Chapter V. "Smart Contracts".

Introduction

Development[215] of so-called "smart contracts" has taken place in recent years, and is associated with development of blockchain technology and its use for "smart contracts". The concept of a smart contract, however, appeared long before blockchain technology – it was described over 10 years ago, in 1997, by Nick Szabo in his publication: Formalizing and Securing Relationships on Public Networks. (Szabo, 1997 Nr 9). The author believes that

> "digital revolution challenges us to develop new institutions in a much shorter period of time. By extracting from our current laws, procedures, and theories those principles which remain applicable in cyberspace, we can retain much of this deep tradition, and greatly shorten the time needed to develop useful digital institutions. Computers make possible the running of algorithms heretofore prohibitively costly, and networks the quicker transmission of larger and more sophisticated messages. Furthermore, computer scientists and cryptographers have recently discovered many new and quite interesting algorithms. Combining these messages and algorithms makes possible a wide variety of new protocols. These protocols, running on public networks such as the Internet, both challenge and enable us to formalize and secure new kinds of relationships in this new environment, just as contract law, business forms, and accounting controls have long formalized and secured business relationships in the paper-based world. Smart contracts reduce mental and computational transaction costs imposed by either principals, third parties, or their tools. The contractual phases of search, negotiation, commitment, performance, and adjudication constitute the realm of smart contracts. Smart contracts utilize protocols and user interfaces to facilitate all steps of the contracting process. This gives us new ways to formalize and secure digital rela-

215 Due to the framework of this monograph, it does not cover all the issues of "smart contracts", which should be addressed in a separate, in-depth dissertation.

tionships which are far more functional than their inanimate paper-based ancestors"[216].

The author indicates that new technologies have been used for concluding contracts for many years. At first, these were simple contracts being, in a way, the electronic equivalent of paper contracts that developed into "Electronic Data Interchange" (EDI)[, which] is the computer-to-computer communication of standardized business transactions between organizations, in a standard format that permits the receiver to perform the intended transaction. It renders traditional static business forms in cyberspace, and maintains the dependence on traditional controls. Beyond simple encryption and integrity checks, EDI does not take advantage of algorithms and protocols to add security and "smarts" to business relationships. It enables more rapid execution of traditional negotiation and performance-monitoring procedure. EDI loses some security features provided by physical paper (such as difficulty of copying) while not gaining advantages from the wide variety of protocols possible beyond simple message-passing of static forms. EDI contracts tend to be merely reiterations of existing terms and conditions, with only some timing expectations changed for the electronic environment. By redesigning our business relationships to take advantage of a richer set of protocols, smart contracts can take us far beyond the paper-based paradigm of shipping around forms in a secure manner"[217].

"Smart contracts" constitute the next stage of development of contracts online. Thus introducing cryptography as well as automaticity of processes and the possibility to automatically "perform" a contract after the premises specified in the programming code, are satisfied. Another significant stage of development of "smart contracts" was the appearance of Bitcoin and blockchain technology, allowing irreversible (as a rule) recording of a "smart contract" in blocks, its strong cryptographic security, as well as the possibility of self-execution. Bitcoin is a classic example of a programmed and self-executing "smart contract". The concepts of Bitcoin and distributed ledgers, but, in particular, the concept of a "democratic" system existing on the Internet only, not associated formally with any territory, resulted in the development of the concept of the so-called DAO (*Decentralised Autonomous Organisation*), i.e., a special form of "smart contract" functioning within a completely autonomous entity existing solely in digital space. The opinions that "smart contracts" will force the establishment of new legal

216 http://ojphi.org/ojs/index.php/fm/article/view/548/469#* of 17 November 2018.
217 http://ojphi.org/ojs/index.php/fm/article/view/548/469#* of 17 November 2018.

frameworks functioning in cyberspace, above the jurisdictions of the respective states, appear more and more often in the literature as well as discussions devoted to blockchains and "smart contracts". The views that modern technologized contracts are soon going to replace lawyers, because e-contracts are going to be self-executing, are not so uncommon. Such far-reaching conclusions are difficult to accept at the current stage of development of "smart contracts". A more specific analysis thereof indicates that, in legal terms, they are not as revolutionary as some might want them to seem[218], (Scherback, 2014) and in a suitable interpretation they are well within the current framework of legal concepts and, for now, do not require the introduction of new, revolutionary concepts of autonomous cyberspace law or lex electronica. However, it is a fact that a new discipline is developing among the lawyers who deal with law and cyberspace – "legal programming", integration of IT with the discipline of law[219] (Scherback, Integrating Computer Science into Legal Discipline: The Rise of Legal Programming, 2014).

Definition of a Smart Contract

From the point of view of the doctrine

The term "smart contract" was described in 1997 by Nick Szabo as a combination of protocols with user interfaces for the purpose of formalizing and securing relationships in computer networks. The objectives and principles of designing those systems were to be based on legal principles, economic theories and the theory of credible and secure protocols. The basic idea of "smart contracts" is that many types of contractual clauses (such as securities, deposits, specification of ownership rights, etc.) may be installed in our equipment and software in such a way that it is costly to violate the contract (if needed – too costly) for the violator, or even impossible. The author also indicates that "smart contracts" cover all the stages associated

218 Sergii Scherback: How Should Bitcoin be Regulated, European Journal of Legal Studies Articles No. 7, pp. 45-91; http://cadmus.eui.eu/bitstream/handle/1814/32273/183UK.pdf?sequence=1&isAllowed=y of 17 September 2018.

219 S. Schrebak: Integrating Computer Science into Legal Discipline: The Rise of Legal Programming https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2496094 of 17 September 2018.

with a contract: searching, negotiations, obligation and, particularly important – its performance.

"Smart contracts" were defined in the Distributed Ledger Technology: beyond block chain. A report by the UK Government Chief Scientific Adviser (which introduced the term of DLT), prepared for the British government, where "smart contracts" were described as contracts whose terms are recorded in a computer language instead of legal language. Smart contracts can be automatically executed by a computing system, such as a suitable distributed ledger system. The potential benefits of smart contracts include low contracting, enforcement, and compliance costs. However, there was noted the significant risk of the possibility of reliance on the computing system[220].

The latest literature devoted to the law and latest technologies has also attempted to define that term. Merit Kolvart, Margus Poola and Addi Rull define "smart contracts" as smart, electronic "agents", being a computer program capable of making a decision if certain preliminary conditions are met. At the same time, the authors were correct to note that the term "smart contracts" is understood differently by representatives of different fields. IT specialists consider smart contracts to be automatized solutions replacing traditional contracts, functioning in cyberspace without any jurisdiction and without the need to refer to any applicable laws. However, that statement seems to be too simplified, because, in legal terms, the character of the given "smart contract" is going to depend on multiple factors, and thus one may not assume a priori that it does not constitute a contract, even though expressed in a peculiar manner. That is because for lawyers, "smart contracts" are automatized agreements containing legal contracts, because it is impossible to avoid jurisdiction[221]. (Kolvart, Margus and Addi, 2016)

In their online publication entitled *Legal Engineering on the Blockchain: 'Smart Contracts' as Legal Conduct*[222] (Goldenfine and Leiter, 2018), Jake Goldenfine and Andrea Leiter noted that automated transactions on the internet are part of everyday life for many people. An automated transaction can be thought of as a means of exchanging value in which some di-

220 http://fintechpoland.com/wp-content/uploads/2017/01/Technologie-rozproszonych-rejestrow-UK-GOfS-FTP-NASK-PL-1.pdf of 17 July 2018.

221 Merit Koolvart, Margus Poola, Addi Rull: Smart Contracts [in]: The Future of Law and eTechnologies, ed. T. Kerikmae; A. Rull; Heidelberg, New York, London 2016r. pp. 134-136.

222 The material may be downloaded from the source https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3176363 of 18 August 2018.

mension of the actual exchange is processed by a machine, without human intervention. However, the relationship between the computational mechanism that processes the exchange, and the natural language contract that constitutes the agreement is not always clear (like in the case of Bitcoin – own remark). Smart contracts complicate this further because they are capable of more than simply processing payments. Technicians make use of technical standards and try to fill them with legal principles that demonstrate the character of standards. The authors believe that in any particular domain standards constitute a mosaic of rules that form the discrete regulatory modules (e.g., ISO – own remark) to which private agreements refer (e.g., by referring to a standard or a norm). As regulatory modules, they structure patterns of action and behavior into translatable packages that define the criteria for both technical interaction and legal transaction. The developing ecosystem is currently produced by various kinds of private entities that provide the computational modules for law-enforcement systems, while "standardizing" legal principles. In other words, it is development of legal regulations in technical architecture (by developing libraries of machine-readable transaction modules that correspond to traditional contracts), so as to facilitate enforcement of laws. That process may be called legal engineering (Goldenfine and Leiter, 2018).

Guido Governatori, Florian Idelberger, Zoran Milosevic, Regis Riveret, Giovanni Sartor and Xiwei Xu believe that a "smart contract" is any self-executing program operating in the environment of a distributed ledger, in particular in blockchain technology, aimed at ensuring the parties implement and perform the automated transaction. The performance may take place on the basis of records in software or result from external activities (Guido Governatori, 2018).

A concise but correct definition was suggested by A. Sherborn[223] who defined "smart contracts" as automatically executed contracts bound by computer protocol, written in code, which automatically execute programmed functions in response to certain conditions being fulfilled. He notes that this concept is not novel, but with the integration of blockchain technology, "smart contracts" have the potential to automate and guarantee the performance of a great variety of obligations without the need for a central authority, legal system, or external enforcement mechanism. In these cases, smart contracts bring clarity, predictability, auditability, and

223 A. Sherborne: Blockchain, smart contracts and lawyer, https://www.ibanet.org/Document/Default.aspx?DocumentUid=17badeaa-072a-403b-b63c-8fb-d985d198b.

ease of enforcement to contractual relations while mitigating the risks associated with human involvement (Sherborne, 2017).

Legal point of view

The definition of "smart contracts" does not only function in theoretical or doctrinal deliberations on their essence. They have all been functioning for a relatively short period of time and, as the literature has suggested, they are at a preliminary stage of development. Their huge potential has been noticed and so they have been introduced in legal regulations. They are not only a de lege ferenda postulate, but also actually implemented laws.

An example may be amendment to statute 44 of chapter 26 of the Arizona States, by adding art. 5 concerning electronic transactions[224], under which "SMART CONTRACT" MEANS AN EVENT-DRIVEN PROGRAM, WITH STATE, THAT RUNS ON A DISTRIBUTED, DECENTRALIZED, SHARED AND REPLICATED LEDGER AND THAT CAN TAKE CUSTODY OVER AND INSTRUCT TRANSFER OF ASSETS ON THAT LEDGER
and one may not claim it has no legal effects, validity or enforceability solely because it contains "smart instructions". Furthermore, regardless of other regulations, it is considered that the data secured using blockchain technology is equivalent to other data, secured in other ways. That principle applies to ownership-transfer contracts or contracts for use.

The definition of a "smart contract" was also included in Decree of the President of the Republic of Belarus No. 8 of December 21, 2017, annex No. 1 on Development of Digital Economy[225] – program code[226] intended for functioning in the transaction block ledger (blockchain), another distributed-information system for purposes of automated performance and/or execution of transactions or performance of other legally significant actions.

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224 Bill Text AZ (Arizona House Bill) HB2417 of 2017. See https://legiscan.com/AZ/text/HB2417/id/1497439.

225 http://law.by/document/?guid=3871&p0=Pd1700008e of 17 July 2018.

226 Many definitions use the term "code". It was defined by S. Schrebak: Integrating Computer Science into Legal Discipline: The Rise of Legal Programming https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2496094 of 17 July 2018. Code is software that allows the computers' functioning, interconnectedness and interaction. Put it more simply, everything that one sees on the Internet is delivered by means of code.

The latest European regulations that include definitions of smart contracts are the Maltese acts regulating blockchains: Malta Digital Innovation Authority Act C901[227] and Virtual Financial Asset Act C778[228]. Both introduced an identical definition: ''smart contract'' means a form of innovative technology arrangement consisting of: (a) a computer protocol; and, or (b) an agreement concluded wholly or partly in an electronic form which is automatable and enforceable by execution of computer code, although some parts may require human input and control and which may be also enforceable by ordinary legal methods or by a mixture of both.

In the opinion of the author, that definition completely reflects the essence of a "smart contract" and may be considered a model.

"Smart contracts" are slowly becoming reality, one that is legally regulated. At lot indicates that, in the foreseeable future, other states in the world are also going to introduce proper regulations in that regard. That is why that issue is worth examining.

The Notion, Properties and Classification of "Smart Contracts"

Notion and properties

The term "smart contract" may be considered as not particularly accurate, because it does not really reflect its actual role or notion, often causing misunderstanding. In public statements, in particular those made by start-uppers, we often read that a "smart contract" replaces a contract, is not subject to any territorial jurisdiction and functions only online. That thesis is particularly wrong and expresses so-called wishful thinking[229] (Rogers, Jones-Fenleigh and Sanitt, 2017).

The term "smart contract" is very non-uniform, both in literature and in practice, and covers a number of different events. Basic elements included in most definitions are: a record in programming code and self-execution or an automated method of execution. Sometimes, but not always, the ele-

227 http://justiceservices.gov.mt/DownloadDocument.aspx?app=lp&itemid=29080&l=1 of 11 November 2018.

228 http://justiceservices.gov.mt/DownloadDocument.aspx?app=lp&itemid=29079&l=1 access of 11 November 2018.

229 J. Rogers, JH. Jones-Fenleigh, A. Sanitt: Arbitrating "smart contract" disputes [in:] International arbitration report, October 2017r. Northon Rose Fulbright http://www.nortonrosefulbright.com/files/20170925-international-arbitration-report-issue-9-157156.pdf of 20 July 2018. p. 22.

ments listed also include the need to record in a blockchain or in DLT. In practice, most "smart contracts" are recorded that way. That element is also indicated by the legal definitions presented above. However, the literature does not always indicate that element as decisive. There is also indicated the following element: recording in the code of modules containing contractual clauses or other functionalities, as well as their irrevocability[230] (execution on account of recording in a program).

The word "contract" used in the notion described should be considered particularly unfortunate, as it suggests that, in each case, we are dealing with an agreement, which is not the case. "Smart contracts" are not always agreements, either in the legal or casual sense[231]. In practice, "smart contracts" may be classified into two types: 1) an actual agreement, concluded solely online, through its acceptance (but often also, additionally, by downloading software), that is "self-executing" – an example of such an agreement is an agreement among miners for mining Bitcoin; 2) a tool (medium) of record (usually in a blockchain) reflecting an agreement concluded before and in a traditional way (e.g., on paper or in the form of a document), often being a framework or conditional agreement, the performance of which (i.e., in programming terms, by launching further processes) by the program is automatic. From such a point of view, a "smart contract" is not always an agreement, but rather a tool that reflects it and facilitates its execution. The term "smart contract" should only be used in the former case. For that reason, in this study that term is written in inverted commas, to emphasize a certain autonomous term, not as an agreement in the legal sense. In legal definitions, "smart contracts" are defined as a program or programming code, i.e., as the technological tools that allow one to either (a) conclude an agreement and execute it automatically in part or in full or b) only execute it automatically completely or partly, while it is recorded in DLT or a blockchain, using a technique that guarantees authenticity and integrity as well as non-repudiation (not so much of the agreement, but rather of the record). All in all, what a "smart contract" is, is determined by its contents or the contents of the agreement that is the basis for launching it.

A "smart contract", or actually the agreement that determines it, does not function in a legal vacuum, or outside of the law, or by replacing the

230 See also below.

231 As presented in A. Sherborne: Blockchain, Smart contracts and lawyer, p. 5 https://www.ibanet.org/Document/Default.aspx?DocumentUid=17badeaa-072a-403b-b63c-8fbd985d198b.

law. That is regardless of whether it is concluded in electronic form directly through the programming code that constitutes a smart contract, or in a traditional way. It is associated with such issues as legal capacity, capacity for acts in law, way of concluding (declaration of intent, form, causality or abstractness), contents of the agreement, abusive (prohibited) clauses, execution, expiry, invalidity, possibility to amend, etc. As well as the "classic" regulations associated with choice of applicable law and jurisdiction, and in the lack of choice – allowing to search for them. Principles just like these referred to Bitcoin which is, in fact, a "smart contract". These issues refer to the classical interpretation of private law, and so this monograph is not the place for an in-depth examination.

In "smart contracts", the problem is not the agreement that is recorded or executed through this tool, but rather the technology that does not always allow synergy between the event resulting from legal regulations and operation of the program. Another problem may be anonymity of the entities (beneficiaries) concluding a contract in cyberspace. It is a much broader problem, as it not only refers to smart contracts, but also to other agreements concluded electronically, and it requires a separate discussion that exceeds the scope of this study.

The essence of a "smart contract" consists in its self-execution on the basis of permanent and, in fact, irremovable records in DLT or blockchain blocks. Depending on the type of blockchain, changes are currently either impossible (in case of applying a public blockchain of significant computing power), significantly hindered (in some private blockchains) or reversible (in case of some DLTs or private blockchains). This may result in a situation when, despite the appearance of the events justifying a lack of performance of an obligation under an agreement (e.g., a defect of a declaration of intent, absolute invalidity, suspended ineffectiveness, etc.), an obligation will be performed, including in case of a final and valid court judgment, and it will not be possible to "cease" its performance. However, such performance will bear a legal defect and be deprived of legal grounds, which also happens in traditionally performed agreements. Lawyers know the legal tools that allow the recovery of the condition which should appear on account of challenging an agreement[232]. However, they are not al-

232 For example, when performance of a "smart contract" consists of making a payment, if the agreement is found invalid or challenged, the payment should be returned. If it is not returned voluntarily, it may be difficult to enforce it, especially if the agreement is international in character, or when the payment is made using cryptocurrencies.

ways effective or sufficient[233]. The situations is becoming seriously complicated not in legal terms, but rather in terms of potential recourse claims regarding "smart contracts", where a number of entities are functioning, and one event causes the execution of another one (like in domino effect), where the impossibility to suspend performance of an agreement (e.g., with regard to the first event) may activate the subsequent one and so on.

Some say that the advantage of "smart contracts" is their non-repudiation and certainty of performance, and thus a lack of the necessity to enforce them before courts. Taking into account the legal regulations that apply nowadays, that statement resembles wishful thinking. Although an agreement is "self-executing", this does not mean a lack of the possibility to challenge it and to pursue one's claims before a court. In the countries, the procedures of which include presumption of correctness of the contents recorded in blockchains, it is easier to demonstrate the fact of conclusion of an agreement and to prove its contents, which does not result in the prohibition to pursue claims against the agreement itself[234].

Classification

"Smart contracts" as well as the agreements associated with them are very diverse and impossible to classify unequivocally. The classifications vary depending on the criterion adopted.

In terms of the way of concluding an agreement connected with "smart contracts", they can be classified into a) those concluded solely through the programming code included in the "smart contract", b) those concluded solely in the traditional way (e.g., on paper or in the form of a document), c) hybrids, where the framework agreement associated with the "smart program" is concluded in a traditional way, while its details and special elements, in programming code, or an agreement is concluded in parallel in

233 When drawing up a "smart contract", it is a good idea to allow the possibility to interfere with provisions and enforceability of the agreement, e.g., if the agreement is found invalid with a final and valid judgment.

234 Also in M.Kolvart, M. Poola, A. Rull, Smart Contracts [in:] The Future of Law and eTechnologies, ed. T. Kerikmae, A. Rull, Heidelberg, New York, London 2016r, p. 137 who believed that, in most cases of applying smart contracts, the parties may assume a lack of the need to enforce the contractual provisions before a court, which does not repeal jurisdiction or the right to pursue it in court.

the code and in the traditional way[235]. That classification is significant from the point of view of evidentiary proceedings before courts in case of a dispute. The programming code, through which an agreement is concluded (points a and c), is not always understandable for non-professionals[236]. The contents of an agreement is "embedded" in program modules which are filled in by the parties. There is usually no visualization of the agreement which is present when concluded in the traditional way. And the party/parties do not always realize the mechanism or manner of operation, or even the contents of the agreement. It is not a new situation, because agreements have been concluded online for many years, at first using passive forms, then active forms, when accepting and launching software, etc., without knowledge of the modules or principles of functioning. In "smart contracts", there is also recording in blockchains or DLT and self-execution of the agreement. When concluding an agreement through programming code, the parties submit declarations of intent in accordance with general principles of the law, with the principle of, for example, freedom of expression and of submitting declarations of intent. The fact that they express it through a program is of no relevance for assigning the effects of declarations of intent. The issue of using IT systems for submitting declarations of intent was described in detail almost 20 years ago (regarding, for example, programmed electronic mail or EDI), and "smart contracts", as a new, electronic medium, do not change anything in that regard (Szostek D. , Czynność prawna a środki komunikacji elektronicznej, 2004) (Beatge, 2002) (Wiebe, 2002) (Klam, 2002) (Heun, 1994) (Sussenberger, 47-49) (Koch, 1998). When using programming code for concluding an agreement, we have to take into account the risk of its defectiveness, of programming errors, software defects, risk associated with hacking attacks, etc., as seen in the example of the eDEO case[237]). Although smart contracts are to be certain and predictable as a rule, they remain exposed (like any software) to mistakes and errors in programming, which additionally increases the irre-

235 See also J. Rogers, H. Jones-Fenleigh, A. Sanitt: Arbitrating Smart Contract Disputes, p. 21 http://www.nortonrosefulbright.com/files/20170925-international-arbitration-report-issue-9-157156.pdf of 25 September 2018.

236 For an example of the functioning and programming of a "smart contract", see https://www.youtube.com/watch?v=lQ4USRtzWko.

237 David Siegel, 'Understanding the DAO Attack for Journalists' 19 June 2016 <https://medium.com/@pullnews/understanding-the-dao-hack-for-journalists-2312dd43e993>.

versible character of blockchains[238]. A program recorded in a blockchain may not always be debugged (by finding and removing a defect from the software), and, despite the defect, the consequences of its self-execution may be serious and difficult (although not impossible from the legal point of view) to reverse. Programming errors may result in defective execution of a smart contract, there may appear discrepancies between the coded and traditional versions of an agreement, and they may function on the basis of inaccurate data[239].

In terms of the structure of "smart contracts", there are a) declared smart contracts and b) module smart contracts. The former appears in simple agreements, either bilateral or multilateral, where the whole contract is embedded in the code and is concluded in an adhesive way, i.e., by joining and accepting the whole, or a lack of the possibility to conclude a contract. An example of such a contract is an agreement among the miners in the Bitcoin system. A module "smart contract" allows a party to choose alternative, suitable modules that have been pre-programmed in the programming code. Although a party has freedom in choosing them, it may not change the contents or sequence of the modules. Its choice is limited to the options provided in advance in the system. Module smart contracts are used both for simple agreements and more complicated ones, including multilateral agreements.

In terms of the program language of the code, there are a) imperative and b) declarative "smart contracts". Currently, most smart contracts assume an imperative approach, under which a "smart contract" directly specifies the computational operations which are to be executed for the purpose of executing the agreement. "When programming using an imperative language, the programmer records an explicit sequence of codes which are to be executed for the purpose of obtaining the intended result. The programmer must write what should be done and how. Declarative

238 A. Sherborne: Blockchain, smart contracts and lawyer, p. 6 https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwi_y9294qjcAhWMBiwKHa3gCUMQFggvMAA&url=https%3A%2F%2Fwww.ibanet.org%2FDocument%2FDefault.aspx%3FDocumentUid%3D17badeaa-072a-403b-b63c-8fbd985d198b&usg=AOvVaw1fDNjqMc9uJ2HdilGS44eI of 25 September 2018.

239 J. Rogers, H. Jones-Fenleigh, A. Sanitt: Arbitrating Smart Contract Disputes, p. 22; http://www.nortonrosefulbright.com/files/20170925-international-arbitration-report-issue-9-157156.pdf of 25 September 2018.

languages are an alternative to imperative languages[240]. Conventional algorithms may be analyzed, taking into account two components: the logical component which specifies what is to be done and the control component which specifies how it is to be done. The logical component is aimed at expressing the knowledge which may be used in the algorithm, while the control component only affects its effectiveness. As a result, when programming they have to record the exact sequence of steps to specify what to do. The programmer only describes what is to be done without specifying how to do it. Declarative smart contracts may be drawn up using various declarative languages, such as functional languages and logic-based languages[241]." (Governatori and inni, 2018).

As regards the criterion of the ecosystem, in which a "smart contract" functions, there exist the contracts: a) functioning in a closed ecosystem and b) with external sources that obtain additional data. The former are mainly based on an imperative programming language and all the functions, activities and events are decreed in the contract code. The "smart contracts" that refer to or make use of data from other sources (by obtaining them) are more complicated. They may be of referential character, may be obtained from a trusted third party (e.g., a court, public notary or trusted entity as defined in the EIDAS regulation) or from another entity.

In terms of the method of recording "smart contracts": a) in DLT or b) in a blockchain. For both types of "smart contracts", it is possible to use a number of different IT systems (public, private, etc.), as there are many DLT and blockchain systems.

Another criterion of classifying "smart contracts" is the way in which the agreement is executed. One of the properties of "smart contracts" is automaticity, or self-execution. However, the level of self-execution may be different. Contracts may be classified as a) completely self-executing or b) partly self-executing, in which, for full performance of obligations, additional activities are necessary, undertaken either by other software, devices or by another person/entity.

Using other criteria, "smart contracts" may be classified as a) self-destructing, i.e., when the code self-destructs after the obligation is performed or b) self-learning, i.e., based on the algorithms that are (or are similar to) artificial intelligence, making use of external sources for "learning", or rather for changing the way of performing a contract on account of a change in

240 See also R. Kowalski: Algorithm=logic+control, Magazine Communications of the ACM, No. 22, July 1979 pp. 424-436.

241 https://link.springer.com/article/10.1007%2Fs10506-018-9223-3 of 21 July 2018.

external sources (e.g., a change in the amount of interest results in a change in the way of performing the obligation).

In terms of access and possibility to conclude an agreement, "smart contracts" may be classified as

a) open – available for an unlimited group of people (including foreign entities),
b) partly open (e.g., for entities from a certain territory, e.g., the EU) or
c) closed – for a specified group only. In terms of the number of parties to a smart contract:
   a) bilateral or
   b) multilateral.

In terms of subject of the agreement:

a) those associated with the digital economy;
b) those associated with traditional economy or
c) hybrids.

These may include the contracts that use tokens or operate solely based on blockchain records without token transfers.

In terms of their cross-border character: a) international or b) domestic. In the former, it is necessary either to choose the law applicable to the contract or to look for it based on general principles of the law. In the latter, the law and jurisdiction are specified in advance, because of a lack of the cross-border element. In terms of the method of solving contract-related disputes: a) subject to arbitration or b) subject to procedures before traditional courts.

The above are just examples of classifications of "smart contracts", and are not exhaustive. Their multiplicity, diversity as well as the possibility to apply many different criteria, do not allow a presentation of a complete and exhaustive classification.

Tokens in "smart contracts".

Introduction

One of the tools used in "smart contracts" are tokens. They are not necessary for a "smart contract" to function, but over the last four years we have been witnessing tokenization of "smart contracts" and a growing tendency to trade in them in "cryptocurrency exchanges". "Smart contracts" and tokens are used more and more often for collecting funds for initiatives related to blockchains and cryptocurrencies. An example is ICO (Initial Coin

Offering), referring to disposal of tokens in public offerings, usually in exchange for cryptocurrencies. Tokens, in particular those with a successful ICO, are usually listed in "cryptocurrency exchanges", where initial buyers may dispose of them and new buyers may enter the exchange at any time. Depending on the type of agreement, tokens may play various roles. For example, it may (but does not have to) provide its holder with: access to services, but also the possibility to participate in a discussion, to address, for example, the issue of participating in a project (a classic example is the DAO project), but also the right to share in the profits or the right to the interest on the payment made in cryptocurrencies.

From a historical point of view, the first symbolic record related to disposal of tokens appeared in 2014, when seven projects generated the total amount of USD 30 million. The largest project of that time was the disposal of the tokens of eter – over 50 million eters were disposed of for over USD 18 million. The year 2015 was more peaceful: seven transactions generated a total of USD 9 million, including the largest one – Augur – which collected a little over 5 million dollars. The interest in tokens (on account of an increase in the value of Bitcoin) started to grow in 2016, when 43 companies, including Waves, Iconomi, Golem and Lisk, generated 256 million dollars. That sum included the infamous sale of chips in an independent investment fund, The DAO, the objective of which was to encourage development of the ecosystem by allowing investors to vote on which projects are to be financed. A little after the sale, over USD 150 million was collected, while a hacker stole (using a software loophole) tokens of the value of ca. 60 million dollars, which caused the project to collapse. A sudden explosion of interest in tokens took place in 2017 – 342 issues generated almost USD 5.4 billion and place that concept among the top innovations in blockchains. The decrease in the value of Bitcoin at the turn of 2017/2018 has not decreased the interest in tokens within ICO[242]. In the first half of 2018, 150 projects disposed of tokens in exchange for USD 4.83 billion.

The concept of ICO, including tokens, thus became the most serious blockchain-using project, and the high amounts invested in the new tool demonstrate the size of that market and the place for "smart contracts".

242 https://www.coindesk.com/information/what-is-an-ico/ of 23 July 2018.

Definition

The term "token" is not new – it has been functioning for years in digital transactions as a security mechanism, in banking and in the qualified electronic signature PKI. It has recently adopted a new meaning, different than before, as well as new functions. As a result, completely different tools may be called tokens.

An earlier one – a generator of one-off codes, i.e., an electronic device (which may be in a "cloud" and use a dedicated app on a cell phone) used for authenticating online transactions, usually banking transactions. It consists of generating a sequence of digits using a unidirectional function based on two parameters – one permanent for the given device and another one, entered with a keyboard, from a monitor or generated based on time"[243], a token, or one-time-password (OTP) generator. Regular tokens display variable codes, usually every 60 seconds. In banking, on account of the relatively high cost of generation, the tendency appeared to use a one-time code card (as used by banks several years ago) or to generate one-time text-message passwords.

The new meaning of the word "token" is significantly different from the previous one, and rather refers to the meaning resulting from direct translation from the English language, where "token" is a sign, symbol or evidence of something. That term is usually used in the phrase *digital token*.

Literature provides the following definition of token: a

> "settlement unit generated in already existing blockchains. It is a digital representation of a unit of value issued by a private entity or institution, developed for independent management of its business model, so as to allow the users to interact with its products, as well as to facilitate and estimate the benefits among the parties interested. As tokens operate on the basis of blockchains, they may have all the properties of cryptocurrencies, as well as additional properties and functions e.g., self-destruction after use. They may play the role of chips, tickets, coupons, and even ballots"[244].

The definition is not full, because there exist and are traded tokens not based on blockchains.

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243 https://pl.wikipedia.org/wiki/Token_(generator_kodów) of 26 June 2018.
244 M. Grzybowski, Sz. Bentyn: Kryptowaluty, p.277-278.

In terms of the issuer, tokens may be classified as embedded in a blockchain (native) or issued by the given entity (with or without a blockchain) for subsequent repurchase.

For the purposes of this study, a token shall be understood as a digital token based on blockchain technology.

While preparing this publication, the most popular token was one established on the Ethereum platform (Ethereum is both a cryptocurrency and an IT platform). Currently, the tokens that may be generated include: ERC-20 tokens and their extensions – ERC 223 and ERC-721. The Ethernum tokens include Utility Tokens and Security Tokens.

Utility Tokens provide access to services. They are usually used as means of payment for products or services (and may be usually obtained by ICO). These tokens are sometimes called "app coins" or "app tokens". *Security Tokens* reflect the balance of rights, ores or other financial or investment instruments[245]. It is indicated that they could also reflect shares in an enterprise or other entitlements. An example of a link between a share in a company and a token is the regulation of 30 May from the State of Vermont, described in more detail in chapter V.

The term "token" also has a legal definition in, among other places, Decree No. 8 of 2017 of the President of Belarus, under the annex to which a digital token is a record in a blockchain ledger or another distributed ledger (DLT), the purpose of which is verification of the right of the person holding a token to the given civil right and/or it is a cryptocurrency.

An interesting definition was suggested by the Maltese lawmakers in the Virtual Financial Asset Act C778[246] of July 2018, under which "virtual token" means a form of digital medium recordation that has no utility, value or application outside of the DLT platform on which it was issued and may only be redeemed for funds on such platform directly by the issuer of such DLT asset: Provided that electronic money shall be excluded from this definition.

A token is nothing more than a record in a blockchain which may function within "smart contracts", but also outside of them. In the former case, it is one of the elements of a smart contract, and thus, following the *a maiori ad minus* principle, it should be treated (like smart contracts) as a

245 See also http://antyweb.pl/ethereum-erc20-token/ of 26 June 2018.

246 http://justiceservices.gov.mt/DownloadDocument.aspx?app=lp&itemid=29079&l=1 access of 11 November 2018.

technological tool[247] in which the given entitlement of its holder is recorded under an agreement.

Tokens – legal issue

A token may be distributed under any type of "smart contract" or outside of them. Whenever we want to determine or attempt to indicate its legal character, we have to take into account a number of elements, among others the law applicable to the agreement, under which it is generated and disposed of, but also the contents of that agreement (taking into consideration the ius cogens and ius dispositive provisions). It is not difficult to demonstrate applicable law in the case of ICO, because the entities that distribute tokens are usually real entities functioning in the real world, with real, physical seats[248]. A token is a tool and its function is determined by the laws applicable to it.

Therefore, in legal terms a token does not constitute some sort of revolutionary legal instrument unknown before. It is nothing more than a new medium of a legal instrument, which is indicated by the latest positions adopted by financial-supervision authorities, as seen in the report[249] of the US Securities and Exchange Commission of 25 July 2017, in which it warns market participants that the offers and sale of digital assets (tokens) through "virtual" organizations managed by the organizations using DLT or block technologies, among others those described as ICO or "token sales", are subject to the requirements of federal securities laws. Whether the given investment transaction includes offering or selling a security – regardless of the applied terminology or technology – depends on facts and circumstances, including on the economic realities of the given transaction. A report on an SEC investigation stated that the tokens offered and sold by the "virtual" organization called "DAO" constitute securities, and so are subject to federal securities laws. The report confirms that issuers of distributed securities or of the securities based on block technologies, must register the offers and sale of such securities, unless a valid exemption ap-

247 On how a token works and what its programming looks like: https://www.ethereum.org/token and https://www.youtube.com/watch?v=jfFgecLL8UA of 25 July 2018.

248 Attempts were made to distribute tokens on an anonymous basis, but without much success.

249 https://www.sec.gov/litigation/investreport/34-81207.pdf.

plies. The persons participating in unregistered offers may also incur liability for violating the provisions on trading in securities. Furthermore, stock exchanges, on which those securities are traded, must be registered, unless they are released from that obligation. The provisions of the federal act on trading in securities, associated with registration, are aimed at ensuring all the suitable information is obtained, and are subject to regulatory control for the purpose of protecting investors (COMMISSION, 2017).

Independently from the opinion of the US Securities and Exchange Commission, one week later, i.e., on 1 August, a similar position was adopted by the Monetary Authority of Singapore – MAS)[250]. It stated that the tokens offered or spent in Singapore will be regulated by the MAS if they meet the definition of the product specified in the act on securities. If digital tokens are covered by the definition of securities included in the SFA, issuers of such tokens will be obliged to submit and register a prospectus in the MAS system before offering such tokens, unless they are exempt. The issuers or intermediaries trading in such tokens would also be subject to the requirements regarding issuance of permits under the act on special financial arrangements and financial advisers, unless they are exempt, and to the applicable requirements regarding counteracting money laundering and the financing of terrorism. Furthermore, the platforms that facilitate secondary trading in such tokens would also have to be approved or acknowledged by the MAS, as an approved exchange or acknowledged market operator, accordingly. The digital tokens offered in Singapore and those offered in other countries are very different. Some offers may be subject to SFA, while others may not. All the issuers of digital tokens, intermediaries that facilitate or advise as regards offering digital tokens, and platforms that facilitate trading in digital tokens should, therefore, obtain independent legal advice in order to ensure their compliance with all the applicable provisions and, in certain cases, should consult with the MAS.

Europe has also paid attention (European Securities and Markets Authority[251] (ESMA) (Authority, 2017) and Polish Financial Supervision Authority (KNF)[252]) to the issue of trading in tokens and to the need for the

250 http://www.mas.gov.sg/News-and-Publications/Media-Releases/2017/MAS-clarifies-regulatory-position-on-the-offer-of-digital-tokens-in-Singapore.aspx of 25 July 2018.

251 https://www.esma.europa.eu/sites/default/files/library/esma50-157-828_ico_statement_firms.pdf.

252 https://www.knf.gov.pl/o_nas/komunikaty?articleId=60178&p_id=18.

entities functioning through ICO, whether they are or are not obliged to obtain a suitable permit for trading in them.

A very interesting regulation regarding trading in tokens was introduced in Belarus (it has been effective since 1 January 2018). Under the quoted Decree of the President of Belarus, legal persons are authorized to hold tokens and, taking into account the special properties specified in the decree, are entitled to create and publish their own tokens in the Republic of Belarus and abroad. They are also entitled to store tokens in virtual wallets, including with the use of cryptographic-platform operators, cryptocurrency-exchange operators, and to purchase, alienate tokens and to perform other transactions (operations) with their use.

Natural persons are entitled to hold tokens and, taking into account the special properties resulting from the decree: to acquire and store tokens in virtual wallets, to exchange tokens for other tokens, to purchase them, alienate them not only for Belarussian rubles but also for foreign currencies and electronic money, and to donate and transfer tokens. The activities consisting of mining, acquiring and alienating tokens, performed by natural persons without employing other natural persons under employment agreements and/or civil law agreements, do not constitute business activities. What is more, tokens do not have to be reported to state authorities. Cryptographic-platform operators and "cryptocurrency-exchange" operators are obliged to ensure availability on accounts in the banks of the Republic of Belarus of monetary means to the amount of not less than 1 million Belarusian rubles for a cryptographic-platform operator and not less than 200,000 Belarusian rubles for a "cryptocurrency-exchange" operator. A cryptographic-platform operator is entitled: to open accounts in banks and non-bank, credit-and-finance organizations in the Republic of Belarus and abroad for making settlements on trading and operations being carried out by them; to receive remuneration for services being rendered, including in tokens, to establish its amount and the order of collection from trading participants (customers); to perform (organize) transactions with residents and non-residents of the Republic of Belarus, aimed at placement of tokens, including abroad, acquisition and/or alienation of tokens for Belarusian rubles, foreign currency, electronic money, exchange of tokens for other tokens in the interests of customers or in own interests; to perform (organize) other transactions (operations) with tokens, with the exception of operations on the exchange of tokens for civil-right objects other than Belarusian rubles, foreign currency and electronic money. If the rights validated with a token are transferred to another person, it is enough to transfer the token to that person, except for the case of transfer of a right that

requires entry in state registers. A token transfer will be considered completed when the operation of transfer is reflected in the blockchain transaction ledger or in another distributed IT system based on the applicable principles (protocols). It is admissible to use tokens as remuneration for verification, to perform other operations in the transaction blockchain ledger or in another distributed ledger technology system. The projects in the scope of information and communication technologies, including with the use of transaction block ledger technology or DLT, may be executed under civil law partnership agreements.

The latest legal regulations in the world related to tokens and smart contracts is the Maltese Virtual Financial Assets (VFA) Act[253] of 5 July 2018. In combination with two others (Innovative Technology Arrangements and Services Act[254] and *Malta Digital Innovation Authority Act*[255]), that act regulates the manner of issuing tokens, state-authority supervision and protection of participants in token trading. However, as there are many types of tokens, a token may be considered not only a security or a financial instrument, but also a cryptocurrency or identification item.

The size and variety of tokens result in a situation when they will never meet the definition of securities or financial instruments. It is necessary to examine them each time from the legal point of view. Sometimes they will constitute cryptocurrencies, other times – identification items, used for the purposes similar to securities, i.e., embodying certain entitlements due to their holder, or solely for identification purposes, i.e., to entitle the given person to collect certain benefits. Their identification function[256] (Machnikowski, Kodeks cywilny. Komentarz, 2016) consists of facilitating performance of obligations, including identification of the persons entitled. What is important is that in terms of identification items, the term "document" (being an identification item) should be interpreted broadly. It may be any material that allows the recording of certain characters on account of the new definition of the term document, not necessarily a tangible one.

To sum up, as a technological tool, in practice a token does not change a lot in legal terms, but constitutes an interesting and innovative implemen-

253 http://justiceservices.gov.mt/DownloadDocument.aspx?app=lp&itemid=29079&l=1, access on 8 November 2018.
254 http://justiceservices.gov.mt/DownloadDocument.aspx?app=lp&itemid=29078&l=1, access on 8 November 2018.
255 http://justiceservices.gov.mt/DownloadDocument.aspx?app=lp&itemid=29080&l=1, access on 8 November 2018.
256 P. Machnikowski [in], Kodeks cywilny. Komentarz, Warsaw 2016, p. 1670.

tation of law in programming codes. It will be interesting to observe its development, as well as development of the legislation related to it.

"Smart contracts" as private law

"Smart contracts" and lawyers

Over the last twenty years, we have been witnessing an extremely fast development of technology as well as ICT systems. The development affects different sectors of the economy, thus producing a completely new one, i.e., a "digital" economy, supraterritorial and global in character. Even some lawyers are surprised by the character of some agreements, and of the law applicable to them, or to the location of data storage, not necessarily associated with the domicile of the persons concluding them.

The appearance and use of blockchains and establishment of "smart contracts" is the next stage of the above-mentioned development process. It is impossible for "smart contracts" to replace laws, or lawyers, but they will result in new specializations and competences. It would be impossible to stop the development of "smart contracts", which streamline and facilitate business processes in many sectors, such as power or logistics, which is reflected in financial results. It should be remembered that they only constitute tools, not laws, and as tools, they are going to be developed while implementing laws, not replacing them. Since the very start of the development of new technologies, lawyers have been using IT tools that change the way they function, but also generate the demand for specialist knowledge and competences. The blockchain is just another stage of development – a difficult stage, because at present few lawyers deal with it, just as few lawyers dealt with the issues of using electronic mail or websites twenty years ago. The uses of new technologies in lawyers' work may be divided into: a) using specialist online platforms and databases (of legislation, publications, judgments, etc.); b) using ICT tools for contacting clients, courts or administrative authorities (emails, electronic registry offices, video conferences, etc.) – put simply, quite often previous activities are performed in a digital form (an email is sent instead of a traditional letter); c) transferring data and resources to clouds and sharing resources with colleagues, and sharing data with clients using a cloud (those activities are being slow-

ly, but systematically, implemented and accepted by lawyers[257]); d) automating [258] the processes by using wizards, templates, automaticityin filling in data, e.g., based on xml (automation takes place at different levels and stages; right now it is usually partial and requires external sources, and often, also physical initiation by a person (currently, we are witnessing the initial phase of that development)); e) using DLT and blockchains as new ways of recording data (the initial stage or the start-up phase); f) using "smart-contract" tools for concluding or performing agreements (the initial stage or the start-up phase) and g) legal engineering[259] – connecting legal regulations, as theses, with IT modules being program codes (implementation of legal provisions to programming codes (Furlog, 2012)) – that concept is at an experimental, pilot phase, executed within scientific research[260]. Each of these stages refers to a change or development of the

257 That process in the EU was significantly accelerate by issue of CCBE (Council of Bars and Law Societies of Europe) guidelines of 19 May 2017. See also D. Szostek (ed.): Bezpieczeństwo danych i IT w Kancelarii prawnej, Warsaw 2018 p. 303 et seq.

258 S. Schrebak : Integrating Computer Science into Legal Discipline: The Rise of Legal Programming, p. 7 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2496094 of 22 July 2018.

259 See about law engineering: S. Schrebak : Integrating Computer Science into Legal Discipline: The Rise of Legal Programming, pp. 1-33 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2496094 of 22 July 2018.

260 The development of legal engineering, just like the development of other types of expert systems, takes place in stages. Scientists assume different classifications of such stages. Developing the system of the code implementing legal regulations takes consists of the following stages: identification, i.e., describing what problems will be solved by the system, how and who will use it; conceptualization, ensuring formalization of lawyers' knowledge; prototyping, i.e., developing a prototype for initial testing purposes, identification and elimination of functional defects; development of the user interface; and testing and redefinition, which includes testing of the system. Expert systems are the systems that contain in-depth and rich knowledge at expert level in the given specialized field, functioning automatically. In law, they are called LES (Legal Expert Systems). They consist of the following elements: a database of knowledge representing the information used by the system in the process of solving problems; the mechanism of inference which, at different levels, consists of artificial intelligence or advanced algorithms that ensure interaction between the database of knowledge and the input data related to the problem which is to be solved, and presents the conclusions based on that interaction, as well as a user interface – the mechanism that ensures exchange of information with the user. See Jordan Furlong, 'The evolution of the legal services market: http://www.law21.ca/2012/11/the-evolution-of-the-legal-services-market-stage-1/, http://www.law21.ca/

tools used, but none of them will replace laws, even though they will affect laws and force adaptation to the changing reality and needs[261].

Custom, common law, lex mercatoria, arbitration and smart contracts

Nowadays, smart contracts are developed by private entities using so-called legal engineering, creating so-called ecosystems which, as indicated above, may take different forms, open, closed, functioning in a closed ecosystem or one that requires an additional source of data, etc. Closed smart contracts, functioning within one organization, usually subject to one jurisdiction, do not pose problems. A challenge is presented by the more and more popular smart contracts of a global character, functioning solely in cyberspace, for entities that function in different legal systems. The global character and tool of smart contracts significantly impacts agreement standardization, but also those laws applicable to them. The first chapters of this study indicate the significant impact of custom, standardization, and also technical norms, on the application of laws in cyberspace. It is possible, but not certain, that, in the foreseeable future, the regulations included in smart contracts will constitute legal references, like ISO norms for IT. And it is not so much production of some new norms, unknown before, but rather implementation of the already existing norms in programming codes, allowing them to be applied to a higher or lower degree. That is because the international trade of today already exists lex mercatoria (e.g. INCOTERMS) or standardized rules (e.g., UNIDROIT, PECL or DCFR) (Popiołek, 2013). Smart contracts may constitute the tool allowing them to be more easily applied together with any other rules, functioning today, regarding international agreements and interpretation thereof (e.g. within hybrid smart contracts).

The English literature (Goldenfine and Leiter, 2018) indicates that the activities of the private entities[262] that develop libraries of transaction mod-

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2012/11/the-evolution-of-the-legal-services-market-stage-2/, http://www.law21.ca/2012/11/the-evolution-of-the-legal-services-market- stage-3/ of 1 August 2018.

261 An example in Europe is consumer law which, at the beginning of its development, mainly referred to traditional ways of concluding agreements with a consumer, while it currently covers the whole of eCommerce and, to a growing degree, also the digital economy.

262 Such as: Enterprise Ethereum Alliance,4 Mattereum, Open Law (2017), Agrello (2017),5 the R3 Consortium (2018), Common Accord, and Legalese (2017–2018).

ules readable in a natural language, thus establishing the foundations for more complex transactions, which are more and more often implemented in smart contracts, demonstrate many common features with development of lex mercatoria in the Middle Ages, customs or common law. The authors indicate that the initial Medieval documents were "technical" artifacts connecting human conduct with enforcement of the law. They were not prepared by judges, but by lawyers (public notaries) who developed the standards of legal grounds. Firstly, common law determines and specifies which behaviors are good or bad, and secondly, it allows the indication of the behaviors that are reasonable and acceptable, and finally, it interferes and authoritatively determines the rules of conduct. The medieval common law was a dictionary-based system: the contents, basic principles as well as structure were specified, to a large degree, on the basis of entries of documents in a catalog. Those cataloged documents were, in a way, functioning as a library of acceptable transactions. It is argued that the decision on what conduct is legal or not depends on the proper and available records. (Goldenfine and Leiter, 2018). It is also worth noting the medieval *lex mercatoria*, "when transactions performed by merchants from different states were subject to standards of common law. At that time, there developed the autonomous laws of merchants, considered common laws. The cause for that was the practical necessity to establish a quick and secure system of laws for the classified exchange of goods for money or transportation. They applied in the fairs located and functioning in many European cities. At that time, merchants' laws were supplemented with courts, the procedures of which resembled contemporary arbitration – the courts would resolve the disputes resulting from the agreements concluded at the markets. An important role was also performed by public notaries (lawyers) who legally shaped most agreements concluded in international trading[263] (Fuchs, 2013) (Fuchs, Lex marcetoria w międzynarodowym obrocie handlowym, 2000).

Lawyer's work consists of the ability to transfer reality to proper records in a document or a number of documents comprising a sort of register, so as to allow debt collection. In the Middle Ages there were agreements drawn up by public notaries, while nowadays agreements are drawn up by lawyers in cooperation with IT specialists in "smart contracts". The analogy

263 B. Fuchs: Lex mercatoria-term [in:] System prawa handlowego. Vol. 9, Międzynarodowe Prawo Handlowe, ed. W. Popiołek, Warsaw 2013, pp. 47-50; B. Fuchs: Lex marcetoria w międzynarodowym obrocie handlowym. Kraków 2000, p. 21 et seq.

to lex mercatiora from the Middle Ages is very visible, with the reservation that bartering from the past was replaced with "smart contract" ecosystems. Despite the passing of one thousand years, the issue of a lack of regulations (this time regarding the global digital economy), is solved in a similar way, especially that supranational arbitration constitutes the optimum method, often used in trans-border agreements within "smart contracts", (Sherborne A.) instead of domestic courts (allowing the possibility to overcome the issues with selection of the law and specialization of the arbitrators), the decisions of which are enforceable in domestic jurisdiction under the New York Convention (Goldenfine and Leiter, 2018). The issue is open as to whether the agreements within smart contracts will be subject to specialized authorities (arbitrations) which may also function online or, as is the current case, traditional arbitrations. Probably, arbitration is going to become, for many reasons, the preferred method of solving disputes related to smart contracts, and the disputes related to smart contracts will, in turn, lead to innovations in arbitration, because through the laws and procedures of arbitration the arbitration authorities will adapt to the needs resulting from the new types of disputes.

As some disputes related to "smart contracts" may be associated with evidence for existence of computer equipment and/or software, and there is the risk of disclosure of confidential information on source code, which may have serious commercial consequences for one or both parties, is better to agree that the disputes will be resolved through confidential arbitration and to limit disclosure of information. Some disputes related to "smart contracts" will be the disputes regarding laws and agreements, but others will be highly technical in character, for example if modules do not function according to expectations. It may be presumed that arbitration courts will probably, in time, establish groups of specialized arbiters with suitable experience, and will publish procedures adapted to the needs of the respective groups and types of "smart contracts"[264] (Rogers, Jones-Fenleigh and Sanitt, 2017).

264 J. Rogers, JH. Jones-Fenleigh, A. Sanitt: Arbitrating "smart contract" disputes [in:] International arbitration report, October 2017r. Northon Rose Fulbright http://www.nortonrosefulbright.com/files/20170925-international-arbitration-report-issue-9-157156.pdf of 23 September 2018. p. 23.