5. How smart can a contract be?

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I INTRODUCTION

Decentralized, steady and immediate, the blockchain promises to substitute a lot of intermediate agents in the near future.[2] Several industries, non-governmental organizations (NGOs), and even States are paying particular attention to this technology or are already investing in the development or transposition of their business on the blockchain.[3] The rise of cryptocurrencies, based on blockchain technology, provides for a tremendous economic potential for start-ups or companies to fund their activities by launching Initial Coin Offerings (ICOs).[4] Besides the financing of a company, blockchain technology enables companies to register and share every operation of a supply chain, including the order, manufacturing, transfer in inventory, shipping, receipt at a retail outlet and, finally, delivery to the end-user.

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[1] This chapter echoes another reflection published in Carron Blaise and Botteron Valentin, *Le droit des obligations face aux 'Contrats intelligents': Blockchain, Smart Contracts et contrats de droit suisse*, in Carron Blaise and Müller Christoph (eds), *3e Journée des droits de la consommation et de la distribution* (Bâle, 2018). Considering the fast-paced evolution of the topic, and while the matters are addressed from a different angle in the two publications, certain assessments of the authors have evolved during the writings.

[2] The authors would like to thank Shahab D. Ghalambor, Esq., attorney in New York, NY, for his valuable suggestions and help in proofreading this chapter, and Mattea Saliba, BLaw, for her help in proofreading this chapter.

[3] For example: The Institute of International Humanitarian Affairs of Fordham University, in collaboration with the United Nations, worked on a blockchain project to fight human trafficking (see infra n 20) or Dubai, who aims to allow visa applications, bill payments and license renewal using the blockchain, https://www.forbes.com/sites/suparnadutt/2017/12/18/dubai-sets-sights-on-becoming-the-worlds-first-blockchain-powered-government/#5f504c9f454b (last visit, 1 May 2018).

[4] In 2017, the biggest ICOs were Falcon, Tezos, EOS, Bancor, and Paragon, who altogether raised USD 966 million; See https://hackernoon.com/2017-a-year-in-review-initial-coin-offerings-91ec1c7367a5 (last visit, 13 August 2018).

By running smart contracts on a blockchain, an entrepreneur or a company can automatically generate operations and program in advance the consequences of potential situations arising during a legal contractual relationship. Smart contracts can ensure that a legal contract will be correctly executed or that a payment made in advance will be – either totally, or partially – refunded in the event of non-performance, or defective performance. As a result, the blockchain that supports the smart contracts ensures 'automated justice', by offering the user the possibility of programming, in code, myriad possible circumstances, along with their corresponding consequences.[5]

In their original, historical purpose, smart contracts were thought to offer a trusted platform for parties to execute their contractual relationship, disconnected from the centralized, official bodies. Therefore, they gave every person the opportunity to participate in votes, fundraising, or commercial exchange without the intervention of the State, or any kind of official body or register.[6]

However, with the massive adoption of blockchain technology throughout recent years, many governments started to regulate this activity. Some proclaimed a total ban of bitcoin and cryptocurrency trading (e.g., China and the Republic of Korea[7]), while others adopted rather friendly regulations.[8] In contrast, Switzerland chose a supportive way of regulating the phenomenon. In January 2018, the Swiss government set up a working group involving two Federal Councilors and specialists in the field to examine the opportunity to regulate cryptocurrencies, ICOs and the blockchain[9]. The Swiss Financial Market Supervisory Authority (FINMA) adopted new guidelines in February 2018 that classify cryptocurrencies into three categories, depending upon the way they can be used in the blockchain: payment tokens; utility tokens; and

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[5] Eliza Mik, *Smart Contracts: Terminology, Technical Limitations and Real World Complexity* (2017) 9 *Law, Innovation and Technology* 280.

[6] Timothy May, *The Crypto Anarchist Manifesto*, https://www.activism.net/cypherpunk/crypto-anarchy.html (last visit, 13 August 2018).

[7] Rosie Perper, 'China is Moving to Eliminate All Cryptocurrency Trading with a Ban on Foreign Exchanges', *Business Insider*, 5 February 2018, http://www.businessinsider.com/china-eliminates-all-cryptocurrency-trading-2018-2 (last visit, 1 May 2018).

[8] Among others, Japan, Canada, Germany, Holland and Switzerland: Rakhee Pal, 'Countries Approving Cryptocurrencies', *Medium.com*, 19 December 2017, https://medium.com/the-mission/countries-approving-cryptocurrencies-b5bbca1a5a03 (last visit, 13 August 2018).

[9] Swissinfo.ch, 'Swiss Authorities to Consider Blockchain Supervision', *Swissinfo*, 18 January 2018, https://www.swissinfo.ch/eng/business/future-finance_swiss-authorities-to-consider-blockchain-supervision/43834520 (last visit, 1 May 2018).

asset tokens.[10] From a legal point of view, FINMA's position is that there is no need to adopt new laws because payment tokens and utility tokens are considered solely as a means of payment, provided that they do not have an investment function. In contrast, asset tokens directly correspond to securities.[11]

This chapter focuses on the legal aspects of smart contracts and their integration into Swiss contractual law, without exploring the issues related to the anonymity granted by blockchain technology. In Section II we define some fundamental concepts, such as blockchain, smart contracts and decentralized autonomous organizations (II.A). We then examine the possibility of qualifying smart contracts as legal contracts under Swiss law (II.B). Section III examines selected issues under Swiss law, both when a legal contract pre-dates the creation of a smart contract (III.A), and when a smart contract pre-dates the legal contract (III.B). Finally, Section IV includes a general assessment of the overall situation, and reflects on the future implications of smart contracts.

II FUNDAMENTALS

II.A Concepts

II.A.1 Blockchain

The blockchain is a decentralized transaction ledger. It is stored and updated simultaneously on a network of computers (i.e., nodes), with every node permanently retaining the last version of the register.[12] It offers the possibility of registering an operation, a transaction or an event, or even carrying out financial transactions without a central register. Every operation is irreversibly registered on a block of data listed on a chain of blocks. As long as a node still stores the chain, the ledger will survive, even without human activity. For every transaction, users announce the sender's address, the receiver's address and the data transferred to the whole network. The blockchain stores several operations in a block and encrypts the block's content through an algorithm into a value called a 'hash'.[13] This hash can be screened anytime, by anyone on the ledger.[14] The executed transactions cannot be suppressed from the system

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[10] Finma, *Guidelines for Initial Coin Offerings* (2018) p. 3, https://www.finma.ch/en/~/media/finma/dokumente/dokumentencenter/myfinma/1bewilligung/fintech/wegleitung-ico.pdf?la=en (last visit, 1 May 2018).

[11] Ibid. p. 8.

[12] Melanie Swan, *Blockchain, Blueprint for a New Economy* (O'Reilly, 2015), p. x.

[13] Ibid. p. viii.

[14] Rolf H. Weber and Simone Baumann, 'FinTech – Schweizer Finanzmarktregulierung im Lichte disruptiver Technologien', *Jusletter*, 21 September 2015, p. 12; The blockchain can either be verified online (e.g.,, on the site etherscan.

without compromising the blocks of the chain which follow it, which would then render the original chain unrecognizable by the nodes.[15] As a result, the blockchain is simultaneously resilient, transparent and inviolable.[16]

Several blockchains coexist today. They are based on the same technology, but use differing protocols.[17] For more than six years,[18] the blockchain supporting bitcoin was the only functioning large-scale public blockchain. New public blockchains have been developed since 2015, in particular when the Swiss-based foundation Ethereum came out with a new type of blockchain-based platform.[19] Ethereum's offering affords the ability to perform computer programs – the *smart contracts* – on the blockchain and creates its own cryptocurrency, the 'Ether'. Since then, new public blockchains have been created with their own cryptocurrencies, such as Ripple, EOS, Litecoin, and others.

Besides the public blockchains, upon which virtually every user can register an event, blockchain technology is also usable for private purposes as a ledger to store encrypted data. It can be used for data storage in the private sector, or for other governmental or non-governmental purposes, such as humanitarian aid. For example, in November 2017, the Institute of International Humanitarian Affairs, in collaboration with the United Nations and Fordham University, hosted a summit during which the World Identity Network and the United Nations announced the launch of a program which records data concerning undocumented children on a private blockchain to ensure that their

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io for the Ethereum blockchain), or it can be downloaded in software that allows the execution of transactions on it (e.g.,, Ethereum Wallet). The entire blockchain will then be saved on the user's computer, and is referred to as a 'node'. The node updates every time the user runs the program.

[15] Rolf H. Weber and Simone Baumann, 'FinTech – Schweizer Finanzmarktregulierung im Lichte disruptiver Technologien', *Jusletter*, 21 September 2015, p. 12.; Barbara Graham-Siegenthaler and Andreas Furrer, 'The Position of Blockchain Technology and Bitcoin in Swiss Law', *Jusletter*, 8 May 2017, n. 6.

[16] Melanie Swan, *Blockchain, Blueprint for a New Economy* (O'Reilly, 2015), p. 1; Quinn Dupont and Bill Maurer, 'Ledgers and Law in the Blockchain', *King's Review Magazine*, 23 June 2015, Kingsreview.co.uk (last visit, 13 August 2018).

[17] Andreas Furrer, 'Die Einbettung von Smart Contracts in das schweizerische Privatrecht' (2018) *L'organe professionnel de la Fédération Suisse des avocats*, p. 105.

[18] Bitcoin's first block was generated on 3 January 2009 and Ethereum's first block on 30 July 2015.

[19] Kristian Lauslahti, Juri Mattila and Timo Seppälä, 'Smart Contracts, How will Blockchain Technology affect Contractual Practices?', *ETLA Reports* N 68, Helsinki 2017, p. 12.

existence is recorded on a tamper-proof system that facilitates the fight against human trafficking.[20]

Let us now explore a hypothetical, but technically possible, example which we will revisit throughout this chapter to illustrate and analyze various issues.

> *Example: A private airline company develops an application based on a public blockchain in order to sell tickets and automatically solve related operational issues which may appear before, during or after its flights. Blockchain technology will allow the airline company, as well as its prospective travelers, to transparently and inviolably register the transfers of data between them. Each time a set of data is exchanged between a traveler and the airline company, the process will be recorded in a new block on the blockchain.*[21]

II.A.2 Smart contract

Historically, the concept of 'smart contract' was first used by American lawyer and computer scientist Nick Szabo in 1994. Szabo defined it as a computerized transaction protocol that executes the terms of a contract according to the happening of events.[22] It was meant to be a code-based program that could be used to generate contractual effects between parties.[23] It aimed to reduce fraud and enforcement costs of transactions by guaranteeing that the counterpart will be executed if payment is made or, conversely, that the consideration will be paid if the other party performs its own obligations.[24] It allows two or more parties who do not necessarily trust each other to execute contracts without a third party or a trustee to ensure the performance of the contract's content.[25]

Various meanings are attributable to the concept of 'smart contract', some of which are described below. However, all of these definitions reveal the fol-

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[20] Prableen Bajpai, 'How Blockchain Can Help Humanitarian Causes', *Nasdaq*, 17 November 2017, https://www.nasdaq.com/article/how-blockchain-can-help-humanitarian-causes-cm879186 (last visit, 1 May 2018).

[21] The event will be stored in the blockchain under the address of a contract. The event will be given a hash value resulting from the input of data. The user can explore the blockchain by searching the hash value of the event and find under it the details of the recorded data.

[22] Nick Szabo, *Smart contracts* (1996), p. 1, http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_2.html (last visit, 1 May 2018).

[23] Kristian Lauslahti, Juri Mattila and Timo Seppälä, 'Smart Contracts, How will Blockchain Technology affect Contractual Practices?', *ETLA Reports* N 68, Helsinki 2017, p. 20.

[24] Nick Szabo, *Smart contracts* (1996), p. 1, http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_2.html (last visit, 1 May 2018).

[25] Stephan D. Meyer and Benedikt Schuppli, '"Smart Contracts" und deren Einordnung in das schweizerische Vertragsrecht' (2017) *Recht*, p. 205.

lowing common feature: A smart contract is a computerized program between two or more parties, whose conditions are defined in advance and stored in the blockchain, and which can be automatically executed or enforced, without the need of a third party.[26]

Based on the distinctions suggested by Jaccard,[27] smart contracts can be separated into four categories:

1. A smart contract can send and receive *data*. From a legal point of view, the relevant data can be distinguished into at least three subcategories:

- The first subcategory comprises data *without real legal impact*. For example, it can register basic pieces of information in the blockchain, such as the occurrence of an event. In our hypothesis, the blockchain stores the event that the traveler passed through a gate, which registers the fact that she passed through the airport security checkpoint.[28]
- The second subcategory comprises data that includes *content protected by law* (e.g., intellectual property rights such as copyrights or trademarks, medical records, or classified data for governmental actors, or data that is protected by various privileges) or protected data in the sense of Article 144*bis* Swiss Criminal Code.[29] For example, a smart contract could automatically generate the QR code of a flight ticket that could be used to board the plane and store information about the traveler's preferences, based on his or her booking history.[30]
- The third subcategory comprises data representing *virtual property*, such as an amount of cryptocurrency, which is neither a 'right', nor a 'thing' nor 'data protected by law'.[31] For example, the bitcoin protocol is programmed

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[26] Stephan D. Meyer and Benedikt Schuppli, '"Smart Contracts" und deren Einordnung in das schweizerische Vertragsrecht' (2017) *Recht*, p. 204; Jana Essebier and Dominic A.Wyss, 'Von der Blockchain zu Smart Contracts', *Jusletter*, 24 April 2017, N 31; Andreas Glarner and Stephan D Meyer, 'Smart Contracts in Escrow-Verhältnissen', *Jusletter*, 4 December 2017, N 18.

[27] Gabriel Jaccard, 'Smart Contracts and the Role of Law', *Jusletter IT*, 23 November 2017, N 42.

[28] See also, Section II.A.1.

[29] Art. 144*bis* of the Swiss Criminal Code punishes any person who, without authority, alters, deletes or renders unusable data that is stored or transmitted electronically or in some other similar way. Such data could be any file, of any type, stored or transmitted electronically (e.g.,, Portable Document Format, or PDF, files transmitted by email); Gabriel Jaccard, 'Smart Contracts and the Role of Law', *Jusletter IT*, 23 November 2017, N 43.

[30] Please refer to the italicized example mentioned under Section II.A.1.

[31] Gabriel Jaccard, 'Smart Contracts and the Role of Law', *Jusletter IT*, 23 November 2017, N 44.

to send a certain amount of bitcoins to the miner who successfully solved the mathematic puzzle which allows the encryption of the transaction in one block and the extraction of new bitcoins.[32]

2. A smart contract can issue data representing a *right*, such as a utility token.[33] The token holder has a particular prerogative in a specific application of the smart contract, such as a right to vote or a right to access specific functions by using the token.[34] For example, a Swiss-based blockchain company conducts polling by issuing voting tokens that can be used to participate in a survey.[35] The participants send the voting tokens to one address on the blockchain to cast a positive vote, or to a different address to cast a negative vote.[36]
3. A smart contract can issue data representing an *asset*. When this occurs, the asset holder has a debt or equity claim against the issuer.[37] For example, a cryptobank issues loans in the form of credit sub-tokens which represent a debt against the bank. The sub-tokens must be repaid in accordance with the terms of the loan.[38]
4. A smart contract can have *content similar to an enforceable legal contract*, giving rise to rights and obligations between the parties.[39] In fact, various computer tools were developed specifically in order to achieve such a goal.[40] These tools existed before the concept of smart contracts, as

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[32] For more information, see https://www.coindesk.com/information/how-bitcoin-mining-works/ (last visit, 13 August 2018)

[33] Finma, *Guidelines for Initial Coin Offerings* (2018), p. 3, https://www.finma.ch/en/~/media/finma/dokumente/dokumentencenter/myfinma/1bewilligung/fintech/wegleitung-ico.pdf?la=en (last visit, 1 May 2018).

[34] Gabriel Jaccard, 'Smart Contracts and the Role of Law', *Jusletter IT*, 23 November 2017, N 73.

[35] SwissBorg, *Join the SwissBorg Community and Earn Tokens for Your Participation!*, 16 March 2018, https://medium.com/swissborg/join-the-swissborg-community-and-earn-tokens-for-your-participation-2eee602e0e9a (last visit, 1 May 2018).

[36] Ibid.

[37] Finma, *Guidelines for Initial Coin Offerings* (2018), p. 3, https://www.finma.ch/en/~/media/finma/dokumente/dokumentencenter/myfinma/1bewilligung/fintech/wegleitung-ico.pdf?la=en (last visit, 1 May 2018).

[38] For example, Crypterium https://crypterium.io/; Crypterium, *White Paper: Cryptocurrency Lending* (31 October 2017), p. 6.

[39] Gabriel Jaccard, 'Smart Contracts and the Role of Law', *Jusletter IT*, 23 November 2017, N 55.

[40] For example, the Ricardian contract or legalese.com, both aim to translate existing legal contracts into code that can be executed by a computer; https://medium.com/legalthingsone/ricardian-contracts-legally-binding-agreements-on-the-blockchain-4c103f120707 (last visit, 13 August 2018); Andreas Glarner and Stephan D. Meyer,

defined in this chapter. However, a similar program could be invented to translate legal contracts into smart contracts stored on the blockchain.

From a legal perspective, the conclusion of a smart contract does not necessarily correspond to the conclusion of the corresponding legal contract. A legal contract, in its simplest form, is executed at the moment the parties mutually express their common intent about the essential elements of their agreement (Article 1 Swiss Code of Obligations (CO)[41]).[42] Very often, the smart contract merely executes the commands that a programmer integrated into it, which are intended to reflect the pre-existing common intent of the parties.[43]

Example: A representative of the private airline company and a prospective traveler could execute – in the physical world – a legal contract for the issuance of a plane ticket from Geneva to New York, at a specified price. In order to facilitate the contract and guarantee its automatic performance, the parties could agree that the content of their agreement will be coded in a smart contract and stored on a blockchain. The programmer will write a computer code providing that once the traveler has communicated her identity and paid the price of the ticket to the airline company by transferring payment tokens, she will receive a utility token corresponding to her plane ticket, which was booked during the physical world negotiations, and allows her to board the plane.[44]

Some commands could require trusted information, such as the occurrence of an event, which is triggered by circumstances outside the blockchain. That is the purpose of the so-called *oracles*, which are sensors in the physical world, who provide pieces of information to smart contracts in order to certify the fulfillment of the terms of the contract.[45]

Example: In order to illustrate the role of an oracle, consider the previous example and imagine that the private airline company only issues the plane ticket if the

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'Smart Contracts in Escrow-Verhältnissen', *Jusletter,* 4 December 2017, N 17; Stephan D. Meyer and Benedikt Schuppli, '"Smart Contracts" und deren Einordnung in das schweizerische Vertragsrecht' (2017) *Recht*, p. 208.

41 Swiss Code of Obligations of 30 March 1911 (RS: 220).

42 In this chapter, 'execution' refers to the moment the parties exchange a mutual expression of intent on the essential elements of the contract and commonly intend to be legally bound by their agreement (Art. 1 CO).

43 Stephan D. Meyer and Benedikt Schuppli, ' "Smart Contracts" und deren Einordnung in das schweizerische Vertragsrecht' (2017) *Recht*, p. 208; See also Section II.B.

44 This illustration is elaborated in the italicized example mentioned under Section II.A.1.

45 Kristian Lauslahti, Juri Mattila and Timo Seppälä, 'Smart Contracts, How will Blockchain Technology affect Contractual Practices?', *ETLA Reports* N 68,

> *traveler has obtained her ESTA authorization.*[46] *In order to accurately determine whether the contract has been fulfilled, the smart contract must be fed with information coming from an external source (i.e., the ESTA). The plane ticket would only be issued once a positive answer from the ESTA has been integrated into the blockchain, and processed by the smart contract.*

The '*smart*' part of the contract refers to its ability to interact with other computerized protocols.[47] Smart contracts may have the capability of making 'decisions' at a rather evolved level of automation and develop new business processes. For instance, a smart contract could bind a seller, such as the owner of a vending machine, and its suppliers. To do so, the smart contract would require data concerning the inventory of the vending machine and demand for a particular product by consumers. With that information, the smart contract could then modify the volume of orders to existing suppliers, or propose new contracts, with new suppliers in order to meet the consumer demand. Depending on the level of automation, the smart contracts could be characterized as *shallow smart contracts* if they merely execute basic operations (e.g., sending a token for the purpose of immediately exchanging funds in a cryptocurrency), or *deep smart contracts* if they execute more complicated operations (e.g., numerous operations according to different types of triggers or inputs).[48] The more complex and automated the smart contract is, the more it will be referred to as a *deep smart contract*. Otherwise, if the smart contract only serves to execute simple transactions from a holder to another, it will be qualified as a *shallow smart contract*. For example, a Swiss-based wealth management start-up offers its clients a customized investment smart contract called *smart mandate*, which is a complex type of deep smart contract. Depending on clients' expected returns, ethical bias, risk appetite and general identity parameter, the artificial intelligence generates a 'smart mandate' that manages the clients' portfolios with products placed on a risk-versus-return scale that approximates the clients' various profiles.[49]

Helsinki 2017, p. 17; Andreas Glarner and Stephan D. Meyer, 'Smart Contracts in Escrow-Verhältnissen', *Jusletter*, 4 December 2017, N 37.

[46] ESTA stands for Electronic System for Travel Authorization and is an automated system that determines the eligibility of visitors to travel to the United States under the Visa Waiver Program. See https://www.cbp.gov/travel/international-visitors/esta.

[47] Stephan D. Meyer and Benedikt Schuppli, '"Smart Contracts" und deren Einordnung in das schweizerische Vertragsrecht' (2017) *Recht*, p. 208.

[48] Merit Kõlvart, Margus Poola and Addi Rull, 'Smart Contracts' in Tanel Kerikmäe and Addi Rull (eds), *The Future of Law and Etechnologies* (Springer, 2016), pp. 133–47, p. 136.

[49] For example, SwissBorg, *Technical White Paper*, infra n 100, p. 10.

II.A.3 Decentralized Autonomous Organizations

Smart contracts are not limited to bipartite agreements, but can also bind numerous parties organized in a network or allow for the conclusion of a multipartite agreement. A smart contract that connects multiple parties, all taking part in a common project, can be defined as a Decentralized Autonomous Organization (DAO). In a DAO, a network of interacting smart contracts is executed to allow two or more parties to conduct projects without a central body.[50] The network of smart contracts is used to create a fully autonomous organization, based on the blockchain, that is capable of carrying out the same functions as traditional companies. This DAO operates in accordance with its original computer code, and independently of its original developers. Its activity is organized algorithmically. The code-based decision-making avoids potentially poor management decisions by automatically making the most economically efficient decision, based on clusters of collected data, and by guaranteeing the transparency of the organization's decision-making process. On the other hand, such a model also creates new, and potentially calamitous risks, such as those which arise from errors in the programming code.[51] A faulty chain of code will inevitably lead to a faulty decision-making process, and has the potential to lead to catastrophic results for the parties.

Each member of a DAO contributes by bringing his own efforts or resources, such as cryptocurrencies, in exchange for tokens. The member then participates in the decision-making process within the DAO. A DAO functions without the need for a management team, and can be directly governed by its members according to the rules encrypted in the code.

> *Example: Business travelers who decide to share a fleet of business aircraft create a DAO. They set up a sophisticated system to vote for destinations to which the planes will fly. The tokens issued by the smart contract, against an initial payment of cryptocurrency, are used to bid for a flight route, and a time and date. Those tokens correspond to a certain amount of cryptocurrency. As soon as the number of tokens provided by the bidders is sufficient to cover the operation costs, the flight is booked and confirmed. The DAO, created solely to make the strategic decision of selecting and confirming flights, functions without any central governing body. Of course, the addition of other strategic decisions creates additional layers of complexity, each requiring parameters that will govern the DAO's decision-making process. In this example, the blockchain ensures a system without the need for a trusted third person to ensure that no member flies without paying his ticket, or*

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[50] Stephan D. Meyer and Benedikt Schuppli, '"Smart Contracts" und deren Einordnung in das schweizerische Vertragsrecht' (2017) *Recht*, p. 208.

[51] Kristian Lauslahti, Juri Mattila and Timo Seppälä, 'Smart Contracts, How will Blockchain Technology affect Contractual Practices?', *ETLA Reports* N 68, Helsinki 2017, p. 5. For more details, refer to Sections III.B.2 and III.A.1.

that the tickets will be refunded if a member's desired flight is not booked due to a lack of interest among the other members of the DAO community.

II.B Can Code Be a Contract?

According to Swiss law, a legal contract is executed when the parties exchange a mutual expression of intent about the essential elements of an agreement, and conjointly intend to be legally bound by their agreement (Article 1 CO).[52]

When considering the possible interactions between a smart contract and a legal contract, consider two likely scenarios: the legal contract pre-dates the smart contract (1), or the smart contract is used to fulfill a legal contract (2).

II.B.1 A legal contract pre-dating the smart contract

In this scenario, the parties first execute a legal contract without using a smart contract, or blockchain technology.[53] The parties then use the computer technology integrated in a smart contract to transpose the terms of their agreement into computer code to facilitate and automatize the performance of the legal contract on the blockchain.[54]

Two main scenarios are possible:

1. *The smart contract supports only part of the performance of the legal contract by using blockchain technology*. Under these circumstances, the smart contract is as a way to execute one of the obligations arising from a legal contract executed between the parties. By design, the use of computer code only allows for the execution of one obligation at a time. The computer technology remains useful because the payment will be transparently and inviolably recorded onto the blockchain, allowing the buyer to easily prove and attest to the payment and to the moment in time when it was made.

   Example:[55] A representative of the airline company and the traveler could execute in the physical world a contract in writing for the issuance of a plane ticket from Geneva to New York at a specified price. In order to facilitate and to guarantee the performance of their legal agreement, the parties could agree that the payment

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[52] Peter Gauch, Walter Schluep and Jörg Schmid, *Schweizerisches Obligationenrecht Allgemeiner Teil*, Vol. I (10th edn., Schulthess, 2014), N 225, et seq.; Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Schulthess, 2012), N 562, et seq.

[53] Gabriel Jaccard, 'Smart Contracts and the Role of Law', *Jusletter IT*, 23 November 2017, N 86.

[54] Stephan D. Meyer and Benedikt Schuppli, '"Smart Contracts" und deren Einordnung in das schweizerische Vertragsrecht' (2017) *Recht*, p. 216.

[55] This illustration is elaborated in the italicized example mentioned under Section II.A.1.

will be made using a cryptocurrency functioning thanks to blockchain technology.[56] *While the traveler's performance, i.e. the payment, occurs via the blockchain, the seller's performance, i.e. giving the right to board the plane and to fly to the destination, will take place through the transfer of ownership and possession of the boarding pass via physical shipment or another technology such as email.*

2. *The smart contract allows for the total performance of the legal contract.* The translation of common language into code is not simply a process of replacing legal terms with corresponding commands of imperative programming (e.g., If/Then). The intent of the parties must be interpreted accurately, and then coded in order to correctly define the scope of the parties' obligations.

Example:[57] *The airline company and the traveler first agree in the physical world on the sale of a plane ticket at a specified price payable in cryptocurrency. The legal contract contains a full range of conditions occurring throughout the performance and triggering either a reimbursement or an additional payment obligation (e.g., meteorological conditions, overbooking of the plane, cancelling of flights, additional pieces of luggage, duty-free shopping on the plane, etc.). In order to facilitate and guarantee the performance, the complete contract of carriage could then be embedded in a computer code. The programmer would write a computer code integrating the essential elements of the contract, as well as the potential events anticipated by the parties. Once the traveler has communicated her identity and paid the price using the blockchain, she will get a utility token*[58] *corresponding to her plane ticket and allowing her to board the plane. If one or more conditions happen during the performance of the contract of carriage, the traveler could be automatically reimbursed or charged, based on the financial consequences provided for in the legal contract and translated into computer code.*

As a consequence, if a legal contract pre-dates the smart contract, the former is legally binding, as opposed to the latter. This will inevitably lead to issues concerning the appropriateness and the relevance of the translation into computer code,[59] concerning the consequences of errors contained in the

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[56] It could be discussed if the contract is a contract for sale if the counterpart is cryptocurrencies; see also Mirjam Eggen, 'Verträge über digitale Währungen', *Jusletter*, 4 December 2017, p. 3.

[57] This illustration is elaborated in the italicized example mentioned under Section II.A.1.

[58] Finma, *Guidelines for Initial Coin Offerings* (2018), p. 3, https://www.finma.ch/en/~/media/finma/dokumente/dokumentencenter/myfinma/1bewilligung/fintech/wegleitung-ico.pdf?la=en (last visit, 1 May 2018).

[59] See Section III.A.1.

computer code,[60] as well as the contractual gaps and consequences of modified circumstances.[61]

II.B.2 A legal contract arising from a smart contract

In this case, a legal contract is executed through a smart contract. It is entirely developed on the blockchain to be offered to a contracting party and there is no legal contract in plain language to explain the parties' relative rights and obligations. The parties enter in a contractual relationship ruled by the general rules of the code of obligation, solely through the smart contract.

The parties' agreement can directly emanate through exchange of data on the blockchain, hence executing *smart legal contracts*. For this to happen, a party will first make an offer by integrating lines of computer code into the blockchain, then the addressee will accept the offer by sending information to the smart contract's address.[62] The agreement of the parties is registered and stored in the blockchain; from this moment on, the smart legal contract can no longer be suppressed. The effects deployed by the computerized code are immediate and the parties' obligations are directly executed when the event or condition identified in the computer code (i.e. the trigger) happens.[63] Moreover, if the conditions for performance are realized, no institutionalized enforcement is needed, because the computer code will automatically provide for the correct execution of the contract.

> *Example:[64] The airline company – instead of using the blockchain simply to automatize the performance of the contracts executed in the physical world – can set up an automated ticketing system based on the blockchain. The airline company uses a computer code that provides for the issuance of a plane ticket for a specific journey (i.e., date, time, place of departure and arrival) if certain conditions are met. This constitutes a legal offer containing the essential elements of the contract. For the sake of simplicity, let us assume that the only conditions necessary to trigger the issuance of the ticket are the communication of the traveler's identity as well as the transfer of a certain amount of the cryptocurrency traded over the blockchain. If a traveler wants to buy a plane ticket, she will become acquainted with the content of the airline's offer contained in the computer code, then communicate her identity and transfer the required amount of cryptocurrency to the*

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[60] See Section III.A.2.

[61] See Section III.A.3.

[62] Web clients allow users to create a public address on the Ethereum blockchain and to send data into the blockchain to another public address or to a smart contract's address.

[63] Andrea Pinna and Wiebe Ruttenberger, 'Distributed Ledger Technologies in Securities Post-Trading', *European Central Bank Occasional Paper Series* No.172, April 2016, p. 18.

[64] Please refer to the italicized example mentioned under Section II.A.1.

> *airline company. These two sets of data – the traveler's identity and the transfer of cryptocurrency – are recorded as new blocks onto the blockchain and it is proven with absolute certainty that said data were communicated to the airline company. This communication via the blockchain constitutes the legal acceptance of the offer and, simultaneously, corresponds to the moment of the conclusion of the legal contract. Once these two conditions (i.e., communication of the traveler's identity and transfer of the amount of cryptocurrency) are fulfilled and recorded on the blockchain, the smart contract launches the automatic performance of the contract. The obligation due by the airline company, in the form of a utility token[65] corresponding to the ordered plane ticket, will be sent to the traveler.*

An offer formulated through a smart contract presents similar features to those of a contract with general terms and conditions. Both are difficult to understand for the vast majority of offerees. The fact that the smart contract is written solely in computer code requires some level of protection for the offeree who is not a computer specialist. Various issues, such as the conclusion of a smart legal contract,[66] the content of a smart legal contract,[67] as well as the treatment of an invalid smart legal contract[68] must be carefully considered.

II.B.3 Provisional findings

When analyzing whether the code of a smart contract could be a legal contract, we identified two different situations, depending on the moment when the parties resort to a smart contract. First, the smart contract can be used when a legal contract already exists. In that case, the smart contract stored on the blockchain has the effects of a performance tool, used for practical reasons such as its reliability, its automatic character, its genuine ability to prove the performance, and the opportunity to waive any intermediary, among others. Second, the smart contract can be used as a platform enabling the conclusion of a legal agreement. In that case, the parties enter into a contractual relationship when they run the program of the smart contract and execute it. The smart contract produces legally binding effects and the peculiarities of executing an agreement through a computer program raise complex legal issues, which are examined in the next section. In that scenario, some legal effects can be recognized by the use of the smart contract and the general rules of contract law are applicable for the contractual relationship that arises.

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[65] Finma, *Guidelines for Initial Coin Offerings* (2018), p. 3, https://www.finma.ch/en/~/media/finma/dokumente/dokumentencenter/myfinma/1bewilligung/fintech/wegleitung-ico.pdf?la=en (last visit, 1 May 2018).

[66] See Section III.B.1.

[67] See Section III.B.2.

[68] See Section III.B.3.

III CODE IS CONTRACT: A CONTRACTUAL REGIME OF SMART CONTRACTS

Based on the distinction discussed above,[69] the next section highlights some legal challenges that the substantive law of contracts faces when blockchain technology and the smart contracts are employed, either when a smart contract is preceded by a legal contract (III.A) or when the legal contract arises out of a smart contract (III.B).

III.A Smart Contract Preceded by a Legal Contract: Selected Issues

When a legal contract pre-dates the smart contract, it may at least trigger the following three issues related to the law of obligations: the question of interpretation and the translation of contractual plain language into computer code may be difficult (III.A.1); the fact that contractual performance may be improper due to errors contained in the smart contract (III.A.2); the difficulties in filling in the gaps and adapting the contract because of the use of the smart contract (III.A.3).

III.A.1 Where interpretation is at stake: the difficulty in translating plain language into computer code

The translation of contractual plain language into computer code is not an easy task for at least three reasons:

- First, contractual language is very technical and cannot easily be replaced by commands of imperative programming (i.e., If/Then), especially when it contains indeterminate legal notions, such as termination for 'good cause', obligation of 'good faith' or 'reasonable' period of time.[70]
- Second, even if the contractual text could be translated into commands of imperative programming, the text is not the only element of legal interpretation. According to Article 18 CO, the true and common intention of the parties must be ascertained without dwelling on any inexact expression or designations they may have used, either in error, or to intentionally disguise the true nature of the agreement. Therefore, the intent of the parties

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[69] See Sections II.B.1 and II.B.2.

[70] Regarding indeterminate legal notions, Nedim Peter Vogt and Annaïg L. Vogt, 'Commentary of Art. 243 CO' in Heinrich Honsell, Nedim Peter Vogt and Wolfgang Wieg (eds), *Basler Kommentar Obligationen recht* (6th edn., Basel, Helbing Lichtenhahn, 2015) § 15, N 80 et seq.; Yves Le Roy and Marie-Bernadette Schoenenberger, *Introduction générale au droit suisse* (4th edn., Zurich/Basel/Geneva, Schulthess, 2015), p. 450 et seq.

must first be established, sometimes by reference to extrinsic evidence,[71] in order to then be correctly coded to reflect the real intent of the parties and to define their obligations.

- Third, without an automatic tool that allows for the transcription from computer code into plain language, using a smart contract for the conclusion of legal agreements would be significantly less interesting. Without such a tool, a manual and costly transcription would be required each and every time a difficulty arises in the performance of the contract. However, an automated transcription of legal text (with its high level of language precision) into code is not possible without consistent progress of computer technology in the years to come. For the time being, programmers of translating machines may fail to appreciate the importance of every word in legal contracts, which may lead to interpretation disputes once the contract is formed.[72]

The assessment of whether the translation into computer code is correct requires an interpretation of the legal contract:

- If the parties disagree in the first place on the interpretation of their legal agreement, they will have to go directly to court or engage in an alternative mechanism to resolve their dispute (e.g., mediation, conciliation or arbitration), before they can even try to translate their legal agreement into a smart contract.
- Even if the parties have a common understanding of the legal agreement, they will have to carefully monitor the computer code of the smart contract in order to make sure that it reflects their agreement. Once the smart contract is stored on the blockchain, it cannot be changed and any error must

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[71] Bénédict Winiger, 'Commentary of Art. 18 CO' in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012), ad Art. 18, N 14 et seq., N 61 et seq.; Wolfgang Wiegand, 'Commentary of Art. 18 CO' in Heinrich Honsell, Nedim Peter Vogt and Wolfgang Wieg (eds), *Basler Kommentar Obligationen recht* (6th edn., Basel, Helbing Lichtenhahn, 2015), ad Art. 18, N 44 et seq.

[72] Eliza Mik, 'Smart Contracts: Terminology, Technical Limitations and Real World Complexity' (2017) 9 *Law, Innovation and Technology* 289.

be corrected outside the blockchain after performance has occurred, and the smart contract will keep on running wrongfully.[73]

Example:[74] When an airline company and a traveler enter into a contractual relationship in the physical world, the following provision may apply to their contract: The airline may refuse to carry the traveler or her baggage on the flight if the carriage of the traveler or her baggage may endanger the safety, security, health or wellbeing of other passengers or the crew.[75] The translation into computer code may be impeded because the parties do not have the same understanding of such a provision. Even if the parties have the same understanding, such a provision may be difficult to translate into computer code because it is unfeasible to program all the possible circumstances in which the wellbeing of other passengers or of the crew may be endangered and because a computer is (still) unable to reliably make such an assessment.

III.A.2 Where performance is at stake: the failure to perform due to errors contained in the computer code

Under Swiss law, failed performance includes non-performance, improper performance as well as delay in performance (Article 97 et seq. SCO).[76]

By using a smart contract, the parties usually plan that their obligations are partially or completely executed automatically if the agreed conditions are fulfilled. Moreover, the smart contract can anticipate many scenarios of non-performance, defective performance, delay and impossibility to perform. For each of these, the smart contract can provide a consequence that will be automatically implemented once one condition is fulfilled or once corresponding information is fed into the system (e.g., through an oracle).

Example:[77] The smart contract could provide that a percentage of the price of the flight ticket is immediately due when booking the flight, and that the remaining balance is to be paid at a later stage (e.g., when issuing the boarding pass or when

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[73] If one or both parties are able to block or adapt the performance of a smart contract, then the use of blockchain technology becomes questionable because it will lose two of its core characteristics: resilience and inviolability (see Section II.A.1). See also, Eliza Mik, 'Smart Contracts: Terminology, Technical Limitations and Real World Complexity' (2017) 9 *Law, Innovation and Technology* 282.

[74] Please refer to the italicized example mentioned under Section II.A.1.

[75] This provision is inspired by Art. 7.1.2 of the Conditions of carriage of Swiss, https://www.swiss.com/ch/EN/terms-conditions/conditions-of-carriage (last visit, 13 August 2018)

[76] Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 1218 et seq.; Peter Gauch, Walter Schluep and Jörg Schmid, *Schweizerisches Obligationenrecht Allgemeiner Teil*, Vol. I (10th edn., Zurich, Schulthess, 2014), N 2483 et seq.

[77] Please refer to the italicized example mentioned under Section II.A.1.

boarding the plane). The smart contract could also provide that a lump sum will be paid by the aircraft company if the flight is delayed or cancelled. Finally, the smart contract can provide for the reimbursement of the plane ticket if the flight is cancelled due to force majeure (e.g., a prohibition to land in the destination country).

However, a smart contract designed to ensure a fully automatic contractual performance may not (completely) reach its goals for various reasons:

- A smart contract may contain a computer bug. As a result, the obligations or the performance sequence agreed upon by the parties will not be correctly translated into computer code and the smart contract will provoke an improper performance of the legal contract.
- A smart contract, like any other support of an agreement – even a paper version – cannot anticipate all possible scenarios. Unforeseen situations constantly happen in the course of performance. In such a case, the smart contract may function incorrectly, and may trigger either non-performance, or improper performance.
- Even if a smart contract does contain all possible outcomes, the possibility that the law will be amended between the programming of the smart contract and its performance is real. In that event, the relevant portion of the smart contract would have to be adapted, which is technically impossible because what has been recorded on the blockchain is inviolable.

Example:[78] *The smart contract designed to allow for automatic performance of the contract for carriage may contain a bug with the result that a reimbursement does not take place, even though the plane has arrived too late, only because the programmer forgot to implement such a contractual provision into the computer code. Another example could be a change in applicable regulations between the time of programming of the smart contract and that of the flight, so that the performance – as provided for by the smart contract – becomes defective. One can imagine a smart contract which does not contain a newly introduced compensation provision for late arrival. In that event, if the plane is delayed, the traveler will not receive automatic reimbursement through the smart contract, even if she is entitled to such a reimbursement.*

Smart contracts are intended to be self-enforceable to guarantee performance and justice. They are also supposed to be inviolable and unmodifiable. When a smart contract contains a bug, the programmer cannot fix it or modify it. If neither subsequent human intervention nor a modification of the smart contract is possible, the code has to be perfect from the outset.[79]

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[78] Please refer to the italicized example mentioned under Section II.A.1.

[79] Eliza Mik, 'Smart Contracts: Terminology, Technical Limitations and Real World Complexity' (2017) 9 *Law, Innovation and Technology* 281.

In practice, a perfect smart contract is hardly realistic, except for very simple transactions. Every piece of software contains errors. In such a case, the benefits of automatic self-enforcement are at least partially lost, because the immutable smart contract will continue to operate according to the code stored in the blockchain, without reference to the bug. This will most certainly lead to an unwanted result for one or both parties.[80]

Unlike usual legal contracts (i.e., those without automated computer performance), the smart contracts cannot leave the choice to the party to comply with its terms or not. The parties using a smart contract cannot decide not to fulfill their obligations or to abstain from claiming the other party's obligation. As a performance tool which does not allow for any adjustment, a smart contract seems problematic in relation to many transactions which require flexibility and responsiveness during the performance.[81]

If the smart contract does not perform the way it is supposed to according to the pre-existing legal contract, the parties will have to use the legal rules regarding non-performance or improper performance (Article 97 et seq. CO or corresponding legal provisions) to correct the failure to comply with the provisions of the legal contract. Improper performance or non-performance by the smart contract will be attributed to one party, and the other has the following options:[82]

- First, she can require performance or the cure of defective performance (*pacta sunt servanda*).
- Second, if a party's failure to perform the obligation amounts to a fundamental breach of the contract, the other party may terminate the contract, which releases both parties from their obligation to perform and to receive future performance. Moreover, if something had already been supplied under the contract, either party may claim its restitution.
- Third, any non-performance gives the aggrieved party a right to damages, either exclusively or in conjunction with any other remedies.

Even if one cannot exclude the possibility that some remedies may be provided for in the smart contract (e.g., the payback of a specified sum for each day of non-timely performance, or the restitution of a performance made by one party or even the payment of a flat-rate compensation in case of non-performance), it is unlikely that all possible scenarios can be encoded in a smart contract. As

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[80] Ibid. 282.

[81] Ibid. 283.

[82] Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 1134 et seq.; Peter Gauch, Walter Schluep and Jörg Schmid, *Schweizerisches Obligationenrecht Allgemeiner Teil*, Vol. I (10th edn., Zurich, Schulthess, 2014), N 2486 et seq.

a result, one can expect that the parties will have to go to court or to engage in an alternative dispute-resolution method in order to settle disputes. This judicial or extrajudicial mechanism will take place outside of the smart contract and the blockchain. The enforcement of the decision could either take place outside of the smart contract (e.g., if one party is forced to pay a counter value in fiat-money) or may use the blockchain anyway (e.g., if one party is forced to pay restitution out of the cryptocurrencies received).

> *Example:*[83] *If the airline company faces an unforeseeable cancellation of a flight, for instance because the closing of an airport is ordered by an authority for security reasons, it may well be that the smart contract will immediately refund the ticket price and pay an additional cancellation compensation to the travelers, because the computer code, unlike the applicable legal rules, does not differentiate between different types of cancellation. Even though the smart contract is performed automatically, it may well be the case that the airline company can successfully claim back the cancellation compensation, because the cancellation of the flight can be attributed to extraordinary circumstances which could not have been avoided even if all reasonable measures had been taken.*[84]

III.A.3 Where gaps and modified circumstances are at stake: the difficulty in filling in the gaps and adapting the smart contract

Legal contracts always contain gaps because the parties are never able to draft contractual provisions dealing with all possible situations, or anticipate all future changes in the circumstances. Some possible outcomes will always remain unpredicted or unforeseen and, as a result, untreated.

In such a case, the parties to a plain language legal contract apply general rules to fill in the gaps, using, for example, the hypothetical will of the parties,[85] or modify the terms of the contract, such as the *clausula rebus sic stantibus*.[86] If the parties cannot agree by themselves, their dispute is resolved by a court or through an alternative dispute-resolution mechanism.

If a smart contract contains a gap, the immutable character of the blockchain prevents it from filling that gap. It is also practically impossible to provide for a sensible rule in the computer code that could automatically solve a case of

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[83] Please refer to the italicized example mentioned under Section II.A.1.

[84] For such a provision, see Art. 5 (3) EU regulation 261/2004.

[85] Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 954 et seq.; Peter Gauch, Walter Schluep and Jörg Schmid, *Schweizerisches Obligationenrecht Allgemeiner Teil*, 2 Vol., Vol. I (10th edn., Zurich, Schulthess, 2014), N 1256 et seq.

[86] Ibid., N 1280 et seq.

unforeseen modification of the circumstances, because the possible outcomes will be too diverse to cover.[87]

Consequently, the smart contract will not be able to identify a gap or to fill it in or will not adapt the content of the performance in light of modified circumstances. It is also difficult to imagine a judgment or an award ordering a modification of computer code of the smart contract as it is tamper-proof. It will only be after the program of the smart contract has run that a correcting (extra-) judicial intervention will be possible. Such a mechanism and its enforcement will take place outside of the smart contract, although blockchain technology may be necessary (e.g., to pay restitution for the amount of cryptocurrency originally transferred).

> *Example:*[88] *If a change of circumstances occurs, such as the sudden introduction of a no-fly zone on a territory which causes a flight-time extension, and if the legal agreement and, consequently, the smart contract, does not contain a modification clause, the smart contract cannot be adapted in light of these changes and the airline will have to revert to a civil judge to reclaim part of the payments that were automatically issued by the smart contract. Because the smart contract cannot be modified, this error will be repeated permanently for all agreements already coded under this smart contract.*

III.A.4 Provisional findings

When a legal contract precedes the smart contract, the parties are not obliged to perform their contract via a smart contract stored on the blockchain, but are free to perform their obligations however they choose, based on the freedom of contracts. If they choose this type of performance, they will be facing the following issues, in particular:

- The variety and complexity of legal clauses might be difficult, if not impossible in some cases, to transpose into code. Moreover, each party may have a different understanding of a legal clause, so that a commonly-accepted translation into computer code is impossible from the beginning.
- The smart contract may lead to unwanted failed performance of the obligations because of bugs in the encoding process. Because the smart contract cannot be easily corrected and will perform wrongfully, the necessary steps to solve the coding error will often require legal proceedings before a judge, which will result in the loss of the advantages of self-enforcement.
- If an unforeseen event occurs or if the circumstances such as the regulatory environment change, the immutability of the smart contract prevents any

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[87] Eliza Mik, 'Smart Contracts: Terminology, Technical Limitations and Real World Complexity' (2017) 9 *Law, Innovation and Technology* 290.

[88] Please refer to the italicized example mentioned under Section II.A.1.

amendment or update. Again, the parties will have to solve the problem using a dispute-resolution mechanism (e.g., legal proceedings before a court) outside of the smart contract.

Taking these challenges into account, we are of the opinion that a legal agreement should ideally present the following features to justify a performance through a smart contract and the blockchain:

- Due to the necessary costs of creating and implementing a smart contract, the legal agreement must relate to mass consumer goods or services, enabling the use of computer code for numerous contractual relationships of the same kind, providing for similar contractual provisions.
- Due to the difficulty of encoding the legal language and the intangible nature of a smart contract, the agreement must provide for a standard and straightforward performance, and shall not contain indeterminate legal concepts or complex legal provisions (e.g., performance within a 'reasonable' amount of time).
- Thanks to the automated performance and the intangible nature of a smart contract, its use is particularly appropriate if the parties would otherwise have to rely on a third party to guarantee the correct performance of their legal agreement, such as a third-party escrow agent.

Thanks to the automated performance, a smart contract is also efficient if the contractual agreement provides for lump sum compensations or additional payments in case of clear and easily identifiable events, such as non-performance, late performance and consumers' right of revocation.

III.B Smart Contract Pre-existing a Legal Contract: Selected Issues

When a smart contract serves as a platform to form a legal contract, the following three issues regarding the theory of the law of obligations may arise: how can offer and acceptance happen through a smart contract (III.B.1); does the smart contract enable an effective mutual expression of intent so that a legal contract exists and its content is identifiable (III.B.2), and what happens in case of a vitiated agreement on the ground of the object, the form or the parties' consent (III.B.3)?

III.B.1 Where conclusion mechanism is at stake: offer and acceptance through smart contracts

As discussed above,[89] a smart contract can be the vehicle enabling the conclusion of a legal contract. Swiss law identifies two successive steps in this

[89] See Section II.B.2.

process: first, an offer and, secondly, an acceptance (Article 3 et seq. CO).[90] If the parties exchange a mutual expression of intent on the essential elements of the contract and commonly intend to be legally bound by their agreement, the contract is executed (Article 1 CO).[91]

Lauslahti et al. are of the opinion that a smart contract can be a way of executing legal contracts. According to these authors, the expression of implied intent through the exchange of performances taking place within a smart contract is the main argument to recognize the conclusion and the existence of a legal contract. In this case, the parties' expressions of intent are integrated in the blockchain, in the same way a vending machine functions: by installing the vending machine with its functioning instructions, the seller demonstrates his intent to sell the goods contained in the machine and makes an offer to potential clients. When a buyer inserts money into the machine and chooses a product, she accepts the seller's offer and a contract is entered into, even if there is no express communication of intent.[92]

> *Example:[93] If the traveler wants to fly with the airline company, she can choose among a list of available seats in the plane for one particular flight route, and book it by sending payment tokens to the smart contract. As soon as she interacts with the smart contract, she enters into a precontractual relationship (under Swiss law) as she accepts the system proposed by the company that offers to place bids onto the blockchain to book a flight.*

III.B.1.a Offer

A legal offer is a declaration of intention by the offeror to be bound under a contract with a specified content, under the condition of acceptance by the offeree (Article 3 et seq. CO).[94] The expression of intent may be express or implied (Article 1 para. 2 CO).[95] Because of the freedom of contract and espe-

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[90] Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 601 et seq.; Peter Gauch, Walter Schluep and Jörg Schmid, *Schweizerisches Obligationenrecht Allgemeiner Teil*, 2 Vol., Vol. I (10th edn., Zurich, Schulthess, 2014), N 355 et seq.

[91] Ibid. N 286 et seq.

[92] Kristian Lauslahti, Juri Mattila and Timo Seppälä, 'Smart Contracts, How will Blockchain Technology Affect Contractual Practices?', *ETLA Reports*, Helsinki 2017, N 68.

[93] Please refer to the italicized example mentioned under Section II.A.1.

[94] Eugen Bucher, *Law of Contracts*, in Dessemontet François andAnsay Tuğrul (eds), *Introduction to Swiss Law* (3rd edn., Antwerp/Boston/London/Frankfurt, Kluwer, 2004), p. 107 et seq., p. 114; Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 606.

[95] Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 181 et seq.; Peter Gauch, Walter Schluep and Jörg

cially the freedom of form, an (express) offer can be made orally, in writing, or by using another means that enables direct communication of the expression of intent.[96] Therefore, nothing prevents an offeror from formulating an offer based on the computer code. A smart contract constitutes an offer according to Article 3 et seq. CO if the computer code describes the terms of agreement that the offeree can enter into by accepting.

The smart contract functions as a 'take it or leave it' offer, which only requires the offeree's acceptance. In order to enter into the legal contract, the offeree must not only agree in her mind, but also express her agreement by sending the required data to the smart contract's address. This data can be an amount of cryptocurrency, tokens or any other kind of information transposed in computer code.

> *Example:*[97] *The airline company can store a smart contract on the blockchain which functions as an automated ticketing system. If the smart contract mentions the conditions (e.g., the communication of the traveler's identity as well as the transfer of a certain amount of the cryptocurrency traded over the blockchain) necessary for the conclusion of a contract of carriage, with a specific flight route at a specific date, and provides that the airline company is willing to be bound if the traveler meets these conditions, then the smart contract is a valid legal offer.*

It is worth highlighting that Swiss obligation law does not consider the sending of unsolicited goods as a legal offer (Article 6a CO). This happens in relation to blockchain technology when, for marketing purposes, the issuer of a new token operates an *airdrop*, consisting of a random distribution of free tokens to wallets.[98] Therefore, a person whose electronic wallet is credited with unsolicited tokens is not obliged to provide for any counter-performance or to return the tokens. If the person keeps the unsolicited tokens, it cannot be considered as a tacit acceptance of an offer, and one cannot infer from her behavior the tacit conclusion of a contract with the sender of the unsolicited tokens.

This case must not be confused with a transfer of cryptocurrency taking place by error (e.g., when a mistake is made in the transcription of an address

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Schmid, *Schweizerisches Obligationenrecht Allgemeiner Teil*, 2 Vol., Vol. I (10th edn., Zurich, Schulthess, 2014), N 188 et seq.

96 Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 186 et seq.; Peter Gauch, Walter Schluep and Jörg Schmid, *Schweizerisches Obligationenrecht Allgemeiner Teil*, 2 Vol., Vol. I (10th edn., Zurich, Schulthess, 2014), N 188 et seq.

97 Please refer to the italicized example mentioned under Section II.A.1.

98 Tokens of the new blockchain OmiseGO, advised by Ethereum's founder Vitalik Buterin, distributed 9.7 OmiseGO token to Ether token holders' addresses, for every Ether they hold. See https://www.omise.co/omisego-airdrop-update. (last visit, 13 August 2018).

in the blockchain). In such a case, the receiver has a duty of good faith to inform the sender of the incorrect payment.[99]

III.B.1.b Communication to an undetermined number of people: legally binding offer or simple announcement?

Swiss law operates a distinction between an offer addressed to a determined or determinable number of people (Article 3 al. 1 CO), and a communication sent to an undetermined or undeterminable number of offerees. In the latter case, there is a distinction between a genuine legal offer which binds the offeror for a certain duration (e.g., Article 7 al. 3 CO), and a simple announcement which is not binding for its author (e.g., Article 7 al. 2 CO).[100]

By their nature, smart contracts allow for the conclusion of multiple agreements with a large number of parties. In such a case, we must consider whether a smart contract qualifies as a legal offer to a determinable number of people or as a simple announcement.

For example, when an entrepreneur issues a public smart contract for an ICO, it will usually be accompanied by the publication of a white paper (i.e., a document explaining the project in plain language, its conditions, its objectives and its roadmap).[101] In principle, the investor only has to send, via the blockchain, cryptocurrencies to the issuer of the coins. As a result, the smart contract designed for the ICO will trigger an automated performance and the investor will receive the tokens (i.e., the coins) in return for its transfer of cryptocurrency.

According to Kõlvart et al., the announcement of an ICO made to the public rather than to a specific person is not considered a legal offer unless the announcement clearly states that it is one. If that is not the case, such a statement is merely an invitation to make an offer.[102]

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[99] Note, however, that because the blockchain is anonymous and decentralized, it is not possible to easily contact either the wallet holder, or any central institution responsible for the transaction, the way one would contact a bank for a transfer of fiat money.

[100] Ariane Morin, 'Commentary of Art. 82 CO' in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012), N 82 ad Art. 1 CO.

[101] See e.g. Swissborg, *Technical White Paper*, Lausanne 2017, https://swissborg.com/files/swissborg-technical-whitepaper.pdf (last visit, 1 May 2018), p. 1 et seq.; Crypterium, *White paper: Cryptocurrency Lending*, p. 1 et seq.

[102] Merit Kõlvart, Margus Poola and Addi Rull, 'Smart contracts', in Tanel Kerikmäe and Addi Rull (eds), *The Future of Law and Etechnologies* (Springer, 2016), p. 143.

In our opinion, a smart contract preceding a legal contract should, as a general rule, be considered a binding offer to an undetermined number of people for the following reasons:

1. In practice, the white paper often expressly states that the ICO is to be considered a legally binding offer made by the issuer[103] which, if accepted by the investor, will trigger the automatic transfer of tokens related to the ICO's project.
2. Even if there is no such white paper, the fact that the offeree is able to accept the ICO by simply transferring cryptocurrencies to the related smart contract justifies a qualification as a genuine legal offer. In the same way, the publication of a prospectus consists of a public legal offer – as opposed to a simple, non-binding announcement – when a company initiates a public takeover or when it launches an initial public offering.[104] In both cases, the buyer only has to perform the counterpart (i.e., payment of the tokens or declaration to the bank of his intention to accept the offer in the takeover) to manifest his acceptance and to be bound.[105]
3. Because one of the general functions of a smart contract is to reduce the uncertainty in execution of the parties' obligations, one shall only restrictively admit an ICO to simply be an invitation to make an offer. Because a transaction on the blockchain is irrevocable, the investor who sends cryptocurrencies to a smart contract via the blockchain must be protected in his good faith that the ICO is a legally binding offer, unless the contrary is clearly stated in the computer code, and preferably also in the white paper. Conversely, the entrepreneur should not be able to argue that his public announcement is only an invitation to make an offer directed towards investors, which can still freely be rejected by the entrepreneur.

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[103] For instance, in its ICO, Crypterium states: 'In advance of their use within the Crypterium cryptocurrency bank, Crypterium is offering pre-payment of the CRPT token. Crypterium allow for pre-payment up to 210 000 000 CRPT tokens at the initial market value of 0.0001 Bitcoin per CRPT.' Crypterium, *White paper: Cryptocurrency Lending*, p. 6; QUOINE LIQUID Platform's white paper states that: 'Upon funding his/her account, the Purchaser simply clicks on "Buy QASH", enter the amount the Purchaser wishes to purchase, and hits submit. QRYPTOS will automatically deduct the appropriate amount of BTC or ETH from the Purchaser's account and add purchased QASH tokens.' Quoine Liquid, *White paper* (2017), p. 33, https://liquid.plus/ (last visit, 1 May 2018).

[104] See Art. 27 to 36 SIX Listing rules,
https://www.six-exchange-regulation.com/dam/downloads/regulation/admission-manual/listing-rules/03_01-LR_en.pdf (last visit, 13 August 2018).

[105] See also Kristian Lauslahti, Juri Mattila and Timo Seppälä, 'Smart Contracts, How will Blockchain Technology Affect Contractual Practices?', *ETLA Reports*, N 68, Helsinki 2017, p. 16.

The offeror-entrepreneur shall be bound by his offer and must deliver the tokens once the offeree-investor has accepted it.

III.B.1.c Acceptance

Acceptance is an expression of intent issued by the offeree who unconditionally accepts an offer; as a result, the contract is executed[106]. According to Swiss law, as a general rule, the acceptance of an offer requires an active behavior by the offeree (Article 6 et seq. CO). He must communicate his intent to be bound by a contractual agreement containing all the objectively, and subjectively, essential points described in the offer (Article 2 CO). The acceptance can be communicated in any form. It can be expressed or implied through conclusive acts. This is the case when the offeror infers the existence of the intent to execute a contract, based on the behavior of the offeree.[107]

It is rather unlikely that the acceptance of an offer made in the form of a smart contract would occur by sending an acceptance in plain language ('I accept'). Generally, the computerized offer provides for certain conditions to be fulfilled for there to be acceptance. The offeree has to send the data provided for in the smart contract – very often an amount of cryptocurrency – to the specified public address via the blockchain.

Example: If the airline company stores a smart contract on the blockchain allowing for the conclusion of a contract of carriage, and the traveler meets the required conditions (e.g., the communication of the traveler's identity as well as the transfer of a certain amount of the cryptocurrency traded over the blockchain), then the traveler will accept the offer when acceding to the blockchain and sending the corresponding amount of cryptocurrency to the smart contract's address.

When a person starts executing the terms contained in a smart contract recorded on the blockchain, she communicates her intent to enter into a contractual relationship through her conclusive behavior.

For example, in an ICO, the offeree-investor accepts the entrepreneur's offer by transferring the amount of cryptocurrency provided for in the smart contract. A legal contract is executed through the smart contract which will auto-perform by transferring the tokens via the blockchain to the investor.

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[106] Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 621 et seq.; Peter Gauch, Walter Schluep and Jörg Schmid, *Schweizerisches Obligationenrecht Allgemeiner Teil*, 2 Vol., Vol. I (10th edn., Zurich, Schulthess, 2014), N 433 et seq.

[107] Ariane Morin, 'Commentary of Art. 82 CO' in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012), N 10 ad Art. 1 CO.

The blockchain registers the exact time and date at which said party sent the relevant data amounting to the acceptance of the offer and triggering the conclusion of the contract. The transaction hash is irrevocably registered and can be verified by anyone at any time.

III.B.2 Where the existence and content of the contract are at stake: the difficulty of ascertaining an effective mutual expression of intent through computer code

When offer and acceptance are exchanged via a smart contract, one of the main challenges is to ascertain whether the parties intended what is written in the computer code (subjective interpretation).[108] If the computer code does not correspond in the end to what one of the parties may have had in mind, its content corresponds at least to the meaning the parties should attribute to it in good faith (interpretation according to the principle of confidence; objective interpretation).[109] In this context, recall that a party negotiating an agreement has a precontractual duty to get informed and to understand what she is doing.[110]

In principle, the computer code containing the legal offer, being 'dry code' which merely commands the machine as to what it must execute, is unambiguously formulated and is not subject to interpretation.[111] Therefore, if an offeree expressly or impliedly (e.g., by transferring the required amount of cryptocurrency) accepts the offer contained in a smart contract, it is difficult to negate the existence of a contract, at least based on an interpretation according to the principle of confidence and based on the party's precontractual duty to get informed before accepting the offer.

> *Example: The passenger uses the smart contract to purchase a flight ticket without reading the code and without knowing its exact effects. She sends cryptocurrencies to the smart contract and in return receives utility tokens to board a flight. As it turns out, the flight does not take off to the destination she anticipated, although the actual destination corresponds to what was specified in the smart contract. The passenger would then be bound by the contract, as she was obligated to understand the terms to which she agreed.*

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[108] Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 193 et seq.; Peter Gauch, Walter Schluep and Jörg Schmid, *Schweizerisches Obligationenrecht Allgemeiner Teil*, 2 Vol., Vol. I (10th edn., Zurich, Schulthess, 2014), N 207 et seq.

[109] Ibid.

[110] Ibid. N 949 et seq.

[111] Hans Rudlof Trüeb, 'Smart Contracts' in Pascal Grolimund, Alfred Koller, Leander D. Loacker and Wolfgang Portmann (eds), *Festschrift für Anton K. Schnyder* (Zurich/Basel/Geneva, Schulthess, 2018), p. 709.

The meaning of a computer code remains inaccessible to the vast majority of people. It might then be difficult to acknowledge the existence of a legally binding agreement if the parties cannot read or understand their obligations, which are solely compiled in the smart contract.[112] As discussed previously,[113] an offer formulated through a smart contract presents similarities to a contract with general terms and conditions. Therefore, the protection mechanisms developed within this area of law could apply accordingly:

- *Requirement of an integration clause*. Adapted to the present hypothesis, this means that the parties have to agree that the computer code is part of their contractual relationship. Because the smart contract is used as the sole vehicle of communication for offer and acceptance, this requirement will usually be met as soon as the users understand that the computer code has a contractual content.
- *Unusual clause rule*. If part of the computer code contained in the smart contract is foreign to the transaction concerned and cannot be expected by the offeree, then the provision (i.e., the section of the computer code) is deemed not to be part of the common agreement, unless it has been expressly brought to the offeree's attention.[114] If the smart contract provides for such clauses, it may be advisable for its author to highlight them by pointing them out in a white paper explaining these clauses.
- *Interpretation contra stipulatorem*. According to this rule, if an unequivocal interpretation of the smart contract is not possible, then the relevant interpretation shall be the one that is less favorable to the computer code's author.[115] Such a rule will hardly ever be used in relation with smart contracts, because computer code is usually not subject to interpretation.
- *Abusive clauses*. If the offeree is a consumer, provisions which fall into the scope of application of Article 8 Unfair Competition Act[116] are illicit and therefore void.[117] This provision states that '[a]ny person who, in particular,

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[112] Gabriel Jaccard, 'Smart Contracts and the Role of Law', *Jusletter IT*, 23 November 2017, N 85.

[113] See Section II.B.2.

[114] By analogy: Blaise Carron, 'La protection du consommateur lors de la formation du contrat', in Carron Blaise and Müller Christoph (eds), *3e Journée des droits de la consommation et de la distribution* (Neuchâtel, Helbing Lichtenhahn, 2013), N 82 et seq., quoting: ATF 119 II 443 consid. 1a; ATF 135 III 225 consid. 1, JdT 2009 I 475.

[115] By analogy: Blaise Carron, 'La protection du consommateur lors de la formation du contrat', in Carron Blaise and Müller Christoph (eds), *Droits de la consommation et de la distribution: les nouveaux défis* (Neuchâtel, Helbing Lichtenhahn, 2013), N 82 et seq., quoting: ATF 119 II 443 consid. 1a; ATF 135 III 225 consid. 1, JdT 2009 I 475.

[116] Loi fédérale sur la concurrence déloyale RS 241.

[117] The authors acknowledge that such a question is not related to the existence of the contract (see Section III.B.2), but rather to its validity. This question is treated here for the sake of simplicity.

uses general conditions which, contrary to the rules of good faith, provide, to the detriment of the consumer, for a significant and unjustified disproportion between the rights and obligations arising under the contract is acting unfairly'.[118]

Example: The passenger uses the smart contract to order her utility token granting access to the flight. She sends cryptocurrency to the smart contract. When checking in two hours before the doors close, she sees that she has been denied access to the flight, although a two hours check in before the gates' closing hour is a broadly used rule in other companies. When she reads the smart contract's code she realizes that one code line denies access to the gates if the passenger doesn't check in four hours before the closing gates time. Such a clause, being unusual and unforeseeable, gives rise to the passenger's claims that she could only have been bound by this clause if she had explicitly been warned of its existence in the agreement.

III.B.3 Where contractual validity is at stake: vitiated object, form or consent due to the conclusion via smart contracts

As discussed above, executing a binding legal agreement through a smart contract is a challenging task, in particular in relation to the validity requirements that need to be fulfilled when the contract is formed (Article 11 et seq. CO). The following section is dedicated to the possible defects affecting a legal contract executed through a smart contract, such as those regarding its object (III.B.3.a), its form (III.B.3.b) or consent (III.B.3.c), as well as to the restitution of the performances supplied under a void contract (III.B.3.d).

III.B.3.a Invalidity arising from the object of the legal contract

A legal contract is void because of a defect pertaining to its object, inter alia, if its terms are illegal, immoral or impossible (Article 19 para. 2 and 20 para. 1 CO).[119]

Thanks to the anonymous character of the blockchain, some individuals are tempted to use blockchain technology to enter into illegal contracts. In this context, it must be remembered that one of the historical purposes of smart

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[118] For a commentary of Art. 8 UCA, see Pascal Pichonnaz, 'Commentary of art. 8 LCD' in Vincent Martenet and Pascal Pichonnaz (eds), *Commentaire romand de la loi sur la concurrence déloyale* (Basel, Helbing Lichtenhahn, 2017), ad Art. 8, p. 348 et seq.

[119] Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 720 et seq.; Peter Gauch, Walter Schluep and Jörg Schmid, *Schweizerisches Obligationenrecht Allgemeiner Teil*, 2 Vol., Vol. I (10th edn., Zurich, Schulthess, 2014), N 629 et seq. A contract is also void if its terms are initially impossible (Art. 20 para. 1 CO). This specific case seems less relevant than the others for an execution through a smart contract.

contracts is to avoid State rules.[120] Some pioneers expected these developments to 'alter completely the nature of government regulation, the ability to tax and control economic interactions, the ability to keep information secret'.[121] Their aim was to guarantee the possibility to do business and trade out of any organized, centralized State control, in order to enable democratic control. Smart contracts were thought to allow exchanges of national secrets, unscrutinized by official organs,[122] or to provide for the financing of such projects. For instance, blockchain technology was used to support Wikileaks's mission to disclose classified information when, being boycotted by all official banks, the organization accepted anonymous funding in bitcoins.[123]

As such, one cannot exclude that part of the original aim of developing the smart contract technology on the blockchain was to execute illegal agreements. For instance, the website Silk Road became a platform to sell drugs on the darknet. Cryptocurrencies were used as payment solutions. Agreements to sell drugs against cryptocurrencies are void and, despite a mutual expression of intent by the parties through a smart contract registered on the blockchain, no valid contract can emerge from them. That said, criminal traffic is, in practice, not really impacted by the legal appreciation of its contractual validity, because it is usually not the object of legal enforcement in courts.

An issue could also arise when, after the conclusion of a legal contract through a smart contract, a party realizes that she is involved in an illegal agreement and would like to rescind it or to withdraw from it. Because the legal contract is void, the extracontractual restitution provisions are applicable, including vindication (Article 641 Swiss Civil Code (CC)) or the rules regarding the restitution of unjust enrichment (Article 62 et seq. CO).[124] However, Article 66 CO provides that no right to restitution exists with respect to anything given with a view to producing an illegal or immoral outcome.[125] This situation could arise when an investor sends cryptocurrencies to an ICO in Switzerland, knowing that it is illegal because it violates anti-laundering rules.

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[120] Timothy C. May, *The Crypto Anarchist Manifesto* (1989), https://www.activism.net/cypherpunk/crypto-anarchy.html (last visit, 1 May 2018).

[121] Timothy C. May, *The Crypto Anarchist Manifesto* (1989), https://www.activism.net/cypherpunk/crypto-anarchy.html (last visit, 1 May 2018).

[122] Ibid.

[123] Andy Greenberg, 'WikiLeaks Asks for Anonymous Bitcoin Donations', *Forbes*, 14 June 2011, https://www.forbes.com/sites/andygreenberg/2011/06/14/wikileaks-asks-for-anonymous-bitcoin-donations/#4313047d4f73 (last visit, 1 May 2018).

[124] For a distinction on the two methods, see Section III.B.3.d.

[125] In ATF 134 III 438, the Swiss Supreme Court underlines that this provision only applies if the performance was done in order to attain an illicit goal and not only on the occasion of an illicit agreement.

The above-referenced rules are, in principle, applicable to legal agreements executed via smart contract. The anonymity provided by blockchain technology does not protect illegal or immoral contracts from nullity. However, that anonymity may make it more difficult for a party to identify the person from whom she could claim objects which had already been delivered, or the value of the services already rendered. That said, while protecting anonymity in some ways, the blockchain also contains immutable proof that a specific address sent data (e.g., an amount of cryptocurrency) to another address. If one or several wallets are linked with criminal activities, once the holder of those wallets is identified, it may be easier to prove his illegal behavior and to convict him. The example of Silk Road proves that the public addresses in the blockchain can be traced and associated with individuals or corporations, as this website has since been closed by the FBI, its creator arrested,[126] and many users convicted based on computer forensics.[127]

III.B.3.b Invalidity arising from the form of the contract

Swiss Obligation law provides that the validity of a contract is not subject to compliance with any particular form, unless a particular form is prescribed by law (Article 11 CO).[128] This is known as the principle of freedom of form. In order to be valid, an agreement only has to be identifiable as such, be comprehensible to the offeree and does not have to comply with any specific form.[129] However, there are exceptions, as demonstrated by the fact that the law requires some contracts to be in a particular form. Some agreements are only valid if they are memorialized in writing (e.g., Article 243 para. 1 CO for the

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[126] Martin Untersinger, 'Le créateur présumé de Silk Road 2.0, site de vente de drogue sur Internet, a été arrêté', *Le Monde*, 6 November 2014, http://www.lemonde.fr/pixels/article/2014/11/06/le-createur-presume-de-silk-road-2-0-a-ete-arrete_4519769_4408996.html (last visit, 1 May 2018).

[127] See http://www.gwern.net/DNM-arrests#silk-road-1-sr1 (last visit, 13 August 2018)

[128] For a commentary of this provision, see Julia Xoudis, 'Commentary of art. 11 CO', in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012); Ingeborg Schwenzer, 'Commentary of art. 11 CO', in Heinrich Honsell, Nedim Peter Vogt and Wolfgang Wieg (eds), *Basler Kommentar Obligationen recht* (6th edn., Basel, Helbing Lichtenhahn, 2015).

[129] Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 666.

promise of a gift[130], Article 165 para. 1 CO for an assignment[131]) or as a public deed (e.g., Article 216 para. 1 CO for the sale of immovable property[132]).

When the law requires the contract to be done in writing (Article 12 et seq. CO), Article 13 CO states that it must be manually signed by all persons on whom it imposes obligations.[133] The Swiss lawmaker recently introduced the authenticated electronic signature (Article 14 al. 2*bis* CO), a specific form regulated by the Federal Act on Electronic Signatures (SCSE).[134] This statute provides that the electronic signature is a set of electronic data that serves to verify the authenticity of an act (Article 2 let. a SCSE) and is deemed equivalent to a handwritten signature (Article 14 al. 2*bis* CO).[135]

According to Eggen, the blockchain could be used to register a contract with a digital signature if two conditions are fulfilled. First, the blockchain should offer the technical capability of integrating the contract in the distributed ledger, with a digital signature that complies with Article 14 al. 2*bis*

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[130] For a commentary of this provision, see Margareta Baddeley, 'Commentary of art. 243 CO' in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012); Nedim Peter Vogt and Annaïg L.Vogt, 'Commentary of art. 243 CO', in Heinrich Honsell, Nedim Peter Vogt and Wolfgang Wieg (eds), *Basler Kommentar Obligationen recht* (6th edn., Basel, Helbing Lichtenhahn, 2015).

[131] For a commentary of this provision, see Thomas Probst, 'Commentary of art. 165 CO', in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012); Daniel Girsberger and Johannes Lukas Hermann, 'Commentary of art. 165 CO', in Heinrich Honsell, Nedim Peter Vogt and Wolfgang Wieg (eds), *Basler Kommentar Obligationen recht* (6th edn., Basel, Helbing Lichtenhahn, 2015).

[132] For a commentary of this provision, see Silvio Venturi and Marie-Noëlle Zen-Ruffinen, 'Commentary of art. 216 CO', in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012); Alfred Koller, 'Commentary of art. 216 CO', in Heinrich Honsell, Nedim Peter Vogt and Wolfgang Wieg (eds), *Basler Kommentar Obligationen recht* (6th edn., Basel, Helbing Lichtenhahn, 2015).

[133] For a commentary of this provision, see Julia Xoudis, 'Commentary of art. 13 CO', in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012); Ingeborg Schwenzer, 'Commentary of art. 13 CO', in Heinrich Honsell, Nedim Peter Vogt and Wolfgang Wieg (eds), *Basler Kommentar Obligationen recht* (6th edn., Basel, Helbing Lichtenhahn, 2015).

[134] Federal Act on Electronic Signatures (SCSE), SR 943.03.

[135] For a commentary of this provision, see Julia Xoudis, 'Commentary of art. 14–15 CO', in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012); Ingeborg Schwenzer, 'Commentary of art. 14-15 CO', in Heinrich Honsell, Nedim Peter Vogt and Wolfgang Wieg (eds), *Basler Kommentar Obligationen recht* (6th edn., Basel, Helbing Lichtenhahn, 2015).

CO. Second, the contract should be readable in printed characters.[136] Eggen argues that the ledger's record should make a clear reference to the contract's content.[137] However, considering that a ledger based on blockchain technology cannot display more information than two addresses and a hash of the transaction which corresponds to the block number in which the transaction is recorded,[138] we are of the opinion that it is – at least presently – not possible to execute a legal contract that is subject to the written form (Article 12 et seq. CO) through a smart contract.

In our opinion, if the law requires a contract to be in writing, the only possibility is to manually or electronically sign a pre-existing legal contract. The parties may then provide that it will be recorded in a decentralized ledger using blockchain technology and executed via a smart contract. Of course, as previously argued,[139] the difficulty of translating computer code into plain legal language should not be underestimated.[140]

III.B.3.c Invalidity arising from the parties' consent in the contract

According to Swiss obligation law, a party can invalidate a contract if she entered into it under a fundamental mistake (Article 23 CO), if she was induced to enter into it by the fraud of the other, or a third, party (Article 28 CO) or if she has entered into it under duress from the other, or a third, party (Article 29 CO)[141]. In this section, we will only focus on fundamental mistake as a basis for invalidation. However, this analysis is generally applicable to the other defects in consent (i.e., fraud and duress), which may also serve as bases for invalidation.

From a contractual point of view, a mistake consists of a discrepancy between reality – as observed by a judge – and the facts – as perceived by

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[136] Mirjam Eggen, 'Verträge über digitale Währungen', *Jusletter*, 4 December 2017, p. 9.

[137] Ibid.

[138] See https://etherscan.io/txs (last visit, 13 August 2018)

[139] See Section III.A.1.

[140] Eliza Mik, 'Smart Contracts: Terminology, Technical Limitations and Real World Complexity' (2017) 9 *Law, Innovation and Technology* 289.

[141] For a commentary of these provisions, see Bruno Schmidlin, 'Commentary of art. 23-31 CO', in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012); Ingeborg Schwenzer, 'Commentary of art. 23–31 CO', in Heinrich Honsell, Nedim Peter Vogt and Wolfgang Wieg (eds), *Basler Kommentar Obligationen recht* (6th edn., Basel, Helbing Lichtenhahn, 2015). See also Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 769 et seq., N 782 et seq., N 822 et seq., N 832 et seq.

a party when entering into the contract.[142] This false representation includes imprecise representations, as well as the ignorance of a particular party.[143] A mistake is 'fundamental' if it pertains to the very nature of the executed contract (*error in negotio*; Article 24 al. 1 cipher 1 CO); to the subject matter of the contract or to the identity of the co-contracting party (*error in corpore* or *in persona*; Article 24 al. 1 cipher 2 CO); to the consideration for the promised performance (*error in quantitate*; Article 24 al. 1 cipher 3 CO); or to specific facts which the party mistakenly considered in good faith to be a necessary basis for the contract (Article 24 al. 1 cipher 4 CO).[144] The consequence of a fundamental mistake is that the party laboring under mistake when entering into the contract is not bound by that contract (Article 23 CO) if she respects the requirements of Article 31 CO.[145] According to that provision, a party who contracted by mistake must declare to the other party that she intends not to honor the contract or shall seek restitution for the performance within a year after the mistake was discovered (Article 31 CO). Otherwise, the contract tainted with a fundamental mistake is deemed to have been ratified, and is valid.[146] According to Article 26 CO, a party acting mistakenly and invoking that mistake to repudiate a contract is liable for any loss or damage arising from the nullity of the agreement where the mistake is attributable to his own negligence, unless the other party knew or should have known of the mistake.

Article 23 et seq. CO may be particularly important to contractual agreements executed through a smart contract. Computer code is not easily under-

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[142] Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 782 et seq.

[143] Bruno Schmidlin, 'Commentary of art. 23, 24 CO', in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012), ad Art. 23, 24 CO, N 2.

[144] For a commentary of these provisions, see Bruno Schmidlin, 'Commentary of art. 23–31 CO', in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012); Ingeborg Schwenzer, 'Commentary of art. 23–31 CO', in Heinrich Honsell, Nedim Peter Vogt and Wolfgang Wieg (eds), *Basler Kommentar Obligationen recht* (6th edn., Basel, Helbing Lichtenhahn, 2015). See also Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 769 et seq., N 782 et seq., N 822 et seq., N 832 et seq.

[145] Pierre Tercier and Pascal Pichonnaz, *Le droit des obligations* (5th edn., Geneva/Zurich, Schulthess, 2012), N 808 et seq.

[146] For a commentary of these provisions, see Bruno Schmidlin, 'Commentary of art. 31 CO', in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012); Ingeborg Schwenzer, 'Commentary of art. 23-31 CO', in Heinrich Honsell, Nedim Peter Vogt and Wolfgang Wieg (eds), *Basler Kommentar Obligationen recht* (6th edn., Basel, Helbing Lichtenhahn, 2015).

standable by most parties, and knowledge of such code is inaccessible to the public at large. Therefore, there may be numerous occasions where a party alleges – either in the course of performance or after it – that she did not understand the contract as executed by the smart contract.

> *Example: If a traveler enters into a contractual agreement of carriage offered by an airline company through a smart contract by sending cryptocurrencies to the smart contract's address, she might not have understood key elements of the offer. For instance, she may have relied on non-binding explanations provided on the website of the company instead of analyzing the computer code. As a result, the traveler may be tempted to invoke a fundamental mistake based on Article 24 para. 1 cipher 4 CO, and seek to invalidate the contract on that basis.*

According to Trüeb, a customer who was misled in his conclusion of the contract should have the option to sue the issuer of the smart contract if he or she contracts under false promises in good faith.[147] However, admitting too liberally that claim of nullity jeopardizes the very essence of the smart contracts in their public, transparent and inviolable nature. As a result, Trüeb favors a restricted application of Article 23 et seq. CO.

In our opinion, however, Trüeb's arguments are not completely convincing. While we support an objective interpretation based on the computer code,[148] we believe that there is no compelling argument to limit the party's right to invoke a fundamental mistake as a basis for calling null a contract when a smart contract was used to execute the legal agreement.[149] A restricted right to invoke insufficient or defective consent could be tailored to machine-only communications, in an Internet of Things (IoT) environment. As long as there is at least one human being involved in the transaction, she should be allowed to argue that, when entering into a legal agreement via the smart contract, she did not correctly express her subjective intent. For example, she intended to enter into a different type of contract (*error in negotio*), or she did not correctly understand specific facts which formed a necessary basis for the contract. In both cases, she would have expressed a fundamentally vitiated intent.

If we accept the principle according to which a legal contract executed through a smart contract can be declared void by one party claiming a funda-

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[147] Hans Rudlof Trüeb, 'Smart Contracts' in Pascal Grolimund, Alfred Koller, Leander D. Loacker and Wolfgang Portmann (eds), *Festschrift für Anton K. Schnyder* (Zurich/Basel/Geneva, 2018), p. 709.

[148] See Section III.B.2.

[149] One shall be reminded that, according to Art. 26 CO, the party acting mistakenly and invoking that mistake to repudiate a contract is liable for any loss or damage arising from the nullity of the agreement where the mistake is attributable to his own negligence, unless the other party knew or should have known of the mistake.

mental mistake, it is technically almost impossible for the programmer of the smart contract to anticipate every type of potential fundamental mistake in advance. It is equally unrealistic to imagine that a computer code could contain an efficient test which would enable it to distinguish between a genuine fundamental mistake, and another type of mistake that does not affect the validity of the contract.

As a result, because the smart contract is unable to identify or cure the party's defect in consent, it will automatically execute the legal agreement. The victim will not be able to stop the performance mechanism of the smart contract, even if she realizes her mistake early and communicates her intent to declare the contract void because of a defect in her consent. Facing this situation, the victim of the mistake has no other choice but to wait and call upon the other party, or a civil judge, seeking restitution of the goods or money delivered, or for compensation for the services rendered that cannot be transferred back.

> *Example: If a traveler wanting to book a round trip flight enters into a contract while accepting a smart contract designed for issuing only a one-way ticket, she has entered into the contract under a fundamental mistake. Despite her deficient consent, the smart contract will automatically execute, and she will receive a utility token for a one-way flight. She will have to call upon a civil judge to ask for a refund, likely on the condition that she transfers back the utility token to the airline company via the blockchain.*

III.B.3.d Restitution of the performances supplied under a void contract

Swiss law provides for two different legal bases to compensate for performances accomplished in (technical) accordance with the smart contract, despite the nullity of the (legal) contract. Because the legal cause for the performances never existed, the applicable rules are those on reclaim, based on Article 641 al. 2 CC[150] (III.B.3.d.i), or the rules on the restitution of unjust enrichment, contained in Article 62 et seq. CO (III.B.3.d.ii).

III.B.3.d.i Reclaim

If the performance involves the transfer of possession of an object, and if the ownership of the object could not be transferred due to the lack of valid cause, its lawful owner has the right to reclaim the object from its possessor based on Article 641 para. 2 CC.[151] According to this provision, the owner of an object has the right to reclaim it from anyone withholding it from him, and to protect it against any unwarranted interference.

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[150] Swiss Civil Code of 10 December 1907 (RS 210).

[151] Paul-Henri Steinauer, *Les droits réels*, Vol. 1 (5th edn., Bern, Stampfli, 2012), N 1015 et seq.

Such a reclaim could only be considered under the following two conditions:[152]

1. The reclaimed thing must be an 'object' (i.e., a tangible item which can be controlled in legal and actual terms);[153] and
2. The reclaim is only enforceable against a holder who is not the owner of the object.

Special circumstances of reclaim of an object for which payment was made with cryptocurrencies requires further analysis concerning those two conditions:

1. As to the first condition, if one qualifies the cryptocurrency as an 'object' subject to ownership, the party who transferred an amount of cryptocurrency to the other shall use the reclaim of Article 641 para. 2 CC, and not the rules on the restitution of unjust enrichment contained in Article 62 et seq., in order to claim the restitution. The main obstacle to qualify a cryptocurrency as an object is its tangibility.[154] Graham-Siegenthale and Furrer consider the bitcoin as an object. They argue that Swiss law recognizes that digital data can be the object of a contract of sale. These authors apply the International technology standard ISO/IEC 2382:2015's definition of 'data' as 'reinterpretable representation of information in a formalized manner, suitable for communication, interpretation, or processing', and consider that digital data can be produced, transferred and traded by the digital economy like goods.[155] However, unlike digital data that are stored in a computer, cryptocurrencies are not stored outside of the blockchain. The blockchain only acknowledges that one public address has lowered its number of cryptocurrencies and that another address has increased its number of cryptocurrencies in equal measure.[156] As a result, in our opinion, cryptocurrencies should not be considered 'objects' in the traditional sense,

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[152] Ibid.

[153] Barbara Graham-Siegenthaler and Andreas Furrer, 'The position of blockchain technology and bitcoin in Swiss law', *Jusletter*, 8 May 2017, p. 13.

[154] Andreas Glarner and Stephan D. Meyer, 'Smart Contracts in Escrow-Verhältnissen', *Jusletter*, 4 December 2017, N 62.

[155] Barbara Graham-Siegenthaler and Andreas Furrer, 'The Position of Blockchain Technology and Bitcoin in Swiss Law', *Jusletter*, 8 May 2017, p. 17.

[156] Mirjam Eggen, 'Chain of Contracts, Eine privatrechtliche Auseinandersetzung mit Distributed Ledgers' (2017) *AJP*, p. 14; Stephan D. Meyer and Benedikt Schuppli, '"Smart Contracts" und deren Einordnung in das schweizerische Vertragsrecht' (2017) *Recht*, p. 220; Gabriel Jaccard, 'Smart Contracts and the Role of Law', *Jusletter IT*, 23 November 2017, N 39; See also Andreas Glarner and Stephan D. Meyer, 'Smart Contracts in Escrow-Verhältnissen', *Jusletter*, 4 December 2017, N 52.

as they are only the sum of the number of blockchain transactions executed in favor of one particular address. The amount of cryptocurrency on an address does not actually exist anywhere outside of the blockchain, which only stores the operations executed on it.

2. As to the second condition, as discussed above, the reclaim is only enforceable against a holder who is not the owner of the object[157]. However, co-mingling of assets – essentially, the mixing of chattel – is a legal cause of acquisition of ownership. By its very nature, money is subject to co-mingling. Cryptocurrencies are now considered by the FINMA as a means of payment, or currencies, or as securities.[158] If a party receives cryptocurrency to his address and the cryptocurrencies are considered to be money,[159] the transaction might be considered to be an original mode of acquisition of ownership, and therefore prevent the application of Article 641 para. 2 CC.

Given that cryptocurrencies lack the condition of tangibility, and that are considered to be 'money' in some cases, we think that they cannot be the subjects of a reclaim under Article 641 para. 2 CC.

III.B.3.d.ii Unjust Enrichment

According to Article 62 CO, if a person has enriched himself without just cause, at the expense of another, the former is obliged to make restitution.[160] The provisions on the obligations deriving from unjust enrichment are subsidiary to those of a reclaim based on Article 641 para. 2 CC and to the contractual provisions of the CO.[161]

If a party sends cryptocurrencies to another by mistake, for instance by using a wrong address, or if a party sends cryptocurrencies through the blockchain

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[157] Stephan D. Meyer and Benedikt Schuppli, '"Smart Contracts" und deren Einordnung in das schweizerische Vertragsrecht' (2017) *Recht*, p. 219.

[158] Finma, *Guidelines for Initial Coin Offerings* (2018), pp. 4–5, https://www.finma.ch/en/~/media/finma/dokumente/dokumentencenter/myfinma/1bewilligung/fintech/wegleitung-ico.pdf?la=en (last visit, 1 May 2018).

[159] Stephan D. Meyer and Benedikt Schuppli, '"Smart Contracts" und deren Einordnung in das schweizerische Vertragsrecht' (2017) *Recht*, p. 219.

[160] For a commentary of these provisions, see Benoît Chapuis, 'Commentary of art. 62 CO', in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012); Hermann Schulin, 'Commentary of art. 62 CO', in Heinrich Honsell, Nedim Peter Vogt and Wolfgang Wieg (eds), *Basler Kommentar Obligationen recht* (6th edn., Basel, Helbing Lichtenhahn, 2015).

[161] Benoît Chapuis, 'Commentary of art. 62 CO', in Luc Thévenoz and Franz Werro (eds), *Commentaire romand du code des obligations I* (2nd edn., Basel, Helbing Lichtenhahn, 2012), ad Art. 62 CO, N 30 et seq.

according to a smart contract which is afterwards deemed void, then the co-contracting party will have been unjustly enriched, and will have to refund the currencies received based on Article 62 et seq. CO, unless another legal provision applies.

> *Example: If a traveler, acting under fundamental mistake (Article 23 et seq. CO), enters into a contractual agreement of carriage by sending an amount of cryptocurrency to the address of a smart contract set up by an airline company, she might invoke the nullity of the contract. Because the smart contract automatically performs, she will not be able to stop the performance. However, she may claim restitution in the amount of cryptocurrency based on Article 62 et seq. CO.*

In the case of cryptocurrencies sent in an ICO, a specific risk may arise if the ICO is considered illegal. The transaction would then be considered a void transaction (Article 20 CO). The right to restitution for any payment executed may be barred, because the original payment in cryptocurrency was made in pursuance of an illegal or immoral outcome (Article 66 CO).

III.B.4 Provisional findings

The parties may execute an agreement through a smart contract, which means that it precedes the legal contract. If the parties choose this way of executing a legally binding agreement, they will face the following issues:

- The party who stores the smart contract on the blockchain makes an offer. When another party starts using the smart contract, they enter into a pre-contractual relationship. The offer can be impliedly accepted by the offeree when she starts executing the smart contract by sending data – very often an amount of cryptocurrency – to the address of the smart contract.
- The content of the smart contract consists merely of dry computer code that is capable of being executed by a machine, but which is, in principle, not subject to interpretation. However, because the meaning of a computer code remains difficult to understand for the majority of people, we suggest that the rules developed for general terms and conditions (e.g., the integration requirement, the unusual clause rule, the *contra stipulatorem* interpretation rule, as well as the prohibition of abusive clauses, among others) apply by analogy to smart contracts.
- A legal contract executed via a smart contract may be void due to vitiated content, invalidated form or insufficient or defective consent. In these cases, the intangible nature of the smart contract and its self-executing character may conflict with the requirements of Swiss law of obligations. As a result, the performances supplied through a smart contract, but under a void legal contract, are subject to restitution in accordance with

a dispute-resolution mechanism which must necessarily take place outside of the smart contract.

Taking into account these challenges, we are of the opinion that the use of a smart contract to execute a legally binding agreement should be reserved to situations presenting the following features:

- The parties to the contract should be technology specialists who can easily understand computer code, and its implications in the physical world. This feature may be of less importance in a near future, once the programs translating computer code into plain language have sufficiently improved.
- The essential performances to be exchanged should be simple, easily describable with computer code, and incorporable into tokens of every type, being payment, utility or asset tokens.
- The companies developing their business on smart contracts should be particularly diligent in the explanation of the effects of the contracts to avoid misunderstandings by users, in order to reduce litigation risk, which involves enforcements mechanisms which would take place outside the system of the smart contract.

IV CONCLUSION

In the world of legal contracts, smart contracts can play a dual role.

On the one hand, one may resort to smart contracts after the conclusion of a legal agreement as a means to perform the obligations contained in that agreement. This is presently their most common use.

However, the transposition of a legal agreement into a smart contract is a challenging task. First, on a computer-technical level, this activity is characterized by the formidable challenge of translating legal obligations, which are complex and require interpretation, into lines of dry computer code which has to be executed by a machine. Moreover, the intangibility of smart contracts stored on the blockchain makes it difficult, if not impossible, to correct the bugs usually present in computer code. Second, on the structural level, a smart contract is an inadequate tool for filling gaps, which are inevitably contained in any legal agreement, or for adapting it to modified circumstances or changes of regulation.

The use of smart contracts as a tool to facilitate and automate performance can be adapted for contracts presenting specific features, such as contracts designed to be formed among many parties and containing standard obligations as well as standard remedies (e.g., liquidated damages). Furthermore, the use of a smart contract is particularly appropriate when the parties do not necessarily trust each other and would otherwise require a third party to guarantee the other's performance. When the legal agreement requires the use

of complex legal provisions and indeterminate legal concepts that require the intervention of a human being in case of a dispute, the smart contract does not provide enough flexibility to be used as a tool to perform the legal contract.

On the other hand, a smart contract may precede the legal contract and be designed so as to allow for its conclusion, while enabling the exchange of an offer and its acceptance. As of today, this type of use of blockchain technology remains theoretical. However, rapid technical developments, as well as increasing economic interest in the field, might give rise to solutions resulting in a major paradigm shift in the near future. To allow for a widespread use of the smart contracts as a means to enter into legally binding agreements, developers and entrepreneurs will have to overcome the legal challenges of establishing the precise moment of the creation of a legal contract through a smart contract, of the way to describe the content of legal obligations with computer code, as well as of the mechanisms that are implemented in case the agreement ends up being legally void.

While companies using complex smart contracts enroll teams of blockchain specialists to review their codes before using them, those who aim to enter into contractual relationships with a wider public of users will have to adapt to their customers' level of code. Therefore, a rigorous and complete explanation of the effects of the code, in plain language, will always be required for the clients to understand the contract they are entering into, otherwise the companies could face litigation in which the users would consider themselves not bound by any code line whose effect was not clearly explained upfront.

In the future, smart contracts may not only bind natural persons or legal entities together, but will rule the IoT. For example, a *smart car* will automatically contract with an electricity supplier to load its batteries when the levels are low, order new tires, brakes and windshield wipers when they are too old, pay for highways and parking, and buy new music and movies for the passengers. A *smart house* will not only buy the household groceries or other consumables according to the tenants' habits, but also get them delivered, pay the rent or mortgage, and procure heating, electricity and water.

If all the connected objects interact to order the exact amounts of what is needed, and performance takes place without any possibility of human error; if lump sums or reimbursements are guaranteed in case of inexecution, can these relationships between the objects without the intervention of the final user still be referred to as *contracts*? And will contract law still be of any practical relevance in this domain? The developments discussed in this chapter tend to show that, at a very high level of automation in a repeated process, laws could disappear in favor of code, which will, on its own, ensure a balance between the price and the execution of the command. The fairness of this balance will not rely on century-old State rules anymore, but on the conditions of the code

itself, bearing the risk that, in the end, computer logic will be utterly disconnected from the human feeling of justice.