 71/LAW/2016, 2016, pp. 17 ff.

machine does not deliver the chosen good after the insertion of the coin, it is clear that the owner of the selling machine is still obliged to perform and deliver the good).

In any case, by entering into a smart contract, parties undertake to perform the obligation therein encapsulated; in addition, since – as was said – almost always smart contracts will be a translation of a precedent agreement already reached, the obligations of parties would nonetheless be, at the very least, to start the execution of the smart contract (*i.e.* to press the button that starts to operate the smart contract).

Generally speaking, in spite of the conceptual dissimilarities, there actually do not appear to exist too many differences between the functioning of a smart contract and that of a mechanical vending machine, or that of a software that suspends the supply of a service in case of missing payment (*e.g.* Netflix allows users to legally watch streaming videos in exchange for a monthly payment; in case of missing payments, the software will simply suspend the service, not allowing users to log in[69]): the fact that the interruption is performed by humans, by software, or by smart contracts with a record in the blockchain, does not in practice seem make a relevant difference legally-wise.

I therefore agree with the scholars who concluded that, "independently from being digitally expressed, every contract is ruled and guaranteed by the law and the parties will be free to file the Court for compensation in case a void agreement has been performed or execution has been spoiled by a malfunctioning due to a system bug"[70].

Another interesting point that was made by the scholarship is the idea that smart contracts are simply a new form of self-help measures, which parties to a contract adopt in order to ensure the performance of their agreements without the need of judicial enforcement[71]. This is consistent with the above-mentioned observation that what usually happens, at least at the moment, is that two parties reach an agreement and thereafter translate part of it into a smart contracts, and then leave the duty to perform it to the machine. In this case, all the relevant legal questions arising from smart contracts must be dealt by the competent judge under the applicable contract law.

In any case, independently of the legal nature of such contracts, another issue to be faced is the probative value of blockchain technology; also, and connected to this, one might wonder: "what happens when the outcomes of the smart contract

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[69] https://help.netflix.com/legal/termsofuse?locale=en&country=IT: "If a payment is not successfully settled, due to expiration, insufficient funds, or otherwise, and you do not change your Payment Method or cancel your account, we may suspend your access to the service until we have obtained a valid Payment Method".

[70] Perugini, M. L. & Dal Checco, P., *Smart Contracts: A Preliminary Evaluation, December 2015*, p. 25.

[71] Raskin, M., *The Law of Smart Contracts*, (September 22, 2016), Georgetown Technology Review, Forthcoming, pp. 32 ff.

diverge from the outcomes that the law demands"[72]? Once again, the answer depends on the applicable law.

Of course, a national agreement, concluded by national businesses and to be performed only on the national soil, would clearly be subject to the corresponding national law, and the jurisdiction would be determined according to the procedural law of that country.

But in relation to international trade, everything is different: it is self-evident that smart contracts may generate enormous problems if the applicable law and the competent jurisdiction are not clearly determined in the agreement; however, as observed above, smart contracts, by their very nature, cannot contain provisions not executable by software (such as the one regarding the applicable law), nor are they built with the intention to depend on a third-party judicial enforcement, and, therefore, it is still hard to imagine how they could include provisions on jurisdiction and applicable law[73].

It would therefore appear to be necessary, if such contracts have to be adopted in day-to-day trade practice, a general agreement (or at least an *ad hoc* provision) that establishes, among the other things, that, in case of need of judicial enforcement, related to the general agreement itself, or to the smart contracts depending upon it, what is the applicable law and which judge has the jurisdiction.

In relation to international trade, this problem may otherwise be without solution; trying to establish the applicable law of a smart contract, in the absence of an explicit choice by the parties, would trigger the well-known problems amplified by the advent of the Internet: should we apply the *lex loci delicti*? The *lex loci contractus*? The *lex loci rei sitae* (the place where the server on which the digital property virtually exists?)? The *lex loci protectionis*? Or should we use other criteria?

Similar problems would arise with regard to jurisdiction.

Therefore, there appears to be a great need of a solution to these uncertainties, or at least a model provision/law that deals with them, in order to avoid that, in a near future, if such contracts happen to start truly spreading, businesses start to use smart contracts giving them too much confidence and, in case of failure of the software, no one knows where to file a lawsuit, according to which law, and therefore how to predict its possible outcome.

Excessive faith in technology without adequate knowledge of the inevitably arising legal problems may cause a disaster, especially in international trade. It appears to be crucial to adopt an international approach to solve these issues; otherwise, each country may provide for different regulation on the subject matter, thus introducing indirect obstacles to international trade. It appears to be better to propose a framework in advance, than to wait for a number of national

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[72] Raskin, M., *The Law of Smart Contracts*, (September 22, 2016), Georgetown Technology Review, Forthcoming, pp. 25 ff.

[73] *See* Savelyev, A., *Contract Law 2.0: «Smart» Contracts As the Beginning of the End of Classic Contract Law*, Higher School of Economics Research Paper No. WP BRP 71/LAW/2016, 2016, pp. 20 ff.

laws that eventually will need to be harmonized and unified, because of the inevitable disparities. Given the rapid evolution of the technologies under consideration, it is inevitable that further studies and analyses must be carried out; nonetheless it is desirable that Uncitral, with its expertise in the field, leads this process.

This could be achieved through a proposed model law/rules which may be acceptable worldwide, or offering a legal guide or practical recommendations, in any case providing the technical assistance required for a similar endeavour. If this happened, many of the above-indicated questions would automatically and systematically find a solution, thus allowing for a proper exploitation of the potential of this innovation in international trade.

E. Conclusions

This paper has tried to outline the legal landscape arising from blockchain technologies and their applications, such as decentralized smart contracts and virtual currencies; it has tried to investigate if and to what extent such technologies may imply a legal revolution, or if it is sufficient to simply adapt the existing legal categories to them.

While I recognized that decentralized smart contracts, blockchain and virtual currencies may become mainstream technologies, I believe that they are not going to cause a legal revolution.

Even recognizing that a lot of regulatory issues arise from a public law perspective, this paper also focused on the less analysed issues related to international trade law. In this regard, the implementation of blockchain-based smart contracts creates problematic legal questions, particularly in relation to the applicable law and to jurisdiction. In fact, decentralized smart contracts are indeed designed with the purpose of avoiding the need of an intermediary to assure the exact performance of a contract, and to be self-sufficient and autonomous; however, sometimes, either for a bug, or for other reasons related to the dichotomy between real and virtual world, the intervention of a third party may be necessary to correct them, and to reach the required lawful outcomes of the given contract.

Nonetheless, considering that smart contracts can arguably be deemed actual contracts in their legal meaning, or at the least some form of self-help technology chosen by parties to ensure compliance with contractual obligations, it seems that most of the legal questions arising with smart contracts can and should be dealt with current contract law provisions; however, it is necessary to identify which national contract law applies to decentralized smart contracts, and this may be resolved through an *ad hoc* provision in the agreement or through the proposition of legal rules applicable to the most problematic aspects of smart contracts, *i.e.* applicable law and jurisdiction. Under this perspective, a contribution by Uncitral in devising model provision/agreements dealing with and regulating smart contracts would seem to be able to bring a really valuable contribution to the healthy development of these new contractual practices, and thus indirectly favour

the continuing growth of international trade, keeping pace with technological innovations.

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