Algorithmic Contracts in European and United States Contract Law - A Comparative Legal Analysis

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Abstract - **Although perhaps still abstract to many, the term 'algorithmic contracts' may soon become as common and more widely known as the - equally abstract-sounding - cryptocurrencies (bitcoin), smart contracts, or blockchain. Algorithmic contracts are a separate category from smart contracts, the so-called digitally enhanced contracts, and are contracts in which an algorithm determines the obligations of the parties - this is how L. Scholz aptly described the essence of these contracts.**

In my presentation, I would like to analyze whether current contract law in the European Union is adequate for algorithmic contracts, i.e., can an algorithm effectively make fundamental determinations about the content of a contract, and will such provisions bind the parties? Will it be possible to invoke an error of declaration of intent in the case of a malfunction of the algorithm caused, for example, by a systems failure, or in a situation where, admittedly, there was no failure, but the algorithm misanalyzed the data?

I would also like to refer my considerations to the US legislation and the views of doctrine representatives presented there and further answer the question of whether the regulatory approach adopted there could also guide possible developments in European law.

Keywords - component; formatting; style; styling; insert (key words)

I. INTRODUCTION

For lawyers dealing with the law of new technologies, it is obvious that it is necessary to seek answers to a number of legal challenges and problems that successively arise in connection with the development of information technologies. Paraphrasing the Latin ubi societas ibi ius, one can say that where there is technology, there, is also law. Thus, in the past, the scientific discourse focused on issues related to the provision of electronic services, cloud computing, personal data protection and, more recently, issues related to Blockchain, smart contracts, the Internet of Things or artificial intelligence. At present, there seems to be a lack - at least on a scale comparable to that concerning artificial intelligence - of discussion concerning algorithmic contracts, although undoubtedly this topic seems to have a high practical relevance. It should be mentioned that, as early as 2021, algorithmic contracts were already used in more than half of the high-frequency trading in the US financial markets [1]. In the consumer market, too, so-called algorithmic contracts are increasingly common, a good example being, for example, the purchase of airline tickets.

II. ALGORITHMIC CONTRACTS – CONCEPT, TYPOLOGY AND CHALLENGES

Algorithmic contracts are contracts in which an algorithm determines the obligations of the parties - this is how Lauren Henry Scholz aptly defined the essence of such contracts in 2017 in one of the first works devoted to this issue [2]. Following the definition cited above, Yasmine Benaich, on the other hand, proposed that algorithmic contracts should be understood as contracts whose terms are defined in whole or in part in a code that allows the automation of an algorithm, which can act not as a tool but as an agent of the parties, depending on the importance, complexity, and predictability of the decisions delegated to it [3]. Importantly, however, these algorithmic actions can take on different forms, making this category of contracting not uniform.

And so, as indicated by L.H.Scholz, algorithmic contracts can be differentiated according to the role to be played by the algorithm - i.e. whether as a tool or as an "agent", further according to the task to be assigned to the algorithm (gap filling or negotiation) and further taking into account the criterion of the algorithm used, i.e. a black box algorithm or a clear box algorithm [4].

And so, an algorithm can act as a "negotiator" before a deal is made, and in doing so the parties specify the conditions to be offered or accepted that the algorithm can apply. An example is the so-called high-frequency trading, which is widely used in financial markets mainly in the United States. Such contracts in practice are concluded by an algorithm, which can react quickly to changes in the financial market and allows the submission and eventual execution of orders at frequencies determined in milliseconds. It is the algorithm that sets individual order parameters, such as the conditions for triggering an order, the timing of its execution, the price or quantity of the instruments subject to the order, or how the order is managed once it is placed, with limited or no human involvement.

Another group is contracts in which the algorithm fills in so-called gaps. Their essence will be that the algorithm fills a gap in a standardized set of conditions. Such a classic example of contracts based on a gap-filling algorithm are those concluded for the purchase of airline tickets, where the price of the offered ticket will be determined by the algorithm based on such data as the time of ticket purchase, the number of flights, etc.

In summary, for a contract to qualify as an algorithmic contract, it must meet certain necessary conditions, viz:

1. These are agreements based on pre-built decision-making models.
2. The role of the man actually comes down to the notion of deciding what the role of the algorithm is, i.e., as a "negotiator", or "agent" of the parties or as a tool to determine and fulfill in the contract those provisions that the parties have not previously agreed on.
3. They are characterized by automaticity

The way an algorithm works or can work directly creates all sorts of challenges that need to be realized. And so the use of algorithms to determine terms in a contract creates the possibility of outcomes that are not and indeed could not have been anticipated by the algorithm's creator. An algorithm can produce a result that is unpredictable. A kind of knowledge gap is created, which is dangerous not only for the entity using the algorithm but also for those who want to enter into such a contract. These concerns are not merely theoretical today. For example, point to the situation where a book on flies was priced at $24 million by pricing algorithms that erroneously adjusted prices based on competitors' expectations [5]. Also worth mentioning is the case of Quoine v B2C2, in which the transaction was conducted through an algorithm. Quoine operated a market where investors could exchange BTC (Bitcoin) and ETH (Etherum). Due to a technical problem, Quoine's market maker program temporarily did not have access to external price data for BTC and ETH3. As a result of the above, B2C2 started offering ETH at a reserve price, which was programmed into B2C2's algorithm as a hedge. As a result, B2C2 bought millions of dollars of BTC at a rate 250 times more preferred than the market rate. When Quoine realised the algorithm was wrong, it took action to undo the transaction citing the error. B2C2 filed a lawsuit, claiming that the transactions should be binding [6].

In light of the above, a number of questions arise almost intuitively on the subject of the adequacy of the current provisions of contract law to the reality created by these contracts, i.e. from those concerning the possibility or effectiveness of making legally binding declarations of intent by the algorithm or the possibility of claiming a declaration of intent error in the event of a disruption in the operation of the algorithm. In this context, in turn, the comparative legal perspective between the legal order of the United States and the legal orders of individual European countries seems particularly interesting, and this is due, among other things, to the fact that in the United States, the scientific discourse seems to be much further advanced.

III. ALGORITHMIC CONTRACTS AND U.S LAW

The issue of using simple algorithms to make a contract has been debated among scholars as far back as the 20th century. In their book,, Can Computers Make Contracts," Tom Allen and Robin Widdison stated that 'neither American nor English law, as they currently stand, would confer legal status on all computer generated agreement' [7]. Currently, however, both representatives of the doctrine and the legislation itself seem to present some concepts different from those presented above.

First of all, as far as legal standards are concerned, it is necessary to point to the Uniform Electronic Transactions Act (1999) (UETA) (*"Uniform Electronic Transactions Act" (PDF). uniformlaws.org. National Conference of Commissioners on Uniform State Laws. 1999. Retrieved April 10, 2022.)* and the Electronic Signatures in Global and National Commerce Act of 2000 (‘E-Sign Act’).

UETA provides uniform rules governing electronic commerce transactions. It establishes a legal foundation for the use of electronic communications in transactions where the parties have agreed to deal electronically.

UETA validates and supports the use of electronic communications and records and places electronic commerce and paper-based commerce on the same legal footing [8].

According to H.L.Scholz, the UETA is the piece of legislation that facilitates the creation of algorithmic contracts in that it equates electronic records and signatures with paper records and handwritten signatures [9]. Moreover, this author concludes that the UETA includes an understanding of algorithms as agents [10]. At the same time, however, attention should also be paid to the voices of those representatives of the doctrine who point to certain doubts that may arise in the context of algorithmic contracts considering the provisions of the UETA. Well, the authors S.Chopra and L. White, referring to Section 9 of the UETA, which states that an electronic record or electronic signature is attributable to a person if it was the act of the person” pointed out that this provision allows for the possibility of avoiding a situation in which responsibility for the mistakes of artificial agents is assigned to the operator or user. However, in the opinion of these authors, this provision is not fully clear. This is because it is difficult to judge based on its content when a particular record or signature will not be the act of a person. This will be especially difficult when the system is malfunctioning in such a way that one might be tempted to conclude that a new act (agent) has occurred [11].

As previously indicated, in the context of algorithmic contracts, the E-Sign Act, which requires that the actions of an artificial agent be "legally assigned" to its user, will also be legally relevant, with the statement that,,A contract. . . may not be denied legal effect, the validity or

enforceability solely because its formation, creation or delivery involved the action of one or more electronic agents so long as the action of any such electronic agent is legally attributable to the person to be bound" [12].

In the context of the above, it seems quite obvious that the consensus also seems to be that it is possible under US law to qualify certain activities of algorithms as electronic agents. Hence, it may not be surprising to see L.H.Scholz's recognition that since algorithms act as humans the law of agency is the appropriate source of law in this regard, but nevertheless, a qualification assuming that the algorithm is not a human being should be included. Ultimately, it is possible to consider an algorithm as an agent without legal personality or as a quasi-agent for the purpose of understanding the legal obligations of their principles [13].

Parallel to the above, which also cannot be fastened, is the evaluation of the algorithm as a mere tool, which only implement the will of their owners without the ability to learn and make decisions. However, as L.H.Scholz rightly points out, already today the acceptance of this position is not fully possible given the capabilities of their operation [14].

IV. ALGORITHMIC CONTRACTS – EUROPEAN PERSPECTIVES

When analyzing the regulatory environment for algorithmic contracts in Europe, it should first be emphasized that there is currently no single piece of European Union law that comprehensively regulates the issues related to these contracts. Furthermore, it should be pointed out that there is currently no single, extensive, and coherent concept of contract law in European Union law. However, there are some European regulations that explicitly address the subject of obligations, such as, for example, directives related to consumer trade or product liability, etc. The only significant achievement in this area is the fact that the European Union has now adopted a single, comprehensive, and coherent concept of contract law. The only significant achievement in the unification of European contract law is the Principles of European Contract Law (PECL), which, and it should be emphasized, act as an instrument unifying contractual practice, and not a strictly normative act. Therefore, the purpose of this work is firstly to signal the challenges that algorithmic contracts may bring to contract law, and secondly to present the concepts and views emerging in individual European countries (in and outside the European Union). These goals are vital since the above-mentioned lack of regulation in the area of European Union law makes a comparison of the law in the European Union and the law of the United States problematic. At the same time, it is not possible to discuss the legal systems of individual European countries in detail in this paper, if only due to editorial limitations, and therefore the analysis will be limited to presenting the views of various doctrines established by different European countries concerning such fundamental issues such as for example, the question of freedom of contract or declaration of intent.

First and foremost, it seems indisputable that the decision of the parties on whether or not to conclude a contract using an algorithm is within the bounds of the principle of freedom of contract, which is deeply rooted in all legal systems of European countries. Also the previously mentioned Principles of European Contract Law – PECL, Article 1:102 states that Parties are free to enter into a contract and to determine its contents. Thus, if the 'effect' of the algorithm is known to the parties in the light of the above mentioned principle, a contract concluded using the algorithm is legally binding. The views of the doctrine which states that a declaration of intent can be made in electronic form, including by automated means, and by doing so not affecting its validity, remains valid.

Even though the above conclusion states that a declaration of intent remains valid, the questions remains open – whether automated declarations of intent fall within the concept of a declaration of intent at all? [15].

The answer to this question was one of the first to be sought after by the representatives of German legal doctrine as early as in the 1960s. In German science, this issue is compared to the analogy for affixing a handwritten signature to a *blank* statement. It is pointed out that a person who signed and gave such a statement to another person will be bound by its contents, although in essence, he had no way of predicting what content would be placed above the signature. Someone who signs a *blank* document must expect that their declaration will be treated as a statement of intent and that there is a risk of the document being filled out contrary to the will of the signatory. According to the concept presented, the source of the imputation of the legal effects of a statement of intent is not the will of the one making the statement, but the confidence induced by the statement in other participants in the binding force of the statement. And this view can also find its application in algorithmic contracts [16].

Establishing that we will be dealing with a statement of intent, moreover, allows us to seek an answer to another question, namely, what if the content of the statement made by the algorithm was not anticipated or was not even foreseeable by the person using the algorithm?

The answer to this question will depend on what caused the operation of the algorithm not to coincide with the statement of intent, i.e., whether the cause is an error inherent in the algorithm itself or at least in the operation of the antivirus.

If there has been a distortion of the statement of intent due to an error inherent in the algorithm, it would seem that entities using algorithms should bear strict liability for legally momentous actions performed through these algorithms, and this is due to at least the following two circumstances:

- The certainty of economic trading as that which prevails over individual interest

- Algorithms often make statements en masse, so potentially evasion can have incomparably more serious consequences than if they were made individually.

Based on the views outlined above, the so-called concept of declaration of intent based on the principle of liability for induced trust has been formed in German doctrine, according to which declarations of intent made in the context of electronic communication will concern those behaviors to be a manifestation of the will of the sender, or in other words – the user of the program [17].

Polish doctrine, on the other hand, emphasizes that when assessing the problem of a possible discrepancy between the content of statements generated in an automated manner and the user's actual will, priority should be given to the protection of the entity acting in reliance on the declarant's conduct and the resulting legitimate expectations [18].

As for Anglo-Saxon doctrine, on the other hand, this doctrine, to some extent analogous to the views presented on the backdrop of U.S. legislation, has developed the concept that protection should be granted to such an interpretation of the programmed machine's actions as would be shared by reasonably judgmental addressees. This concept was developed on the basis of the 1971 English court decision in Thornton v. Shoe Lane Parking, where the court held that a parking machine expressed the will of its owner, and the good faith of customers should be protected [19].

At the same time, however, it should be pointed out that if the other party could have easily noticed that an error had occurred, then such an entity using an algorithm can claim a legally relevant error. Thus, if the entities using algorithms are usually entrepreneurs whose goal is to conclude economically beneficial transactions, the question should be asked whether the mere fact of quoting an obviously low price for a good or service should arouse suspicion of the existence of an error on the part of the submitter. That should certainly be decided in the circumstances of a particular case, and not at the legislative level.

Of course, the above mentioned concepts are not uniform in all EU countries, so I would like to refer to the model law. And so art. 4.110 Principle of European Contract Law states the party may avoid a contract for a mistake of fact or law existing when the contract was concluded if the other party knew or should have known of the error, and leaving the party in error was contrary to the principles of good faith and fair dealing. Also, the Unidroit Rules state that each party should act (including in shaping the content of the contract) in accordance with the principles of good faith and fair dealing.

In conclusion, it should be pointed out that the principles of an algorithmic contract essentially correspond to the content of the contractual provision. Moreover, due to the principle of freedom of contract, it may be concluded that an algorithm can create a binding contract.

However, in a situation where the final content of the contract does not correspond to the intention of the parties, the possibility of evasion will depend on other circumstances. However, it is important to remember that a statement of intent – regardless of its form, technological environment, time and place of submission, and other factors – always remains the same institution of civil law. Any other assumption would have to be considered unhelpful on pragmatic grounds, as it would complicate incredibly business transactions. Importantly, in the case of algorithmic contracts, it is also relevant to refer to the so-called meta-principles, i.e. good faith and fair dealing.

Of course, at this point, it is very important to note that the issues related to algorithmic contracts are not limited to those related to the statement of intent, but as shown above, European doctrines tend to focus around this issue.

V. CONCLUSION

The above considerations lead to the conclusion that although the current theoretical and legal approach to algorithmic contracts in the United States or some European countries seems to focus on other issues, in both cases it seems indisputable that these contracts are fully legally binding and admissible. Moreover, the current regulatory environment makes it possible to assess that contract law is neither archaic nor completely out of step with the realities created by the reality of new technologies, for many views already developed by doctrine representatives can also be successfully applied to algorithmic contracts. Of course, the above does not exclude the need for further debate in this area, the development of certain guiding principles or model rules, or even certain legislative changes, but these are not revolutionary changes. Nor is it the case, contrary to what is commonly assumed about issues related to new technologies, that the emergence and subsequent spread of algorithmic contracts leave several legal questions unanswered. It is therefore entirely possible to agree with M. Olivier, who rightly states that "Thus, the problem for contract law is not so much that these contracts are doctrinally unenforceable, but rather that contract law doctrines need to adapt to explain why these contracts are enforceable" - which both doctrinal representatives from the United States and individual European countries seem to do as demonstrated in this work.

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