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"Never trust anything that can think for itself if you can't see where it keeps its brain"
(Arthur Weasley, *Harry Potter and the Chamber of Secrets*)

THE EMBEDDING OF SMART CONTRACTS INTO SWISS PRIVATE LAW

Keywords: Contract law, smart contracts, blockchain, declarations of intent, interpretation.

In this paper, the author examines Smart Contracts ("SC"), statements of will and the parties' intention to create legal relations. These statements of wills are attributed to the parties who have agreed to the basic principles of a contract, but also the contracts used during the SC services. The SC declaration is within the scope of consent. The expressions of will and knowledge of the SC and natural persons are subject to different rules of interpretation. The invalidity and reasons for rescission are to be assigned to the correct declaration of will and knowledge.

I. Introduction and Questions

Blockchain technology¹ with its decentralized registration structure (distributed ledger technology)² not only enables the secure, conceptually unchangeable traceable storage of information at any time, but also executes the program functions. These stored decentralized programs, SC³ execute their function. They can also be used for various external processes i.e. input data (so-called oracles), take receipt of money, measure temperature

¹ See the presentations of MEYER/SCHUPPLI from a legal point of view, "Smart Contracts" and their integration into the Swiss Private Law, *Law* 2017, p. 204 ff. (204 ff.); ESSEBIER/WYSS, From the blockchain to Smart Contracts, *Jusletter* 24 April 2017.

² See the various functions of the "distributed ledger", MIRJAM EGGEN, *Chain of Contracts*, *AJP* 2015, p. 3 ff.

³ See MEYER/SCHUPPLI, loc.cit., p. 207 ff; ESSEBIER/WYSS, loc.cit., Rz. 29 ff; BACON/BAZINAS, "Smart Contracts": The next big thing, *Jusletter IT* 18. 5. 2017; GABRIEL OLIVER BENJAMIN JACCARD, Smart Contracts and the Role of Law, *Jusletter IT* 23. 11. 2017; ROLF H. WEBER, Disruptions to performance and enforcement of rights for Smart Contracts, *Jusletter* 4. 12. 2017; GLARNER/MEYER, Smart Contracts in escrow relationships, *Jusletter* 4. 12. 2017; Swiss Legaltech Association,

data, information on payment address, location, exchange rate data, acknowledge receipt of a parcel, achievement of a required Quorum in a reconciliation, output data of another SC etc.). This pre-defined input data can then trigger the program functions.

However, all program functions are only used if the corresponding miners have confirmed both the information provided to the program regarding the identity of the data source as well as the validity of the data ("Mining Nodes"). These functions can be illustrated by a simple example⁴.

Cars are leased on a blockchain platform X. The application foresees that each car can be activated as soon as the user has paid the leasing rate. If a leasing instalment does not arrive after two reminders, the car will no longer be unlocked, i.e. the lessee can no longer open the car or start the engine, until the appropriate rate has arrived. The lessee will be informed automatically. Also, the operator of the platform is automatically notified. He should be informed about the location of the vehicle and these are marked with the corresponding map material so that he can decide whether appropriate measures are necessary, with regards to the location of the vehicle i.e. parking fees, whether it is parked in a no-parking zone etc.).

If A now wants to lease a corresponding car, he concludes the leasing contract with B. In this contract, they agree to use the above application. A and B conclude the contract exclusively via the application provided by platform operator X.

From a technical point of view, such projects based on blockchain technology do not pose any fundamental problems. In the above example, the identity of the lessee can be verified with a private key. This enables the lessee to clearly identify his activities on the system, the leased asset vehicle and conclude the leasing contract with all conditions met i.e. leasing rates, terms of payment etc.). The payments of the leasing instalments, whether to a FIAT account of a bank or with a specially created crypto currency account, can be automatically saved as "Oracle" information, along with the location information of the vehicle.⁵

The miners check the identity and validity of the transferred information, the originality of the Oracle source and the validity of the corresponding information. The results of the program code only becomes effective if the miners confirm the result of the program routine as correct. However, the miners can only check whether the information has come from the correct source (i.e. it has been signed with the correct private key) and whether it contains the correct format at the syntactic level. They can only check the relevant data to ensure that it is correct and not manipulated. However, no semantic control of the content

Regulatory Task Force Report, Data, Blockchain and Smart Contracts, Proposal for a robust and forward-looking Swiss ecosystem, January 2018 (<https://swisslegal.tech/de/>); KAULARTZ/HECKMANN, Smart Contracts - Applications of Blockchain Technology, CR 2016, p. 618 ff.; BUCHLEITNER/RABL, Blockchain and Smart Contracts, eolex 2017, p. 4 ff; REGGIE O'SHIELDS, Smart Contracts: Legal Agreements for the Blockchain, 21 N.C. Banking Inst. 177, 2017.

⁴ See Chamber of Digital Commerce, Smart Contracts: 12 Use Cases for Business & Beyond (<https://digitalchamber.org/>).

⁵ Cf. on the effects in logistics, ANDREAS FURRER, Der Einsatz der Blockchain in der Logistik, Jusletter 4. 12. 2017.

is possible. This is the reason why a SC is particularly safe as the need for blockchain external data can be reduced to a minimum.

This paper does not deal with the technical details of such a project. Rather, the focus is on the legal framework of the SC, especially on the contractual relationship between the persons who want to use the SC for their contractual relationship.

II. Systematic Position of Smart Contracts in the Legal System

A. Necessity of Anchoring the Smart Contract in the Legal System

The above example shows that the function of a SC is focused on automating legal processes. This includes contract management, monitoring the fulfilment of obligations and the execution of transactions, as long as the necessary conditions are met. From a technical point of view, hardly any limits are discernible; but there are some limitations from a legal point of view.

All transactions, allocations of values or entitlements triggered by the SC (the following collectively referred to as "SC actions") will only have the desired effect, if they provide a legally binding basis for entitlement. If one wants to capture this in an image, then the SC is the engine of a vehicle, while the legal right or claims are equivalent to the tyres of the wheels. The strongest motor is of no use if the power is not brought to the ground.

For the economy, SC are revolutionary because they very efficiently eliminate a major weakness of the established legal constructs, the execution of legally binding obligations. Therefore, SC are nothing new when it comes to their legal quality as such.

B. Embedding Smart Contracts in the Legal System

SC are only used in connection with blockchain. A SC enables the creation of decentralized applications, from which the possibilities and limits of the interaction of the contracting parties result. Such an application is based on a protocol provided either by a platform provider or as open-source on a blockchain. At the level of the protocol, it may not always be possible to determine its author, because, for example, an entire team of authors have worked on it or because it is the overall result of a long and possibly automated programming process. There can also be an entire system of SC interacting with each other (Smart Contract System) or a specific SC that will be replaced by another when the defined conditions are fulfilled (e.g. in the case of a "pre-sale token" in the context of an ICO⁶/TGE⁷).

The author of the application can be both a contracting party of the basic contract as well as the provider of the platform. As a basic business model, a platform provider provides for a defined market (e.g. financial products), a protocol and based on this protocol various applications are built and used (possibly also from third party providers). These applications

⁶ Initial coin offering.

⁷ Token-generated event.

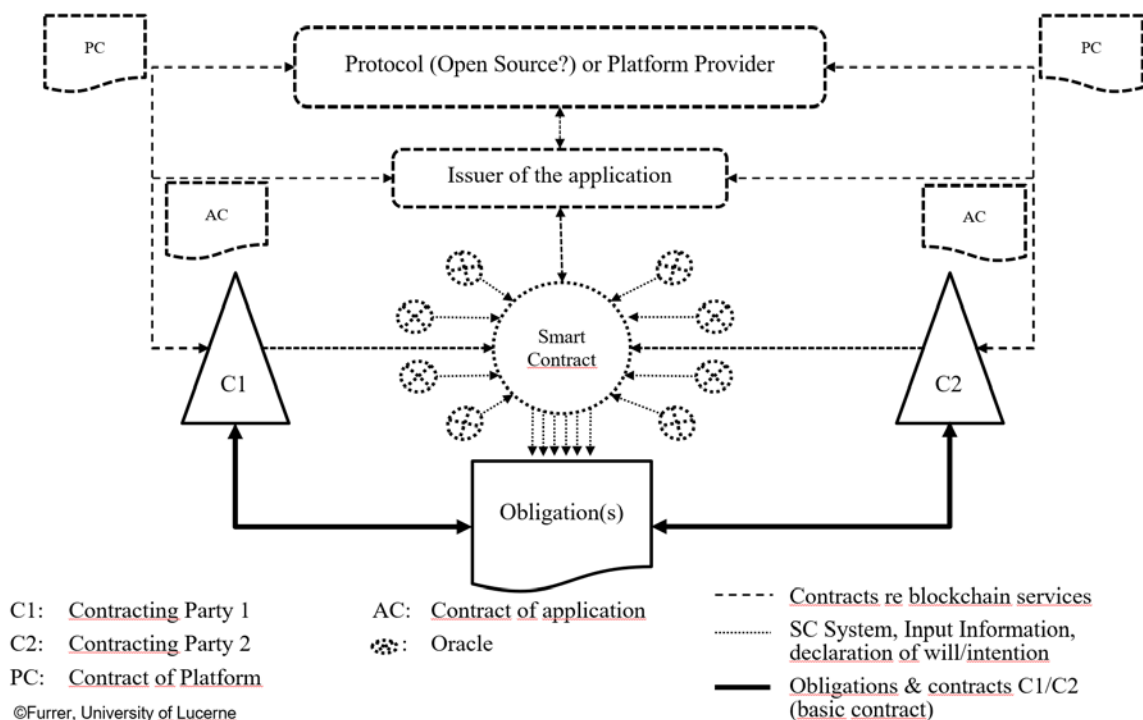
offer specific functionalities for its users, so that parties can use these SC for facilitating the execution of their legal relationship.

Ultimately, a whole series of protocols can lie on top of each other. For example, an author can develop an application to facilitate the processing of letters of credit⁸ in international trade. For this purpose, it can use an open-source protocol that has been specially developed for international trade in commodities trading, such a platform can be based on Ethereum.

This multi-level conflict has three consequences:

- Firstly, there is an author of an application that provides specific functionality. This author must assume responsibility for the programmatic function. Whether this author uses the application itself to close SC or whether he is even the author of the protocol, it is irrelevant for the assignment of the role (but not the legal effect, as it will still be shown).
- Secondly, no one can use the functionalities of an application for a SC that has not first gained access to this application (or to the platform with this application). This access to the application, and possibly also to the protocol, forms an important interface for the legal assessment since the legal framework for the use of the application can already be designed with this accession.
- Thirdly, most, but not all, of the legally relevant operations carried out by the SC can be traced back to actions of a user. These actions, in turn, represent a legally relevant interface that needs to be examined in further detail. It should be noted that this is a prototypical representation. In some applications, it is not always easy to work out the individual roles in this system. However, this is necessary in order to identify the legal relationships behind a SC and ultimately either makes the legal relationships legally binding or at a later stage, assesses the legality of the transactions triggered by SC.

⁸ See GLARNER/MEYER, loc. cit., paragraphs 28 and 49 et seq.



These legal relationships can be represented schematically as shown in the image above. This shows that a distinction must be made between four legal levels⁹:

- Platform Contract:¹⁰ The application is based on one (or more) protocols. Whether this is actively operated by a platform provider or made available as open-source on a blockchain, it is essential for the assessment of the legal consequences for the parties concerned insofar as it can decide whether a contractual relationship exists at all. In particular, a contractual relationship is not to be accepted, if the protocol is provided by the author(s) as open-source, for free use in the blockchain. In this case, it is the author of the application using the functionalities of a specific blockchain infrastructure for the purposes of its application. Although there is a contractual relationship between the authors of the applications and those of the protocol or the infrastructure, it should not be further deepened in this context¹¹. On the other hand, the parties that create a SC, use the application and thus indirectly benefit from the functionalities of the protocol. They have no direct contractual relationship with the authors of the protocol. However, the situation is different when a provider provides a platform (e.g. for financial transactions, logistics applications, charity collections) and the individuals concerned do not get in touch with the platform until they have registered on the protocol. In this case a direct contractual relationship

⁹ Cf. in particular with regard to the legal relationships with the providers of protocols and applications, MEYER/SCHUPPLI, loc.cit., p. 207 ff., 210 ff.

¹⁰ In the figure above, the broad dashed line.

¹¹ MEYER/SCHUPPLI, loc.cit., p. 207 ff., 210 ff.; GLARNER/MEYER, margin 19 ff.

between the parties concerned and the platform operator, means the protocol can be used functionally.

- Application contract:¹² A very important function fulfils the concrete application. The author of this application provides a tool as a service, which the parties concerned may use in order to set up their basic contract. The scope of SC functionality therefore depends on the application used, where these individual functionalities of the SC with information from external information sources such as temperature, money receipt, geodata etc.) can be linked.

It is also possible to directly link a single SC to a blockchain. In this case, the following applies the role of the author of the application contract according to the role of the author of this SC.

When using the application, V1 and V2 each close a contract with the author of the application. The code of the SC must meet the conditions relevant to the SC between V1 and V2. This will then be used to make the declarations and create the intent required for the contractual obligations.

- Basic contract:¹³ In the actual contract between V1 and V2, the parties agree on their mutual rights and obligations, and there is a consensus¹⁴ to use a SC to create, conclude and/or perform the contractual obligations between them.

As far as the common role of V1 and V2 is concerned, V1 and V2 may be legally affected by the relevant actions of the other parties or by the functions of the SC.

As already mentioned, this is a sketch of a prototypical relationship, the peculiarities of the third-party effect these legal transactions (such as for example transfer of ownership¹⁵ or automated creation of legal entities).

It may also be the individuals responsible for a protocol or a SC person cannot be determined and so a claim against these persons cannot be filed because the responsible entity or person can't be determined. As will be shown below¹⁶ these questions must first be elaborated on the basis of a prototypical model to work out the relevant legal relationship and the assigned legal questions.

¹² In the figure above, the thin dashed line.

¹³ In the above graphic, the solid line.

¹⁴ Cf. here: SCHWENZER, loc.cit., Rz. 29.01.

¹⁵ JACCARD, loc. cit., Rz. 13 ff.; HESS/LIENHARD, Transfer of Assets on the Blockchain, Jusletter 4. 12. 2017.

¹⁶ See Chapter IV.

III. From Functionality to Law

A. Declarations of Intent and Knowledge about Smart Contracts

The entire Swiss Code of Obligations is based on declarations of will and knowledge. This also covers legally relevant actions, because an action (e.g. the transfer of an object, the transfer of an amount of money, a complaint regarding the quality of an object purchased) only has legal effect if it is based on the legal will that these actions constitute a legally relevant action.

According to the general and undisputed view, declarations of intent consist "in the notification and thus simultaneously in the execution of the final will to establish, amend or terminate a right or legal relationship".¹⁷ This is universally valid, the different forms of declaration of intent abstractive definition covers the entire spectrum, including normative declarations of intent, for example, through the principles of trust to a person in a legally binding manner. For a legally effective declaration of intent, there must be a will to act, an awareness of explanation and a willingness to do business that can be proven.¹⁸

The outstanding feature of a declaration of intent is that the individual expressing himself can determine the content and scope of his obligations. In an offer, the service, the price and the time of performance can be precisely described; in the case of an acceptance, a "Yes" will suffice. If it adds further conditions to the "Yes", then its declaration of intent is again qualified as an offer.¹⁹

Declarations of knowledge are mere notifications of ideas and wills and must be distinguished from a declaration of will. They are characterised by the fact that they are not designed to constitute a legal success. The difference lies in the fact that these are not shaped by the will of the person expressing himself but are laid down in law. A design statement such as a reminder shall have the legal consequences of default within the meaning of Art. 102 para. 1 CO; the announcement of a power of attorney shall constitute an expression of intent with the persons named in Art. 102 para. 1 CO. Art. 35 para. 3 CO: Both therefore qualify as a declaration of knowledge.

The distinction between declarations of intent and declarations of knowledge is not always clear, clarification is needed to ensure the recipient has understood the corresponding declaration as a declaration of intent. This can be demonstrated using the example of a commercial letter of confirmation.²⁰ As a rule, this does not constitute a constitutive legal effect, but according to Art. 6 CO it can develop the legal effects of a declaration of intent depending on the concrete circumstances.

¹⁷ KRAMER/SCHMIDLIN, General Introduction to the Swiss Code of Obligations and Commentary on Art. 1-18 OR, Bern Commentary Vol./No. VI/1/1, 1986, para. 4.

¹⁸ INGEBORG SCHWENZER, Swiss Code of Obligations, General Section, 7th ed. 2016, para. 27.02.

¹⁹ FURRER/MÜLLER-CHEN, Swiss Code of Obligations, General Section, 3rd ed.2018, Chapter 3 Rz. 8.

²⁰ KRAMER/SCHMIDLIN, loc.cit., marginal 67.

An object can be handed over with the aim of a transfer of ownership, a transfer of the property or with the reservation of the preservation of the of indirect ownership. The handover can be a fulfilment of a purchase or rental object. However, it can also only be used as a pattern and therefore does not constitute an act of performance of a purchase or rental contract (but possibly a legally relevant assurance). The legal relevance of these acts, the will behind the actions must be the will of the individual carrying out the action. For this, you can refer to the classic rules of interpretation for declarations of intent including the principle of trust.²¹

A complaint about the quality of a purchased product is only legally relevant if there is a will to act and the complainant wants to make a complaint in the legal sense (and not just to verbally complain). On the other hand, the legal consequences of a notice of defects in the sales law are governed by Art. 201 ff. OR.

As stated above, V1 and V2 also agree on a contract according to Art. 1 or by using SC technology. The content of this contract can be agreed verbally or in writing and the SC code corresponds to this content (or at least a part of it). Which content of the contract is derived from the code of the SC, and whether this is the real will of the contracting parties is a question of interpretation and will be discussed in more detail below.

Legally, a more demanding issue is the case in which the SC generates SC actions within the framework of contract execution and/or fulfilment, which must be based on a legally relevant will as explained above.

If the SC triggers a payment, this can be a fulfilment of the purchase price, but also the payment of a contractual penalty or the payment of a retained escrow or securities account. If SC V2 sends a reminder or puts it in default, there will be a legally relevant will behind it.

These explanations are generated by the SC based on the programmed code. The programming languages used²² are mostly related to the Java programming language with references to other well-known programming languages such as C++ or Python. Solidity, for example, an object-oriented syntax that can only be executed on the Ethereum Virtual Machine ("EVM"), is relatively common. However, there are also others, not limited exclusively to Ethereum Syntaxes such as Truffle or Embark, but the development here is still very much in flux, so that new syntaxes arise and disappear again. The source-code for these SC is usually disclosed. Due to the use of well-known programming languages, these languages are for interested laymen in principle comprehensible. However, it should be noted that it is unreasonable for most people to understand the content of a SC in the source-code, and it depends on the assumption that this is not understandable for laymen.

Each SC action of the SC is thus based on an automatically generated "will" of the SC based on its code, which ultimately makes a declaration of will and knowledge on a case-by-case basis when the programmed prerequisite is present, the programmed code and incoming information is used. But since a SC neither has its own consciousness nor has a

²¹ BGE 138 III 659 E. 4.2.1.

²² See JACCARD, loc.cit., Rz. 10 ff.; KAULARTZ/HECKMANN, loc.cit., p. 619.

will of its own, the triggering of a SC action, the corresponding willingness to act (and in the case of declarations of intent, an additional awareness of explanation and a business will) is located with a natural person to be. This bridge must be built on the basis of arguments in order to determine the legal relevance of a SC triggered SC action.

In this sense, the SC acts as a kind of substitute. From a legal point of view, the following is of utmost importance, meaning that the individual action at the time of the conclusion of the contract. At this moment the parties do not exist. What we have is a generated SC in accordance with the specified algorithm for the expression of will and knowledge on the basis of pre-defined parameters.

For example, a low inventory (Oracle) can automatically conclude a contract with the supplier based on the price and delivery times of the suppliers (Oracle), which has submitted the optimal offer provided for in the algorithm (price vs. risk of empty inventory). The warehouse keeper might have decided otherwise in the specific case.

In this function as deputy or agent, from a legal point of view the SC is a kind of "will and knowledge generation machine" that expresses this will through the SC actions. This will is generated from the programmed code, using the information from the users and the organizations.

This approach forms the central bridge from technology to law. Because the attribution of these declarations of will and knowledge lead to the central building blocks of civil law, which can only have distinct legal effects.

For example, offer and acceptance lead to the conclusion of a purchase contract with two bonds, namely the obligation to hand over the goods and the obligation to pay the purchase price. A reminder leads to the legal consequences of default in accordance with Art. 102 CO and thus to the payment of interest on arrears as well as stricter liability of the debtor.

Therefore, this link between the declarations of will and knowledge by execution in the code of a SC and the underlying declarations of the individual concerned should be examined.

B. Link to the Declarations of Will and Knowledge of the Persons Concerned

As explained above, it can be assumed that a machine cannot build but generate its own will. This (probably) indisputable starting point led KIANIČKA²³ in particular, following an intensive discussion in Germany, to distinguish between electronic declarations of intent, automated declarations of intent and agent declarations.

²³ KIANIČKA, The Agent's Declaration: Electronic Declaration of Intent and Artificial Intelligence as a Use Case of Legal Basis Liability, Diss. Zurich 2012.

- An electronic declaration of intent results from the choice of an electronic form of communication such as an e-mail or chat and therefore offers no particular difficulties with regard to the will to act, awareness of explanation and business will (will of legal consequence).
- This must be distinguished from declarations of intent, which are automated to varying degrees, based on relevant action parameters. This may lead to a situation with no involvement of a human being neither at the time of the creation nor at the time the declaration is sent.²⁴ Depending on the technical mediatization or the degree of automation, however, the relationship between the declaration and the will related thereto can no longer be established, so that the will is no longer a criterion for attribution. In this gradual development, the automated declaration of intent is characterized by the fact that although there is a will to act, the other two prerequisites of awareness of explanation and business intent are dependent on the degree of automation.
- Finally, in the case of an agent declaration, the will to act only exists with regards to the general conditions, but not with reference to the declaration made individually. There is neither an awareness of explanation nor a willingness to do business for this individual explanation.²⁵

KIANIČKA claims that with an agent declaration and (depending on the degree of automation) an automated declaration of intent, the legally prescribed requirements of the will to act, the awareness of explanation and the business will be missing and therefore such declarations would not have any legal effect. Therefore, such generated will and explanations of knowledge, e.g. no consensus does not result in the conclusion of a contract.²⁶ Conceivable is, however, that this has to do with the principle of trust or (in the agent's declaration) via the legal theory to be cured.²⁷

This critical analysis of automatically generated declarations of intent is only convincing in its starting point, but not the consequences resulting from it. It also contradicts the rightly prevailing doctrine and jurisprudence. It creates an artificial dogmatic ban on modern technologies without recognisable benefits such as the creation of legal certainty and/or the enforcement of mandatory standards under applicable law.

The Zurich Commercial Court recently ruled that in addition to "individually transmitted declarations of intent [...] are also those which are automatically submitted by a pre-programmed computer"²⁸. The program codes represent a common will that legally relevant SC actions can be carried out under the conditions programmed into the program code.

²⁴ KIANIČKA, loc. cit., p. 41 ff.

²⁵ KIANIČKA, loc. cit., p. 147.

²⁶ KIANIČKA, loc. cit., p. 148.

²⁷ KIANIČKA, loc.cit., pp. 167-201.

²⁸ ZR 116/2017 p. 132, judgment of 16. 12. 2016. In the present case, this concerned transactions relating to the release of the fixed exchange rate on 15. 1. 2015. An automated trading platform automatically executed and called options on the basis of the account data of the individual user, his specified limits

For example, an automated inventory system can trigger an order at prices that are either fixed or determined based on referential factors when a certain level of inventory is reached with a specified dealer (or a defined group of dealers). Similarly, in the introductory example, a reminder can be sent after the leasing instalment has not been paid, depending on the pre-programmed prerequisites or the leased car can be decommissioned.

In this sense, a clear distinction must be made between the functions of the computer program and the desired legal relationships. It is undisputed and indisputable that a SC has no legal personality of its own and therefore cannot form or express its own will. The computer program itself is also not the contract itself but reflects (or at least should reflect) the will of the parties to the contract. Despite its misleading name, it is also not an independent contract. The program code of a SC represents the common will of the contracting parties in the basic contract and generates and expresses the individual will of a contracting party. It may therefore be used as evidence of the concurring will of the parties in the basic contract, which, of course, is subject to the free assessment of evidence by the court.²⁹

Contrary to the opinion of KIANIČKA, it is therefore not necessary to reject each connection between the will formation with persons and the will and knowledge explanation by automated systems overall. This consensus can be contrary to the view of KIANIČKA, it can also be traced back to the contractual ties of the individuals concerned, be it in the basic contract between the individuals or through the application contract or the platform contract. These contracts form the relevant points of contact for the individual and the company. Declarations of intent and knowledge that have been concretized and expressed in actions using the program code.

C. Relationship Between the Individual and the Automated Declaration of Will and Knowledge

1. Central Issues

It follows from the above that the automatically generated declarations of will and knowledge of a SC must be analysed in a differentiated manner. Neither a blanket endorsement of the legally binding nature nor a dogmatic and narrow denial is expedient. Rather, these declarations must be able to be assigned to an appropriate declaration of a specific person. This link between the SC actions and the will of a person must therefore be analysed in detail.

It is important to take into account the three levels of the basic, application and (if applicable) platform agreement described above. In all these contracts they may contain elements for the will of the person concerned which ultimately reduces the scope of the obligations of the individuals affected. In the spotlight the following questions are particularly relevant:

and instructions and the current exchange rate data (but it was at the expense of the user and in favour of the bank).

²⁹ FURRER/MÜLLER-CHEN, loc. cit., section 4 paragraph 23; also BGE 138 III 659 E. 4.2.1.

- Programming: Did the application programme run correctly when the SC was created?
- Interpretation: What are the automatically generated will and the explanations of knowledge?
- Scope of consent: Includes the underlying declarations of intent (will to act, awareness of explanation, business will) and declarations of knowledge (willingness to act) of individuals the content of automated declarations of will and knowledge and does the SC actions thus obtain legal effects (such as a consensus, for example)?
- Legal validity: Are the resulting declarations of intent and will legally valid?
- Contestation: Can the declarations of intent be contested based on the challenged that there is a lack of will?

2. Correct Execution of the Program in the Smart Contract

The SC's program code expresses a prior consensus at the level of the application contract in which the parties define the desired functionality of the SC so that the SC created by the parties concerned can generate the declarations of will and knowledge they need to fulfil their obligations.

The legal validity of a corresponding declaration of intent or knowledge requires that the corresponding SC actions (such as transactions, messages, storage of data and information, etc.) runs automatically in accordance with the programmed requirements. Therefore, the legal validity of SC actions can be disputed by proving that it has been programmed incorrectly. As a result, the declarations of intent and knowledge due to a programming error did not proceed properly, so that they would also not reflect the will of the person concerned.

This programming error can be on the level of the SC (wrong condition of the SC), but also on the level of the underlying application or protocol (or the corresponding protocols) behind it. There is therefore a breach of contract either (a) the author(s) of the platform(s) and the platform contract(s) or (b) the author of the application and the application contract.

- In the event of a SC error, a breach of contract by the person operating it (V1 or V2) or a breach of contract by the author of the application may be considered if the error can be attributed to a misleading user interface.
- In the event of an error at the protocol level, V1 and V2 are entitled to claims against both the platform operator and the author of the application. However, it will usually be difficult to include the platform operator in the law because it is unclear whether a contractual relationship exists through the use of an application.³⁰

³⁰ See above, chapter II. 2.

This will be the case if V1 and V2 use a platform and use it for an application offered there. In addition, the author of the application can usually be included in the law, because he must test his product in such a way that any errors in the underlying protocol are recognized, because he has assumed responsibility towards his contractual partners for the proper running of the program. He may have a right of recourse against the originator of the erroneous protocol too. However, contractual disclaimers will usually make recourse more difficult, identifying a claimant would also be difficult.

- If the error lies at the level of the application, the author of this application is liable according to the law of Warranty.

However, it should be noted that these are contractual claims. If an error in the program code of the protocol or the application causes damage, a contractual claim for damages exists in principle and the contracting parties can claim this under Art. 100 OR (i.e. except for gross negligence or premeditation). A look at the corresponding existing general terms and conditions (GTC) shows that the liability is exempted as far as possible.

3. Interpretation of Automated Declarations of Will and Knowledge

It was explained above that from a legal point of view, all SC actions are to be regarded as declarations of will and knowledge, because they are preceded by a corresponding decision-making process. Due to the automatic generation of the corresponding will, these declarations of will and knowledge are also subject to special rules of interpretation.

The starting point is that in an automated declaration of will and knowledge there is basically no room for an interpretation shaped by the subjective will of the persons concerned. Rather, the content of these declarations must be derived from the declaration itself, similar to the interpretation of a limited right in rem registered on the land register.³¹ By agreeing to the automatic generation of such declarations, the individuals concerned have given their mandatory consent to this objective interpretation. Of course, the remaining correction factors to be discussed below remain reserved.³²

For this objective interpretation of a declaration of will and knowledge, the classical interpretation methods are to be applied:

- If the SC generates a written document, it shall be interpreted on the basis of the objective wording. As far as the provider forms a personal union with the author of the SC, the specific rules of interpretation for General Terms of Conditions apply analogously. A direct application is not possible because, depending on the complexity of the SC generation process, the terms are not pre-formulated in the classical sense. But the authors of the SC determine the generation process of the SC. Therefore, the written document is shaped by the authors of the SC and this corresponds again to a pre-formulation of General Terms and Conditions. The other GTC

³¹ See, for example, BGE 132 III 651 E. 8; 137 III 444 E. 2.2; judgment 5A_127/2013 E. 4.1.

³² See Chapter III. 3. G).

requirements created for a large number of contracts are one-sided and are fulfilled without any problems.

- Often, however, the SC will not produce a document, but will make a declaration of will or knowledge through SC actions:

Acceptance is affected by transfer of the purchase price, the average commissioner is notified based on clear signals from a sensor in the container, and the agreed lump sum is automatically transferred when the delivery deadline is exceeded.

In all these cases, care must be taken to ensure that these SC actions are not only contract execution actions, but also declarations of intent or knowledge, the legal validity of which must be examined.

4. Interpretation of the Declarations of Intent of the Persons Concerned

If the content of the automated declaration of will and knowledge shall be interpreted in accordance with the above principles, it shall be examined whether this declaration, to be understood in this way, can be attributed to the person binding them. For this allocation, the real will of the parties at the time of approval of the SC must first be determined.³³

As stated above,³⁴ this will be ultimately characterised by the basic contract, the application contract and, if necessary, through the platform agreement:

- The primary will result from the basic contract in which the use of a SC was agreed. This contractual relationship is constitutive for the will to use a SC at all for the execution of the contract. However, it also sets out the decisive parameters under which conditions the SC may initiate an action on behalf and for the account of the contracting parties.
- It should be noted that the content and scope of the declarations of will and knowledge triggered by the SC also results from the application, because these factors shape the legal framework of the possibilities and limits of the SC. If a contractual relationship exists with the platform operator, this contractual relationship must also be taken into account accordingly. For the analysis of the will of V1 and V2, their agreement to application³⁵ and to the platform agreement³⁶ must also be analysed.

The final result is the scope of the consent of V1 and V2, which must be determined individually in each case by taking an overall view of the various interpretations of wills in these contracts. From such a viewpoint, the scope of the SC's legally binding will and commitment can be determined. Such an analysis includes, on the one hand, the approval of an automated declaration of intent, on the other hand the scope of the declarations of intent to

³³ FURRER/MÜLLER-CHEN, loc. cit. cit., section 4, paragraph 20

³⁴ See chapter II. 2.

³⁵ In the figure above the thin dashed lines.

³⁶ In the figure above the broad dashed lines.

which the data subjects wants to be tied. The following are example questions to be examined further:

- Does the basic and application agreement (if applicable in conjunction with the platform agreement) provide sufficiently clear information on the scope of the content of the declarations of intent and knowledge generated by the SC?
- Which interventions of the persons concerned are necessary for the SC to generate and issue a declaration of knowledge and will?
- What intervention options do the persons concerned have during contract execution to avoid declarations of intent and knowledge?
- What other information will the SC use in generating the declaration of will and knowledge?
- According to which principles is a declaration of will and knowledge formed and submitted from the available information (conditions)?

The general means and rules of interpretation may be used to interpret this will relating to the use of the SC.³⁷ In particular, the subjective will of the parties may also be taken into account.

In principle, an implied consent by the simple use of an application is also conceivable (although not recommended for reasons of evidence). However, the user of such a system must ultimately be aware of the framework conditions under which the created SC will draw up a binding declaration of intent for him.

Legally demanding is the case in which the SC generates declarations of will or knowledge fully automatically without further intervention from a party to the basic contract. In particular, the focus is on checking whether the persons concerned have given their consent that the SC actions were triggered without further action and whether they remain within the expected scope. On the other hand, these questions are easier to clarify if a corresponding SC action has been explicitly initiated (e.g. by a mouse click).

Special attention must also be paid here to the special GTC interpretation rules.³⁸ Their application is justified if the basic contract is provided by a contracting party. However, they also apply if a party to the basic agreement is also a party to the application or platform agreement. The entire range of GTC control instruments can be used, in particular the legally valid inclusion (and is this also provable?), but also the validity, interpretation and content control.³⁹

³⁷ See GAUCH/SCHLUEP/SCHMID, Swiss Code of Obligations, General Section, Volume I, 10th edition, 2014, margin 1205 ff. 1222 ff.

³⁸ See FURRER/MÜLLER-CHEN, loc. cit., chapter 4, paragraph 69 ff.

³⁹ FURRER/MÜLLER-CHEN, loc. cit., chapter 4 paragraph 79 ff., 83 ff., 86 ff.

These questions can ultimately only be clarified on an individual case-by-case. The more complex a system is when a declaration of intent is composed, the clearer the consent of the individual concerned must be.

5. Allocation of the automated declaration of will and knowledge through a different analysis

The automatically generated declaration of will and knowledge as well as the individual's will, must be checked with the automatically generated SC action to ensure it has remained within the scope of the declaration of consent of the persons concerned.⁴⁰ If the SC action exceeds the framework set, the affected party is bound by the declaration of will or knowledge behind it. If the SC action is within the scope of this consent, the person concerned is bound by this declaration even if they contain an expressed will.

Insofar as it is possible to prove that the SC action does not lie outside the declarations of consent of the person concerned, his or her actual will takes precedence in principle on the basis of Art. 20 of the Swiss Code of Obligations. However, as it will be shown below, corrective factors must be taken into account here, based on the right of representation.

Since, according to the approach proposed here, the main starting point is the SC's output in the form of declarations of will and knowledge, the question of the legal quality of the information provided by the oracles and the processing of all information into a corresponding automatically generated SC action is irrelevant. All this happens in the sphere of influence and control of the author of the application contract. This concept also enables an openness to future technologies in which the decision-making process is generated dynamically, e.g. by using artificial intelligence. Therefore, in the view expressed here, it is not necessary that the persons concerned enter the code know all the factors or to a greater or lesser extent know what they are talking about. Decisive is alone the comparison of the automated declaration of intent with the scope of approval by the basic, application and/or platform agreement.

The transfer of concrete personal decision-making to an automated system can take place, for example, precisely because the persons concerned wants to profit from an automated decision-making process. Thus, a corresponding system can be superior to human decision-making in terms of speed or due to the complexity of different influencing factors. This is conceivable, for example, in relation to stock exchange transactions in which decisions require very rapid reactions due to various factors such as price developments, economic, political decisions, information relevant to the stock exchange or statements of opinion.

Whether and to what extent the data subjects must be informed about the details of these influencing factors depends, as already emphasised, on the individual cases, decisive elements are, for example, the contractual framework, the assurances, the manner in which these contracts arise or the justified trust of the data subjects in the system. A large number

⁴⁰ Similar, but stronger with reference to the principle "Pacta sunt servanda", MEYER/SCHUPPLI, op. cit., p. 207 ff., 2017; KAULARTZ/HECKMANN, op. cit., p. 621 ff.

of factors are decisive, e.g. the ability to process the various information automatically, the suitability of the algorithms or the performance of the system at foreseeable peak loads.⁴¹ In this way, the functionality of the application and the SCs generated by it can also be described in general terms with regard to the result, but the author of the application is subsequently also liable for ensuring that the results of the SC remain within this framework.

Therefore, the requirement that the program code must be translated into a natural language cannot be made across the board.⁴² Rather, the entire circumstances of the declaration of consent must be included in the assessment. It is therefore advisable to start with the SC action and with the final result of the SC process, which must be covered by the declaration of consent from the framework and SC agreement.

A comparable legal situation can be found in the right of representation. There the represented person can grant the deputy a far-reaching power of attorney, which grants him the right to make legally binding declarations of will and knowledge in the name and for the account of the represented person. As long as these declarations are covered by the basic relationship (e.g. by the order or employment contract), they bind the party represented. The only difference is that the SC automatically makes such declarations of intent and knowledge, whereas in the case of the right of representation these are formed and made by a natural person. However, this is not decisive for the obligation of the represented party.⁴³

For the recipient of a declaration of will or knowledge it is irrelevant whether it was created individually or automatically. Only the recognizability as a declaration of intent or knowledge as well as the imputability to an individual person or at least to a group of individuals necessary for the binding of rights is decisive.

If the legal effects are to be examined when two automated systems communicate with each other, no new legal questions arise in this sense, but the complexity of the audit factors raised may increase due to the fact that the interaction between the dynamic factors of influence can lead to the result being outside expectations because unforeseeable dynamics can develop. However, this possible danger can be contained by the aforementioned principle that all legal consequences of declarations of will and knowledge (such as a consensus) must be covered by declarations of consent of the persons concerned at the level of the basic agreement, application agreement and, if applicable, the platform agreement.

⁴¹ For example, the system of certain banks should not collapse when the fixed exchange rate of the Swiss Franc was released on January 15, 2015 or if the exchange rate of crypto currencies crashes within a short time (see, for example, <https://insideparadeplatz.ch/2018/02/01/rueckschlag-fuer-swissquote-total-absturz/>).

⁴² Thus WEBER, loc.cit., margin 9 ff.

⁴³ GAUCH/SCHLUEP/SCHMID, loc. cit. 1314 f.

6. Effectiveness of Declarations of Will and Knowledge: Form and Invalidity

Like the vast majority of Western-oriented states, Swiss private law is based on the principle of freedom of form (Art. 11 (1) CO), both for the individual declaration of will and knowledge and for any contracts concluded as a result.⁴⁴

A contract is concluded as soon as identical declarations of intent for the conclusion of a legal transaction are available (Art. 1 CO); in the case of fully synallagmatic contracts, a corresponding consensus must exist for both bonds. Insofar as the parties reserve the right to comply with a form or this is prescribed by law, the validity of the legal transaction depends on compliance with this form.⁴⁵

Compliance with formal requirements in the declaration of intent and knowledge generated by a SC is a central problem. For example, the transaction of disposal is subject to an assignment of written form (Art. 165 (1) CO), but also in the area of consumer contracts or in the case of commodities and securities, the formal requirements must be observed. It is also controversial whether the entry of information on a ledger fulfills the requirements of the term "document" (German: "Urkunde"). Here case law recognizes equivalence, or the legislator issues the corresponding equivalent regulations, such as the UNCITRAL Model Law on Electronic Transferable Records of 2017⁴⁶ or in the field of rail, air and sea transport via road freight traffic laws⁴⁷.

In principle, it is possible to conclude an oral contract in most cases. The content of such a verbally concluded contract can later be proven by various documents, e.g. hand notes, contract drafts, brochures and other advertising documents, freight documents or even witnesses. All these possibilities do not constitute the contract per se but serve as evidence of the conclusion and content of the contract. The SC's code can also be proof of the content of an oral (but also a written) contract.

It is self-evident that all declarations of will and knowledge involved must be made in the light of their validity in accordance with Art. 19 ff. OR. In this sense, the legal nature of a declaration generated by a SC does not give rise to any special features.

7. Correction Factors in Swiss Law

Like many other Roman legal systems, Swiss law knows various correction factors that can ultimately change the legal effects of declarations of will and knowledge. The focus is on

⁴⁴ Vgl. hierzu: SCHWENZER, a. a. O., Rz. 31.01 ff.

⁴⁵ Cf. here: SCHWENZER, loc.cit., Rz. 31.44 ff.

⁴⁶ http://www.uncitral.org/pdf/english/texts/electcom/MLETR_ebook.pdf, vgl. hierzu FURRER/BRUGGER, FS Koller, im Erscheinen.

⁴⁷ ANDREAS FURRER, On the Way to Electronic Merchandise Documents: Status of developments in the individual transport modalities, in: Law in the Digital Age, Swiss Lawyers' Day 2015 in St. Gallen (...), 2015, p. 343rd FS St.Gallen

the principle of trust, the control of the GTC or the lack of will and the approval according to Art. 38 f. OR.⁴⁸

According to consistent case-law of the Federal Supreme Court, "according to the principle of trust [...]"⁴⁹ The recipient of a declaration of intent or knowledge generated and submitted by a SC is interpreted by the principle of trust as follows than his understanding is covered by his consent. He can rely on the fact that the generated declarations are also covered by the counterparty's consent (in the same basic agreement or in his application or platform agreement) and that therefore the actual interpretation of the individual taking into account the specific circumstances of the case is not relevant. The recipient must understand the explanation in the sense as the SC has generated it.

The GTC principles⁵⁰ already mentioned above shall apply in particular if the provider forms a personal union with the author of the SC. Under this condition, the provider must be accountable for all ambiguities in the SC's declarations of intent and knowledge (interpretation control), also the validity control (unusual/surprising clauses) and the (in Switzerland very limited) content control apply.

In the examination of any lack of will in accordance with Art. 23 ff. OR (error, deception, fear) is to distinguish between the approval of the basic, application and platform agreement and the individual declaration of intent. Of course, the persons concerned are free to invoke lack of will. As a consequence, the originally assumed scope of the declaration of consent may be limited and therefore no longer cover the declarations of intent and knowledge generated by SC, with the legal consequences described above.⁵¹

Such a development is conceivable, for example, with complex and dynamic systems, if it can be demonstrated that the range of declarations of intent and knowledge, due to the complexity of the corresponding algorithms, is much wider than was apparent to the parties concerned at the time the contract was concluded.

In contrast, a reference to the automatically generated declaration of intent and knowledge is only possible to a limited extent. This largely refers to the case when the person claiming lack of will has taken any action at all and thus triggered the automatic generation of a declaration or helped to shape its content through the transmission of information. Under these circumstances, cases are conceivable with regard to these actions in which there was a legally significant error in accordance with Art. 23 CO.

In this context, reference is made to the obligation to pay compensation in accordance with Art. 26 CO, the errant may invoke the invalidity of the contract but must pay compensation under the conditions of Art. 26 OR.

⁴⁸ WEBER, loc.cit., Rz. 11; MEYER/SCHUPPLI, loc.cit., p. 207 ff., 218.

⁴⁹ See, for example, BGE 113 II 49, E. 1b; 132 III 264, E. 2.2.

⁵⁰ KAULARTZ/HECKMANN, loc.cit., p. 622.

⁵¹ See Chapter III. 3. F).

Finally, the person not legally bound but affected may, by analogy, apply Art. 28 f. OR to approve the declaration of intent and knowledge automatically generated by SC.

8. Legal Consequences of a SC Action Outside the Declaration of Consent

If the SC has made a declaration of intent or knowledge which is not covered by the declaration of consent, it is considered to be legally non-existent and the person concerned is not bound by it. Therefore, a reminder is considered as not issued, a complaint as not raised or a money transfer neither as acceptance, cure of an error nor as fulfilment of a claim. In this sense, Articles 62 et seq. claims arise from unjustified enrichment.⁵²

9. Private International Law

In the above explanations, the application of Swiss law was assumed in each case. In the present case, this is by no means a matter of course, as basic, application and platform contracts may each be subject to a different law. All these contracts should therefore include a jurisdiction and choice of law clause. However, the legal restrictions that arise, for example, in the area of consumer⁵³ and employee protection law⁵⁴, but also in the insurance⁵⁵ or transport sector⁵⁶, must be corrected.

Without a *prorogatio fori*, the competent court is determined by the contract from which the claim is derived, in the present case by the basic contract under which the SC action took place. A Swiss court is therefore competent if a corresponding jurisdiction arises from the Lugano Convention, another previous international source of law (e.g. Art. 31 CMR) or from Art. 112 ff. IPRG.

If a Swiss court has jurisdiction, the applicable law is to be determined separately for each contract due to the lack of a choice of law clause. Thus, a different law may apply to the contract between the parties concerned than to the application and/or platform contract.

For all contracts, the applicable law in Switzerland is determined by Art. 117 ff. IPRG, whereby the application and platform contract is to be qualified as a service contract within the meaning of Art. 117 para. 3 lit. c IPRG and thus the law applicable at the place of establishment of the author of the application or the platform operator applies (Art. 117 para. 2 IPRG).

10. Reasoning

From the above explanations it follows that all SC actions are based on an automatically generated will. Therefore, from a legal point of view, the SC must be seen as a kind of

⁵² See MEYER/SCHUPPLI, loc. cit., p. 207 ff., 210 ff. 221 ff.

⁵³ Cf. about Art. 15 ff. Lugano Convention, Articles 114 and 120 IPRG.

⁵⁴ Cf. about Art. 18 ff. Lugano Convention, Articles 115 and 119 IPRG.

⁵⁵ Cf. about Art. 8 ff. Lugano.

⁵⁶ Cf. about Art. 31 ff. CMR.

"generating machine" for automated wills and explanations of knowledge, in which the concrete information of the users and the Oracles are processed. Since the SC has no will of its own in the legal sense, the immutability must be of these automated declarations on the affected persons, i.e. the parties to the basic contract, must be checked.

The automatically generated declarations of intent and knowledge must be covered by the declaration of consent contained in the application agreement and, if applicable, in the platform agreement, i.e. the automatically generated declarations must lie within this framework.

If this requirement is met, the SC declarations of intent are to be attributed to the persons concerned in principle and binding, insofar as they are not caused by the general correction factors under the Swiss Code of Obligations such as principle of trust, GTC law, grounds for invalidity or legally relevant deficiencies of will. Non-binding SC actions can be initiated by the persons concerned in analogous application of Article 38 f. OR must be approved. Attention must be paid to this, that the corresponding correction mechanisms comply with the right expressions of will and knowledge.

It is therefore important to ensure that all contracts involved are carefully drafted with regard to the questions outlined above. This includes in particular the framework of the declaration of consent, but also liability for any malfunctions as well as the question of jurisdiction and applicable law. The earlier such considerations are incorporated into platform and application projects, the sooner a solution can be found that ensures that the application will generate legally effective expressions of will and knowledge.

In the event of a dispute, the interpretation of these agreements will have to be examined to determine whether the automatically generated declarations are covered by the declaration of consent of the person concerned and whether, if necessary, there are corresponding grounds for nullity or rescission.

IV. Challenges to Civil Law: The Need to Classify Tokens and Smart Contracts

Blockchain technology is still in its infancy, the conceivable applications in industry and trade are far from being exhausted. This requires various functions, ranging from the transfer of mandatory claims to the creation of complex legal constructs (such as the creation of simple companies or legal entities, the issue of uncertificated securities or securities to the transfer of ownership rights)⁵⁷.

⁵⁷ See HESS/LIENHARD; JACCARD, loc. cit., margin 56 ff.

Various classification models are being discussed for this purpose, but more in view of the consequences under financial market law,⁵⁸ but also far beyond.⁵⁹ In particular, a distinction can be made between applications that

- have no legal counterparty (e.g. transaction tokens such as Bitcoin or pure application protocols such as Ethereum, even if they provide a means of payment [such as ETH]);
- have a natural or legal person as a counterparty (e.g. the applications described in this paper, the contractually relevant wills, etc.);
- have no individualizable counterparties but are themselves addressed to an indefinite number of persons and thus have components under company law (DAO),⁶⁰ e.g. a simple partnership, joint ventures or legal entities. In this context, the connection and membership and property rights that must be created and transferred must be examined (but not answered in this context);
- Ownership of property, be it sole ownership, co-ownership or joint ownership.⁶¹ This raises questions such as ownership of data, the creation of property rights in general, but in particular also to secure the transfer of ownership via SC actions and the special requirements for the transfer of assets through the transfer of securities.

All these different types of legal relationships generated by the applications must be checked for their legal validity. Only in this way can the persons concerned be certain that the actions triggered by the SCs can ultimately be traced back to declarations of will and knowledge by natural persons and are therefore also legally binding.

⁵⁸ For example, in its guidelines of 16 February 2017, FINMA subdivided into payment, use and investment tokens tailored to the ICO (www.finma.ch/de/news/2018/02/20180216-mmico-wegleitung/).

⁵⁹ Cf., for example, the BCP proposal of MME Legal | Tax | Compliance (https://www.mme.ch/en/magazine/magazine-detail/url_magazine/conceptual_framework_for_blockchain_crypto_property_bcp/); cf. on the contractual effects, GLARNER/MEYER, loc.cit. cit. Another proposal has been prepared by Untitled INC, see <https://medium.com/untitled-inc/the-token-classification-framework-290b518eaab6>.

⁶⁰ Decentralised autonomous organization, cf. ELEONOR GYR, *Dezentrale Autonome Organisation DAO - Eine juristische Betrachtungsweise*, Jusletter 4. 12. 2017.

⁶¹ So the classification in the BCP proposal, cf. footnote 61.