Concept of Smart Contracts – A Legal Perspective[1]

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Hukuki Yönden Akıllı Sözleşme (Smart Contract) Kavramı

Özet

Teknolojik gelişmeler, gittikçe önem kazanan yeni hukuki kavramların da önünü açmaktadır. Günlük hayatta, Özel Hukuk alanında en çok gerçekleştirilen hukuki işlem türü sözleşmelerdir. Bu özelliği itibarıyla, söz konusu teknolojik gelişmeler, Sözleşme Hukuku alanında üzerinde büyük ve hızlı bir etkiye sahip olmaktadır. Akıllı sözleşme (smart contract) kavramı da teknolojik gelişmelerin, Sözleşme Hukuku alanına getirdiği son gelişmelerden biridir. Esasen, akıllı sözleşme kavramı, adının uyandırdığı izlenimin aksine, yeni bir sözleşme türü olmayıp; sözleşmeden doğan borçların ifası bakımından önemli çözümler getiren bir kavramdır. Çalışmamızda, akıllı sözleşme kavramının tanımı yapıldıktan sonra, akıllı sözleşmenin teknik altyapısı ile ilgili temel bilgiler verilecek ve akıllı sözleşme sürecindeki işlemler hukuki yönden nitelendirilecek ve akıllı sözleşmenin avantajları ve dezavantajları ortaya konulacaktır. Ayrıca akıllı sözleşmelerin hukuki yönden sağlayacağı kolaylıklar ile uygulamada ortaya çıkabilecek olası sorunlar da tartışılacaktır.

Anahtar Kelimeler: Akıllı sözleşmeler, sözleşme hukuku, teknoloji ve hukuk.

JEL Kodları: K12, K22.

Abstract

Technological advances pave the way for new legal concepts with increasingly high importance. Contracts are the most conducted legal transactions in daily life. Thus, technological advances have a great and fast effect in field of Contract Law. Concept of smart contract is one of the latest developments of Contract Law that is introduced by technological advances. Smart contract is not a type of contract, contrary to the impression based on term, but it is a new concept bringing important solutions to legal enforcement of contractual obligations. In our article, a definition of smart contract concept is given at first, then basic information about technical infrastructure of smart contracts shall be discussed briefly, while transactions carried out in process of smart contracts along with advantages and disadvantages brought by smart contracts are analyzed. Furthermore, legal advantages that will be brought by smart contracts and possible legal problems are also discussed.

Keywords: Smart contracts, contract law, technology & law.

JEL Codes: K12, K22

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Introduction

Concept of smart contracts is a new phenomenon in both law and technology. As technology advances with ever increasing speed, law is also trying to adapt to these advancements to sustain legal order and prevent or solve possible new legal disputes that may be introduced by the new technologies. Technological developments has a significant effect on private law and in particular contract law while they bring new ways of doing business and re-order classical legal transactions (De Franceschi, 2016: 3). Thus contract law is one of the most related and effected fields of law by technological advances. For example, in-app purchases, household apps, bitcoin and other types of crypto currencies either bring a new dimension to an aspect of contract law or bring an urge to already settled concepts of contract law[2]. On the other hand, it cannot be automatically accepted that every single one of those developments requires new legal solutions apart from current doctrine of contract law or make a significant change in settled concepts of contract law (Raskin, 2017: 306; De Franceschi, 2016: 3-4).

Although most of these are touted as "ground breaking new technologies", existing legal rules, concepts and doctrines are more than enough to deal with all these "ground breaking new technologies" most of the time. In other words, it is not usually necessary to invent new legal rules or approaches to solve legal problems brought by new technologies; as it is more appropriate to keep a simple approach and try to implement existing rules (Raskin, 2017: 306).

This article analyzes smart contracts from legal perspective. In Part I, we describe brief history of the concept and take a look at terminology. Moreover, basic information regarding technical process of smart contracts is also provided in this part. An overview of defining features of smart contracts is given in Part II, while brief remarks regarding those functions are also made in this part. We try to determine legal nature of smart contracts in Part III.

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[2] See infra 1.3 for explanations regarding whether in-app purchases qualify as smart contracts or not.

1. **Brief History of Smart Contracts and Terminology**

1.1. **Brief History**

Although smart contracts have been increasingly apparent in practice and a growing number of articles are being published about them by legal and IT specialists, the concept itself is not as young as it may seem. The term of "smart contracts" have well been used since 1996. It was first used in an article named "Smart Contracts: Building Blocks for Digital Markets" by Nick Szabo (Szabo, 1996). Contracts which are "coded"; and computerized performance of contractual obligations are also not new (Werbach and Cornell, 2017: 320). Contracts concluded in digital environments such as internet have also been used for more than two decades; however, this is a different concept than smart contracts, as explained below (see infra II, C).

Main idea behind then was and is now embed contracts in hardware and software so that performance and counter performance of obligations are performed through computer programs (Kaulartz and Heckmann, 2016: 618). The idea of smart contracts is based on expectation that without human intervention in performance of obligations risks and transaction costs shall be reduced (Kaulartz and Heckmann, 2016: 618). Furthermore, with smart contracts, people don't need to trust each other, but only to trust the machine to function right (Kaulartz and Heckmann, 2016: 618).

With emerge of block chain, smart contracts have been realized in real sense. On the other hand, one should keep in mind that although the term became popular in last few years, the idea has been discussed for more than 20 years. However, it was not until emergence of Blockchain for smart contracts to be widely discussed as previous technologies weren't suitable to reduce risks and transaction costs (Mik, 2017: 274).

Blockchain is a mechanism consisting of chains of records which serves a as a distributed or shared ledger. Since all records in a Blockchain are distributed through the network and cryptographically secured, it is very hard to tamper and alter the data (Jaccard, 2017: Nr. 14).

2. Terminology

It must be stated that there is not a single definition of smart contract (Savelyev, 2017: 120; Mik, 2017: 272; Raskin, 2017: 310). Furthermore, there are a lot of different definitions as legal scholars or legal professionals and computational scientists and/or IT professionals have usually tried to make definitions based on different aspects of the subject (Mik, 2017: p. 272). This is partly based on different perspectives of IT professionals and legal scholars and partly based on idea fascinated with digital revolution which sees digital revolution as a possible answer to all legal problems (Mik, 2017: p. 272). It also led to acceptance of smart contracts as software by some scholars, while some other scholars approaches the concept in legal sense. Some of the definitions are cited below in order to show differences. On the other hand, it must be stated that definitions below are not the only ones and there are many other definitions.

According to definition of smart contracts by "inventor" of the term Szabo; "A smart contract is a set of promises, specified in digital form, including protocols within which the parties perform on these promises" (Szabo, 1996).

Mik states that "smart contracts can be regarded as self-executing ledger-modification instructions, eg 'if X occurs, send Y amount of token from public address A to public address B'" (Mik, 2017: 277).

Another definition by Greenspan that is also mainly shared by Savalyev is as follows; "A smart contract is a piece of code which is stored on a Blockchain, triggered by Blockchain transactions, and which reads and writes data in that Blockchain's database" (Greenspan, 2016; Savelyev, 2017: 120).

Raskin defines the concept as; "a smart contract is an agreement whose execution is automated" (Raskin, 2017: 309).

According to Meyer/Schuppli, smart contracts are digital programs which are "based on Blockchain, that execute themselves when certain conditions occur and self-executive and tamper-proof due to decentralized and cryptographic design of Blockchain" (Meyer and Schuppli, 2017: 208) .

Kaulartz/Heckmann defines smart contract as "a software, which uses, controls or documents legally relevant actions (in particular an actual exchange of performances) depending upon digitally verifiable events, under certain circumstances with the help of which real or promissory contracts can be concluded" (Kaulartz and Heckmann, 2016: 618).

Although there are various definitions, it may be safe to state that similar definitions based on basic features of smart contracts have begun to be accepted among legal scholars who have dealt with the subject.

Despite its name, "smart contracts" are not "smart" and their legal nature as "contract" in legal sense is disputed (Werbach and Cornell, 2017: 340-341). First of all, "smart" is not equivalent of "intelligent" or "artificial intelligence" but is used in a sense that signals an ability to connect and exchange data with other users.

Focusing on features of smart contracts would be helpful (see infra III). Smart contracts may be defined as computational codes that is built on Blockchain technology in order to sustain self-enforceability and tamper proof (incorruptibility) which executes contractual performance in a trustless manner and automatically when conditions which are coded are fulfilled without any human intervention.

2.1. Similar Concepts

Mik reports that vending machines are incorrectly evaluated as earlier examples of smart contracts in articles written by IT professionals (Mik, 2017: 274). This confusion is understandable as vending machines seem to automate formation and enforcement of contracts (Mik, 2017: 274). Since, contract is formed whenever a person inserts the price of goods or makes payment by a credit card via reader on vending machine and selected good is dispensed automatically by vending machine, process resembles automation of formation and enforcement of the contract. However, vending machine does not conclude contracts nor enforce them as it just dispenses selected good while it cannot automate contractual terms other than price and dispense of the selected good (Mik, 2017: 274) and its legal nature is considered as an offer to third parties at large (offer and

invitation to treat) (Beatson et al., 2010: 35; O'Sullivan and Hilliard, 2012, Nr. 2.23; Angus et al., 2006: 116; Mik, 2017: 274; Thornton v Shoe Lane Parking Ltd. [1971] 2 QB 163)[3]. Furthermore, owner of the vending machine has a discretion over the fate of contract as it has the authority to interfere with process of the machine (Savelyev, 2017: 121). Moreover in transactions with vending machines, one party of the contract is a human being thus contract is not totally free from human intervention as that party either inserts the price of goods or makes payment by a credit card via reader on vending machine manually (Savelyev, 2017: 121).

Legal transactions carried out in digital platforms may also be confused with smart contracts. Such transactions carried out in digital platforms like Amazon or Ebay do not constitute a smart contract as contract is executed by human intervention (Werbach and Cornell, 2017: 321). Furthermore such transactions are carried out through internet and they "are heavily mediated due to the need to compensate for the deficiencies of the internet" (Mik, 2017: 278). For example, in-app purchases which vary from different items for video game characters to news site articles or buying a plane ticket through smart phone application of an airline or downloading an e-book for your kindle via Amazon does not qualify as smart contracts. In all of these examples, direct human intervention/inclusion is necessary to conclude the transaction and all of them require further intermediaries for a secure transaction. On the contrary, smart contracts neither require direct human intervention/inclusion especially for performance nor intermediaries for a secure transaction.

Electronic and/or online payment systems like Paypal present payment services and they cannot be considered as smart contracts while they are instruments only for performance of one of contracting parties' obligation. On the other hand, both the payment and the delivery are executed by the smart contract. Furthermore, contracts which one of parties' obligation is performed by electronic or online payment services may be concluded either verbally, in writing or online, while smart contracts are

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[3] On the other hand, legal nature of display of goods in vending machines constitute an offer or an offer to third parties at large (offer and invitation to treat) is debated in Swiss and German law. For details please see Kocayusufpaşaoğlu, 2014: 181.

concluded, verified and performed solely digital. Moreover, electronic or online payment systems are based on different technological infrastructures while smart contracts are based on Blockchain.

2.2. Technical Process of Smart Contracts

Blockchain is usually directly associated with cryptocurrencies like Bitcoin, Ethereum, etc. However, Blockchain technology is not only used for cryptocurrencies; and smart contracts' technological infrastructure also depends on Blockchain. Smart contract agreements are formed as computer codes and stored on a Blockchain (Sklaroff, 2017: 273). So, in order to understand technical process behind smart contracts, Blockchain is also need to be analyzed closer.

Savelyev defines Blockchain as "a decentralized distributed database of all verified transactions that take place across a P2P-network system operating on cryptographic algorithms" (Savelyev, 2017: 119). According to Raskin; "a blockchain is a decentralized collection of data that is verified by members of a peer-to-peer network" (Raskin, 2017: 317). Blockchain is a set of interconnected blocks, each of which has a list of all prior transactions between the blocks (Mik, 2017: 277). This database created by collection of data in the interconnected blocks form a distributed ledger. Distributed ledgers require the contained data to be stored safely (Sillaber/Waltl, 2017: 497).

Production of new blocks is only possible by a significant computational work which is also called "mining" (Mik, 2017: 277). To interfere or corrupt a block is not preferable because of its cost and hardness (Mik, 2017: 277). Moreover, an alteration in a block must be recorded to all the other blocks, thus meaning a modification in every single block in the chain. For this reason, Blockchain is considered incorruptible (Mik, 2017: 277).

Basically, computer codes on a Blockchain platform is used to determine and verify whether the contractual terms for enforcement of a contractual obligation is met and if they are met, contractual obligations are automatically enforced by computer code again (self-executed without human interference) (Werbach and Cornell, 2017: 334) . The most popular example for smart contracts is regarding car leases (Raskin, 2017: 319; Kaulartz/Heckmann, 2016: 618). A smart contract may be programmed into a leased car's board computer so smart computer may audit whether leasing payments have been

made or not and if not block car's ignition system so that lessee cannot simply drive the car (Raskin, 2017: 319; Kaulartz/Heckmann, 2016: 619). Such smart contract may be formulated as "Check the bank account of lease company on 1st day of each month. If payment isn't made, then immobile the car".

Sillabel/Waltl states that life cycle of a smart contract consists of four stages which are creation, freezing, execution and finalization (Sillabel/Waltl, 2017: 498-499). According to Sillabel/Waltl, creation is the phase in which parties agree on objectives and provisions of the contract - simply contract negotiations - then turn those provisions into computer codes (Sillabel/Waltl, 2017: 498). After the provisions of contract are coded, they are submitted to Blockchain. Persistence of majority of participating nodes is named as "freezing" by the authors during which *any transfers made to the wallet address of the smart contract are being frozen and the nodes take on the role of a governance board, ensuring the preconditions for executing the contract are met*" (Sillabel/Waltl, 2017: 499). Validation and execution of contract is being carried out in execution phase (Sillabel/Waltl, 2017: 499). After execution, storage and confirmation is called finalization in which the contract is fulfilled (Sillabel/Waltl, 2017: 499).

3. Features of Smart Contracts

3.1. In General

There are three basic features of smart contracts that also define the term. These are sole digital structure, trustlessness and self-enforcement. These features are analyzed in more detail below.

3.2. Sole Digital Structure

Smart contracts are fully digitalized and their existence is possible only in digital form (Savelyev, 2017: 124). Unlike classic contracts; oral, written forms or contract formation only by implication is not possible in smart contracts (Savelyev, 2017: 124).

3.3. Trustlessness

Smart contracts are trustless. Trustlessness in this context means that smart contracts don't trust the personality of other contracting party and they exchange, verify and secure the relevant data without relying on parties of the contract or third person

intermediaries (Mik, 2017: 277, Salevyev, 2017: 123). This is aimed at giving some autonomy from potential manipulation of contracting parties and inefficient intermediaries[4].

However, Mik states that Blockchain is only a database and not a transaction platform or transaction environment and accepts only limited external which makes it so "safe" (Mik, 2017: 277). According to Mik, adding new capabilities to Blockchain in order to improve its abilities; in other words, making Blockchain more functional may harm its "trustlessness" (Mik, 2017: 278).

On the other hand, depending on the type of consideration, smart contracts may need an "oracle" (Werbach and Cornell, 2017: 334-335; Mik, 2017: 296). For example, delivery of a package cannot be identified and verified by a smart contract as this is an act that could be executed in real life and off the Blockchain (Mik, 2017: 296). "Oracle" is defined as a system that supply and interpret external feeds which happen outside Blockchain and verify contractual performance (Werbach and Cornell, 2017: 334-335). This may be considered as a factor that decreases the trustlessness of the Blockchain while an oracle is a type of intermediary, they exist outside Blockchain and they are not decentralized (Mik, 2017: 296). So in cases where parties must use an "oracle" for their smart contract, they need to personally "trust" the information supplied by the oracle and operator of oracle (Werbach and Cornell, 2017: 335).

3.4. Self-Enforcement

Smart contracts don't require further actions or intervention of contracting parties for performance and performance is not dependent on wills of the contracting parties or third parties (Cuccuru, 2017: 186). Thus performance is certain in commercial and legal sense and it is technically guaranteed (Mik, 2017: 280). Thus changes in circumstances or parties' intentions don't effect further performance of contractual obligations (Savelyev, 2017: 126). So, self-enforcement in sense of smart contracts is equal with guaranteed performance. However, non-performance is theoretically still possible in smart contracts

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[4] For intermediaries see Sklaroff, 2017: 267.

(Savelyev, 2017: 130). For example, there may not be enough funds in debtor's account to make the payment on due date.

This leaves no room for court decisions ordering enforcement of performance, as self-enforcement means there is no need for third party enforcement agencies like courts. On the other hand, court decisions are the legal remedies for non-performance or bad performance in classical Contract Law (Mik, 2017: 284). Although this may seem like an advantage, it may also constitute a disadvantage, while this also means that contracting parties will not have access to traditional legal protection (Mik, 2017: 285).

Furthermore, so-called "effective breach of contract" shall not be available. However, this draws some critics as despite intentional breach of contract is not desired, it is also not illegal (Mik, 2017: 283). Furthermore, "effective breach" is a recognized legal and economic theory[5]. Mik also draws attention to another consequence of self-enforcement which is associated with preference of aggrieved party in case of a breach (Mik, 2017: 283). According to Mik, aggrieved party is also excluded from his/her right not to exercise any of his/her rights in case of a breach. Moreover, parties may deliberately ignore some breaches in practice while smart contracts don't leave a room for such practice and decreases adaptability of contracts (Mik, 2017: 283).

3. Legal Nature of Smart Contracts

3.1. Contract in Legal Sense or Not?

Whether smart contracts' are contracts in legal sense or not is debated. Contract is a legally binding agreement giving rise to obligations which are enforced or recognized by law (Kocayusufpaşaoğlu, 2014: 95; Treitel, 2003: 1; Helvacı, 2017: 3).

There are two different views on the matter. Some of the scholars don't consider smart contracts as legally binding contracts, in other words contracts in legal sense (Kolvart et al., 2016: 135; Kaulartz/Heckmann, 2016: 621; Cuccuru, 2017: 185). According to Cuccuru; "smart contracts are not legally binding contracts in a technical meaning. Rather, they are

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[5] For detailed information regarding "effective breach of contract" which is also named "efficient breach" please see Sanlı, 2015: 146-148.

an instrument for their conclusion or automatic enforcement a channel for the execution of online agreements, not really agreements in themselves" (Cuccuru, 2017: 184).

On the other hand, some scholars argue otherwise and defend that smart contract are also legally binding contracts (Savelyev, 2017: 123; Werbach/Cornell, 2017: 338). Werbach/Cornell takes a slightly different approach as they state "Nevertheless, we believe that smart contracts are, at the conceptual level, still contracts. Though they might not constitute promises per se—depending on how we understand that idea—smart contracts are agreements that purport to alter the rights and duties of the parties. Not all contracts are executory. An agreement may still count as a contract even though it leaves nothing open to be done or performed" (Werbach/Cornell, 2017: 342).

I believe that smart contracts cannot be considered as contracts in legal sense, rather they are instruments which consist of computer codes to ensure secure transactions and performance of parties' obligations.

3.2. Smart Contracts as Computer Programs

Many scholars accept that smart contracts are software (computer programs). On the other hand, Savelyev points out that smart contracts qualify as computer programs in scope of Intellectual Property Law (Savelyev, 2017: 124). This means that between parties of the underlying contractual relationship, smart contracts' legal nature is debated but there is also another dimension of smart contracts' legal nature. Since they are computer programs, their legal nature within Intellectual Property Law should be analyzed. According to Law on Intellectual and Artistic Works art. 2, computer programs are considered as literary and scientific works.

Conclusion

Some people see smart contracts as a revolutionary step, but they also come with their advantages, disadvantages and limits.

Supporters of smart contracts state that smart contracts decrease transaction costs considerably. Moreover, they set up a more transparent environment for contracting parties.

Smart contracts are introduced as tools for guaranteed performance. This may be true in most cases, but they don't always guarantee performance. Furthermore, it is arguable whether guaranteed performance is desired in every single case in practice.

Smart contracts are also promoted as they will end court intervention to contractual disputes. However, classical tools of legal protection and court intervention in this scope still constitute an important measure of protection for contracting parties.

Smart contracts are also deemed as very safe as they don't "trust" to an intermediary and wills of the parties, once the contract is formed. However, this is not also completely true as performance of certain types of considerations require "oracles" that are also a type of intermediary.

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