

This paper is a tentative translation of the German publication "Funktionale Äquivalenz» digitaler Rechtsgeschäfte - Ein tragendes Grundprinzip für die Beurteilung der Rechtsgültigkeit von Rechtsinstituten und Rechtsgeschäften im schweizerischen Recht", published on Jusletter, Juni 18, 2018

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"Functional equivalence" of digital legal transactions

A fundamental principle for assessing the legal validity of legal institutions and legal transactions under Swiss law

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Blockchain technology opens up new possibilities to implement established legal institutions such as ownership or legal transactions in a technically functionally equivalent manner. The authors propose to recognize a digital system as functionally equivalent to the existence of a legal institution or to a legally valid transactions which fulfils all substantive and/or formal requirements that Swiss law attaches to it. These requirements are subject to judicial review and can be specified in law. This creates immediate legal certainty and can focus on what is necessary from a regulative perspective.

1 The need for a new approach to regulating digitally processed transactions

- 1 A software architecture such as Blockchain Technology¹ poses major challenges for Swiss private law. This is gradually growing out of its first development phase, in which the launch and financing of new projects by ICO ("Initial Coin Offering") or TGE ("Token Generating Events") was in the foreground. In particular, new questions relating to financial markets and tax law had to be examined. However, the first projects have progressed so far that the results of these developments have now proven themselves in practice.
- 2 Many blockchain-based applications contain Smart Contracts ("SC") with functionalities that create legally relevant facts. These SC must be reviewed whether they trigger digital transactions that are legally binding.² The variety of legal transactions that can be executed by SC can hardly be overlooked. From simple execution of contractual obligations (e.g. payment under defined conditions) to complex stock corporations on the block chain;³ from simple security functions to direct ownership rights of real assets such as real estate⁴ or gold⁵. Many of these projects are legally difficult to implement, e.g. direct ownership of real estate,

¹ The term "blockchain" is also technically used as a substitute for other forms of software applications with the same functions. The term "token" is understood as a transferable, unchangeable information and/or functional unit and the term "ledger" as a digital general ledger in which all transactions are recorded.

² Vgl. hierzu ANDREAS FURRER, Die Einbettung von Smart Contracts in das schweizerische Privatrecht, Anwaltsrevue 2018, S. 103 ff. m.w.H.

³ Vgl. hierzu das Projekt der Daura AG (<https://youtu.be/FRCK6EEbYnY>), alle Websites zuletzt besucht am 17. Mai 2018)

⁴ To date there are only corresponding financial products in Switzerland that are backed by real estate values and income, even if the projects occasionally give the impression of going further.

⁵ MME Legal | Tax | Compliance AG, "BCP Framework for Assessment of Crypto Tokens – Classification of decentralizes blockchain-based assets" vom 1. Mai 2018 (https://www.mme.ch/fileadmin/files/documents/180501_BCP_Framework_for_Assessment_of_Crypto_Tokens_-_Block_2.pdf).

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because ultimately the transfer of ownership is only possible through an entry in the land register.

- 3 The diversity of the practical application of SC calls for systematization. The trilogy of payment, use and investment tokens⁶ used by FINMA for financial market law purposes is not differentiated enough for civil law assessment. A further systematization was presented by MME⁷, in which a distinction was made between three categories⁸, each with further differentiating subclasses⁹.
- 4 As part of the Blockchain Task Force¹⁰, a working group was set up to deal with a position paper on the legal classification of ICO¹¹. Contrary to the restrictive title, this working group dealt, to some extent, with the issues of legal validity of legal transactions which are established, amended or fulfilled via SC.
- 5 These transactions raise various questions at private law level, such as:
 - Can claims be ceded by transferring a token?
 - Can a token be used to establish and transfer ownership of an item?
 - Can tokens be securities?
 - Can a ledger be a book-entry rights ledger?
 - Can a stock register be kept via a ledger?
 - Can shares be designed as tokens and transferred by means of tokens?
 - Which goods and storage documents can be issued as tokens?
 - What legal consequences can be attached to such a digital goods document?
- 6 Many of these issues are highly controversial, thus hindering the introduction of such technologies due to legal uncertainty. As a result, the call for relevant legislative adjustments is

⁶ See «Guidelines for enquiries regarding the regulatory framework for initial coin offerings (ICOs)» of the FINMA, published 16 February 2018 (<https://www.finma.ch/en/~media/finma/dokumente/dokumentencenter/myfinma/1bewilligung/fintech/wegleitung-ico.pdf?la=en>).

⁷ MME, (Fn. 5).

⁸ Native Utility Tokens; Counterparty Tokens; Ownership Token.

⁹ Native Utility Tokens: Basic Tokens, Infra- structure Access Tokens, Application Access Tokens, Application Settlement Tokens; Counterparty Tokens; IOU Tokens, Derivative Tokens, Fund Tokens, Equity Tokens, Membership Tokens; Ownership Token: Joint- Ownership Tokens, Co- Ownership Tokens, Sole- Ownership Tokens.

¹⁰ Blockchain Taskforce (<https://blockchaintaskforce.ch/>)

¹¹ Blockchain Taskforce «Stärkung des Blockchain-Standorts Schweiz – White Paper der Blockchain Taskforce», Bern/Zug, April 2018 (https://blockchaintaskforce.ch/wp-content/uploads/2018/05/BlockchainTaskforce_WhitePaper.pdf).

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growing. As is usually the case with new legislative projects, these necessary adjustments may take many years.

- 7 The question therefore arises as to whether it is possible to resolve these urgent legal issues by a simpler dogmatic approach while respecting the existing legal certainty in the analogue world.

2 "Functional equivalence" as a new basic legal principle

2.1 Content of a principle of functional equivalence

- 8 The authors propose to introduce the principle of functional equivalence in Switzerland as a general legal principle with the following content:

- 9 *Insofar as Swiss law attaches the validity of legal transactions or the existence of a legal institution to substantive or formal requirements, these requirements shall be deemed to be fulfilled if a digital system can functionally replace the legal protection concerns behind these requirements on an equivalent basis.*

- 10 As it will be explained below, the principle of functional equivalence can be both recognized as a general legal principle of doctrine and jurisprudence (in need of concretization) and introduced by the legislator.

- 11 This can be illustrated by the following examples:

- Where the law provides for the maintenance of a register, the equivalence of a digital register (e.g. a ledger) shall be recognized as equivalent if it can be demonstrated that this register can guarantee the safe handling and the same access to this information to at least the same extent.
- Ownership constitutes the presumption of ownership (Art. 930 para. 1 Swiss Civil Code; "SSC"), the transfer of ownership (Art. 922 ff. SSC)¹² constitutes the basic presumption of transfer of ownership of the vehicle (Art. 714 para. 1 SSC)¹³. It is a generally accepted view that the property fulfils the functions of legitimacy, tradition, defense, offensive and initiation.¹⁴

¹² Art. 922 des Schweizerischen Zivilgesetzbuches vom 10. Dezember 1907 (ZGB, SR 210) Übertragung unter Anwesenden; Art. 923 ZGB Übertragung unter Abwesenden; Art. 924 ZGB Übertragung ohne Übergabe; Art. 925 ZGB Übertragung bei Wertpapieren.

¹³ Vgl. hierzu hinten, Kap. 3.2.1.

¹⁴ Vgl. etwa VITO ROBERTO/STEPHANIE HRUBESCH-MILLAUER/BARBARA GRAHAM-SIEGENTHALER, Sachenrecht, 4. Auflage, Bern 2017, Rz. 02.63 ff.

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- 12 The principle of functional equivalence already exists in current law, even if it is not described as such. In a long legal development, functionally equivalent forms of ownership have developed in which, in addition to direct ownership, the concept of indirect ownership is generally recognized. The direct transfer of ownership is partially functionally adequately replaced by¹⁵ the transfer of ownership agreement with the transfer of ownership by short hand (*brevi manu traditio*) or by long hand (*longa manu traditio*, Art. 922 para. 2 SSC), by order of ownership (Art. 924 para. 1 case 1 SSC) or by property constitut (Art. 924 para. 1 case 2 SSC).
- 13 In the case of general recognition of this principle of functional equivalence, the legislator must decide whether it should define the framework conditions for recognition of functional equivalence in a particular area of law itself or whether this question must ultimately be answered in practice.¹⁶

2.2 Established principle in transport law

2.2.1 Air freight: From the Montreal Protocol to the Montreal Convention

- 14 The principle of functional equivalence, in the present sense, was established for the first time in air freight transport. In Art. III Montreal Protocol No. 4 to the Warsaw Convention of 1929 (SR 0.748.410.6)¹⁷ (MZA 1975), the contracting parties agreed the following amendment to Art. 5 para. 2 of the Warsaw Convention (SR 0.748.410; WC): "2. *Any other means which would preserve a record of the carriage to be performed may, with the consent of the consignor, be substituted for the delivery of an air waybill. If such other means are used, the carrier shall, if so requested by the consignor, deliver to the consignor a receipt for the cargo permitting identification of the consignment and access to the information contained in the record preserved by such other means.*". In order to meet the various technical standards, Article 5(3) MZA 1975 states that the "*impossibility of using, at points of transit and destination, the other means which would preserve the record of the carriage referred to in paragraph 2 of this Article does not entitle the carrier to refuse to accept the cargo for carriage*".
- 15 From a legal point of view, the aim of this paragraph was to establish a digital solution for the paper-based air waybill. The acknowledgement of receipt shall be treated in the same way as the air waybill and shall not be made dependent on continuous accessibility to the

¹⁵ Vgl. etwa VITO/BRUBESCH-MILLAUER, (Fn. 14), Rz. 185 ff

¹⁶ Vgl. hierzu ausführlicher Kap. 3.2.

¹⁷ Protokoll von Montreal Nr. 4 zur Änderung des am 12. Oktober 1929 in Warschau unterzeichneten Abkommens zur Vereinheitlichung von Regeln über die Beförderung im internationalen Luftverkehr in der Fassung des Haager Protokolls vom 28. September 1955, abgeschlossen am 25. September 1975, für die Schweiz in Kraft getreten am 7. Juni 1998 (SR 0.748.410.6).

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information. Confirmation of receipt is accorded a strong legal position because it is quoted on an equal footing with the consignment note in the WC.

- 16 This principle, introduced as early as 1975, was also incorporated into the 1999¹⁸ Montreal Convention. On this basis, the International Air Transport Association ("IATA") established Recommended Practice 1670 (RP 1670)¹⁹ as a basis for the e-AWB. This protocol enabled a step-by-step transition from paper-based air waybills via hybrid systems to purely digital e-AWB²⁰ (and the eAWB360 with additional functions)²¹, which depends on the status of national legislation at the airline's headquarters and the destinations served as well as the technical expansion standards of the airline and the airports served.²² The importance of this question can be seen from the fact alone that by 2017 52.6% of freight was already handled via pure e-AWB.²³
- 17 From air freight law we can learn that:
- a step-by-step transfer of paper-based legal transactions into the digital world does not require extensive legislation, but the introduction of the principles of functional equivalence is sufficient;
 - further development progresses primarily and gradually along the needs of the economy; and
 - the requirements and prerequisites for functional equivalence can also be defined via an organization under private law or agreements under private law in order to create legal certainty.

¹⁸ Übereinkommen zur Vereinheitlichung bestimmter Vorschriften über die Beförderung im internationalen Luftverkehr, abgeschlossen am 28. Mai 1999, für die Schweiz in Kraft getreten am 5. September 2005 (SR 0.748.411).

¹⁹ «Recommended Practice 1670 Carriage of Cargo Using Electronic Data Interchange (EDI) CSC(MAIL S072)167) », (<https://www.iata.org/whatwedo/workgroups/Documents/rp1670.pdf>).

²⁰ «E-AWB» (<http://www.iata.org/whatwedo/cargo/e/eawb/Pages/index.aspx>).

²¹ «E-AWB360» (<http://www.iata.org/whatwedo/cargo/e/eawb/Pages/eawb360.aspx>).

²² Vgl. hierzu ANDREAS FURRER, Auf dem Weg zu elektronischen Warenpapieren – Stand der Entwicklung in den einzelnen Transportmodalitäten, in: Lukas Gschwend/Peter Hettich et Al. (Hrsg.), Recht im Digitalen Zeitalter, Festgabe Schweizerischer Juristentag 2015 in St. Gallen, 2015, 333 ff., 358 ff.; Digital Cargo (<http://www.iata.org/whatwedo/cargo/e/Pages/index.aspx>).

²³ «E-AWB» (Fn. 20).

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2.2.2 Maritime Freight: Hamburg and Rotterdam Rules

- 18 For various reasons²⁴, the Hamburg Rules²⁵ ("HR") have never attained the relevance it had hoped for in international maritime freight transport, since the most important maritime freight nations have not become contracting states. In this context, however, they are characterized by the fact that the following clause of functional equivalence was introduced in Art. 14 para. 3 HR: *"The signature on the bill of lading may be in handwriting, printed in facsimile, perforated, stamped, in symbols, or made by any other mechanical or electronic means, if not inconsistent with the law of the country where the bill of lading is issued"*. This approach was conceptionally further developed in the Rotterdam Rules²⁶ ("RR"); however, the RR have, for a number of various reasons, not yet received the required number of ratifications and have therefore not entered into force.
- 19 Chapter 3 ("Electronic transport records") RR emphasizes the principle of functional equivalence in clear way. Art. 8 para. 1 RR refers to the need for the consent of the parties to a digital document and Art. 8 para. 2 RR states the principle of equivalence as follows: *"The issuance, exclusive control, or transfer of an electronic transport record has the same effect as the issuance, possession, or transfer of a transport document"*. Art. 9 RR defines minimum procedural requirements for the use of these digital documents and Art. 10 RR defines the minimum requirements for the interaction between paper-bound documents and digital data records.
- 20 Neither the HR nor the RR has been ratified by the most important maritime nations. International maritime freight law still follows the Hague-Visby Rules of 1924/68/79, which contain no references to digital freight documents. For this reason, three private providers (Bolero, essDOCS and E-Title)²⁷ have established private systems in international maritime freight law, which regulates the use of digital freight documents among their contractual partners on a purely private law basis.²⁸

²⁴ Vgl. hierzu ROLF HERBER, *Seehandelsrecht*, 2. Auflage, Berlin 2016, S. 38 f.

²⁵ «Hamburg Rules, United Nations Convention on the carriage of goods by sea, 1978» (http://www.transportrecht.de/transportrecht_content/1024917099.pdf).

²⁶ «United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea» (http://www.uncitral.org/pdf/english/texts/transport/rotterdam_rules/Rotterdam-Rules-E.pdf).

²⁷ Vgl. <http://www.bolero.net/>; «essD°CS» (<https://www.essdocs.com/>); «e-title» (<http://www.e-title.net/>).

²⁸ Vgl. FURRER (Fn. 22), S. 366 ff.

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- 21 International maritime freight law highlights the importance of introducing the principle of functional equivalence. Despite the enormous effort involved in paper-based waybills in international maritime freight transport, all transactions are processed digitally, but are still recorded in the paper document.

2.2.3 CMR protocol

- 22 European cross-border road transport is regulated by the CMR²⁹, which was signed in 1956 and came into force for Switzerland in 1970. The legal basis for the digital consignment note was created in an additional protocol in 2008.³⁰
- 23 The principle of functional adequacy is set out in Art. 2 Protocol which states: *1. Subject to the provisions of this Protocol, the consignment note referred to in the Convention, as well as any demand, declaration, instruction, request, reservation or other communication relating to the performance of a contract of carriage to which the Convention applies, may be made out by electronic communication. 2. An electronic consignment note that complies with the provisions of this Protocol shall be considered to be equivalent to the consignment note referred to in the Convention and shall therefore have the same evidentiary value and produce the same effects as that consignment note.* In the other provisions, individual questions are specified, such as the authentication of the digital consignment note,³¹ the preparation of the digital consignment note³² and the handling of supplementary documents.³³
- 24 Following the rapid ratification of the Protocol by Switzerland and a few other countries, a new wave of ratification has been taking place since 2017.³⁴ In the meantime, there are already a number of private providers offering an operational solution using the possibilities of this protocol.

²⁹ Übereinkommen über den Beförderungsvertrag im internationalen Strassengüterverkehr, abgeschlossen am 19. Mai 1956, für die Schweiz in Kraft getreten am 28. Mai 1970 (CMR; SR 0.741.611).

³⁰ Zusatzprotokoll zum Übereinkommen über den Beförderungsvertrag im internationalen Strassengüterverkehr (CMR) betreffend den elektronischen Frachtbrief, abgeschlossen am 20. Februar 2008, für die Schweiz in Kraft getreten am 5. Juni 2011 (SR 0.741.611.2).

³¹ Art. 3 Protokoll (Fn. 30).

³² Art. 4 und 5 Protokoll (Fn. 30).

³³ Art. 6 Protokoll (Fn. 30).

³⁴ Bulgarien (2011); Dänemark (2013); Estland (2017); Frankreich (2017); Iran (2018); Lettland (2011); Litauen (2011); Luxemburg (2018); Moldawien (2018); Niederlande (2011); Russland (2018); Schweiz (2011); Slowakei (2014); Slowenien (2017); Spanien (2011); Tschechische Republik (2011); Türkei (2018).

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- 25 This example of international road freight transport shows that Switzerland is one of the pioneers of the CMR Protocol and immediately introduced the principle of functional equivalence into the CMR despite the eminently important legal consequences attached to the legally valid consignment note.

2.2.4 Railway freight: CIM / SMGS

- 26 The liberalization of railway transportation in the 1990s led to a new legal fundament of freight law in 1999, in which the CIM Protocol³⁵ to COTIF Treaty³⁶ was substantially revised. Article 6 § 9 of CIM, contains the rule which reflects the principle of functional equivalence in a almost prototypical way: *"The consignment note and its duplicate may be established in the form of electronic data registration which can be transformed into legible written symbols. The procedure used for the registration and treatment of data must be equivalent from the functional point of view, particularly so far as concerns the evidential value of the consignment note represented by those data".*
- 27 This legal basis prompted the International Rail Transport Committee ("CIT")³⁷ to define the requirements for functional equivalence precisely in a detailed manual³⁸, similar to what has already taken place in air freight law. The manual specifies which party is responsible at each individual point in the consignment note. It also specifies the requirements for the transition from paper-bound documents to digital data sets. Furthermore, the manual regulates the principle that both forms can be used in parallel if the paper consignment note contains a reference to the digital data set that is standardized in its wording, this is finally secured by a liability regulation.³⁹
- 28 This example from railway law shows, similar to air freight law, that based on the simple regulation of functional equivalence, an extremely complex international legal situation with

³⁵ «Uniform Rules Concerning the Contract of International Carriage of Goods by Rail (CIM)» (https://www.cit-rail.org/securemedia/files/documentation_de/freight/cim/cim_1999_2010-12-01_fr-de-en_rev_ns.pdf?cid=35767).

³⁶ Übereinkommen über den internationalen Eisenbahnverkehr, abgeschlossen am 9. Mai 1980, für die Schweiz in Kraft getreten am 1. Mai 1985 (COTIF 1980; SR 0.742.403.1).

³⁷ «Das CIT» (<https://www.cit-rail.org/de/>): Das CIT ist ein Verband in der Form eines Schweizerischen Vereins von 126 Unternehmen im Bereich des Eisenbahnverkehrs und der Schifffahrt, die grenzüberschreitenden Personen- und/oder Güterverkehr betreiben.

³⁸ «Handbuch CIM-Frachtbrief» (https://www.cit-rail.org/secure-media/files/documentation_de/freight/glv-cim/glv-cim_de_2017-01-01_c.pdf?cid=35851); «Anpassung vom 28. Juli 2017» (https://www.cit-rail.org/securemedia/files/documentation_de/cim_smgs/glv-cim-smgs_amendment27_de_2017-08-01.pdf?cid=35850).

³⁹ FURRER (FN 22), S. 352 ff.

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two completely different legal circles from China to Portugal can be brought to a uniform solution.

2.2.5 German Maritime Trade Law in § 516 Para. 2 HGB/D

- 29 The German maritime law⁴⁰ revised in 2012 also contains the principle of functional equivalence for bills of lading, i.e. for a commodity document designed as a security, in section 516 (2) and (3) of the German Commercial Code (HGB) *it states "(2) An electronic record that fulfils the same functions as the bill of lading is equivalent to the bill of lading, provided that it is ensured that the authenticity and integrity of the record are preserved (electronic bill of lading). (3) The Federal Ministry of Justice and Consumer Protection is authorized, in agreement with the Federal Ministry of the Interior, to regulate the details of the issue, presentation, return and transfer of an electronic bill of lading as well as the details of the procedure for subsequent entry in an electronic bill of lading by ordinance which does not require the approval of the Federal Council".*
- 30 The German legislature thus also introduces the principle of functional equivalence and expressly transfers the competence to specify this principle to a ministry, without any competence of the German Parliament.

2.3 UNCITRAL Model Laws

2.3.1 UNCITRAL Model Law on Electronic Commerce

- 31 The UNCITRAL Model Law on Electronic Commerce was adopted in December 1996 and is regarded as a reference point for legislative projects in the field of e-commerce. The principle of functional equivalence is laid down in Articles 6 to 8 of the Model Law on E-Commerce with regard to form, signature and relationship to the original and the accompanying report additionally explains in detail that the Model Law is based on the principle of functional equivalence and is presented as follows: *"The Model Law thus relies on a new approach, sometimes referred to as the <functional equivalent approach>, which is based on an analysis of the purposes and functions of the traditional paper-based requirement with a view to determining how those purposes or functions could be fulfilled through electronic-commerce techniques [...] It should be noted that in respect of all of the above-mentioned functions of paper, electronic records can provide the same level of security as paper and, in most cases, a much higher degree of reliability and speed, especially with respect to the identification of the source and content of the data, provided that a number of technical and legal require-*

⁴⁰ Vgl. hierzu: BEATE CZERWENKA, Das Gesetz zur Reform des Seehandelsrechts, Berlin 2014.

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ments are met. However, the adoption of the functional-equivalent approach should not result in imposing on users of electronic commerce more stringent standards of security (and the related costs) than in a paper-based environment".⁴¹

2.3.2 UNCITRAL Model Law on Electronic Signatures

- 32 A short time later, UNCITRAL adopted the "UNCITRAL Model Law on Electronic Signatures".⁴² This Model Law is also based on the principle of functional equivalence laid down in Art. 3 Model Law E-Signature.⁴³ This is explained with reference to e-commerce as follows: *"The "functional equivalent approach" is based on an analysis of the purposes and functions of the traditional paper-based requirement with a view to determining how those purposes or functions can be fulfilled through electronic-commerce techniques".⁴⁴*

2.3.3 UNCITRAL Model Law on Electronic Transferable Records (MLETR)

- 33 In July 2017, after six years of preparation, UNCITRAL⁴⁵ adopted the Model Law on Electronic Transferable Records (hereinafter MLETR) with further explanations.⁴⁶ The MLETR exclusively regulates the handling of securities and is based on the principle of functional equivalence and designs a uniform and technology-neutral system for implementing and ensuring the equivalence of paper-bound documents and digital data records.⁴⁷ Of course, these principles can also inspire national legislators and negotiators of international conventions when dealing with documents that are not of a securities nature.
- 34 The principle of functional equivalence is set out in Article 7 para. 1 MLETR⁴⁸ and is defined in the second chapter *"Provisions on Functional Equivalence"*. This functional equivalence is linked to a number of prerequisites, which have been deliberately designed to be technologically neutral. In particular, no central system is required for processing the digital data

⁴¹ UNCITRAL ML E-commerce, (Fn. 41), S. 20 f.

⁴² «UNCITRAL Model Law on Electronic Signatures with Guide to Enactment 2001 (UNCITRAL ML E-Signatures, Guide to Enactment)» (<https://www.uncitral.org/pdf/english/texts/electcom/ml-elsig-e.pdf>).

⁴³ Vgl. UNCITRAL ML E-Signatures, (Fn. 43), RZ 8, 31, 67, 71, 76, 93, 99, 124 f., 155.

⁴⁴ Vgl. UNCITRAL ML E-Signatures, (Fn. 43), RZ 8.

⁴⁵ UNCITRAL, «A/CN.9/920» (<http://www.uncitral.org/uncitral/en/commission/sessions/50th.html>).

⁴⁶ UNCITRAL, «Model Law on Electronic Transferable Records» (MLETR) (http://www.uncitral.org/pdf/english/texts/electcom/MLETR_ebook.pdf).

⁴⁷ Vgl. hierzu ausführlich ANDREAS FURRER/NICOLAI BRUGGER, noch nicht veröffentlichte Festschrift, Bern 2018.

⁴⁸ 1. An electronic transferable record shall not be denied legal effect, validity or enforceability on the sole ground that it is in electronic form. 2. Nothing in this Law requires a person to use an electronic transferable record without that person's consent. 3. The consent of a person to use an electronic transferable record may be inferred from the person's conduct.

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records, so that blockchain-based applications can also be subsumed under this.⁴⁹ Of particular importance are the provisions on mutual convertibility from paper to data records and back.⁵⁰ In contrast to the legal situation in the railway sector, a sequential legal validity is assumed, while in the railway sector a parallel legal effect⁵¹ is also possible. The Model Law also contains suggestions for the minimum content⁵² requirements for the digital system and for the principles of the effective transmission of digital data records representing a security.⁵³

- 35 MLETR thus builds on the principle of functional equivalence and concretizes it with a view to dealing with securities whose legal validity and transferability are recognized if the minimum requirements laid down in MLETR are met.

2.4 Functions of basic principles in private law

- 36 In his fundamental work "*System and Principles of Private Law*"⁵⁴, FRANZ BYDLINSKI points out the essential importance of legal principles in clarifying legal questions, because these principles form the function of a normative orientation for their systematic-teleological further development in novel legal questions. Such basic principles of private law include, for example, freedom of contract, the principle of consensus, *pacta sunt servanda*, the principle of legal equality of natural persons, but also principles such as the invalidity of a declaration, the lack of will, the principle of self-responsibility, or the protection of legitimate expectations. Both the Federal Supreme Court and academics regularly refer to corresponding basic principles of private law in their justifications for assessing a legal effect.
- 37 These basic principles cannot be presented in more detail in the present framework. At its core, the aim is to build a bridge between the incalculable diversity of life and the (rightly preserved) fragmentary nature of law: In consideration of these principles, the user of law can orientate himself within these basic principles and find a case solution consistent with the applicable law. Last but not least, it is also a question of weighing up different legal principles and a discourse on the fundamental values and objectives behind the legal principles.
- 38 As indisputable as their importance is, it may be disputable which principles should form part of this core element of the law. It should be noted, that this canon of legal principles does

⁴⁹ Explanatory Note to the UNCITRAL Model Law on Electronic Transferable Records, (Fn. 47), Ziff. 197.

⁵⁰ Art. 17 und 18 MLETR.

⁵¹ Vgl. oben Kap. 2.2.4.

⁵² Art. 8 ff. MLETR.

⁵³ Art. 17 f. MLETR.

⁵⁴ Franz Bydlinski, *System und Prinzipien des Privatrechts*, Wien 1996.

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not form a fixed corpus, but rather represents a network of principles and rules that slowly adapts to social developments.

- 39 The following concluding chapter explains why the principle of functional equivalence should be included in this canon of Swiss fundamental principles of private law and the legal consequences it will have.

2.5 The principle of functional equivalence as a recognized principle that can be restricted by law and the courts

- 40 UNIDROIT has thus succeeded in creating a worldwide agreement on principles for the creation and transfer of securities within a globally recognized framework. This shows that the principle of functional equivalence is widely recognized as the basic principle of the interface between classical law and the law represented in the digital world.
- 41 This principle cannot, of course, apply indefinitely, thus the law must be open to interpretation. In this sense, the concept of an "object" in Art. 641 para. 1 SCC is discussed controversial among academics; however, it is open to interpretation, particularly with regards to the question of whether ownership of crypto currencies is possible.⁵⁵ On the one hand, Art. 656 para. 1 SSC clarifies that an entry in the land register is necessary to acquire property. Therefore, a digital private land register kept alongside the land register cannot fulfil this function. On the other hand, the question that the transfer of a book-entry right pursuant to Art. 973c of the Swiss Code of Obligations ("SCO") can take place via a blockchain application has been affirmed on several occasions, as long as it meets or fulfills the requirements of Art. 973c para. 2 ff. SSO.⁵⁶
- 42 In this sense, the principle of functional equivalence reflects the justified expectations that users and other persons affected by a legal transaction have in the new technology. Ultimately, parties (or users) of an SC trust not only in the functionality of the corresponding applications, but also that they are legally binding (even towards third parties). The provider of products and services via blockchain protocols and applications must accept that the purchaser becomes the authorized party with the transfer of the token and that this purchaser

⁵⁵ BARBARA GRAHAM-SIEGENTHALER / ANDREAS FURRER, The Position of Blockchain Technology and Bitcoin in Swiss Law, in: Jusletter 8. Mai 2017; BENEDIKT SEILER/DANIEL SEILER, Sind Kryptowährungen wie Bitcoin (BTC) itcoin (BTC), Ethereum (ETH) und Ripple (XRP) als Sachen im Sinne des ZGB zu behandeln? sui-generis 2018, S. 150 ff. m.w.H.

⁵⁶ Lukas Müller/Milena Reutlinger/Philippe J.A. Kaiser, Entwicklungen in der Regulierung von virtuellen Währungen in der Schweiz und der Europäischen Union, EuZ 2018, S. 80 ff., S. 83.⁵⁷ Vgl. hierzu Kap. 3.2.2.

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can also validly transfer the token according to the protocol and/or application. For this purpose, the corresponding functional equivalence to known legal institutions must be guaranteed.

- 43 From a tax point of view, this principle is already reflected in the "economic approach". A transfer and/or holding of taxable assets is already taxed today, even if the legal questions regarding the legal validity of the transfer and ownership have not been fully clarified.
- 44 As the examples from railway or air freight law show, associations, user groups or members will draw up recommendations for the technical and organizational framework conditions, which must of course withstand judicial review.
- 45 In this sense, a court must ultimately decide on the concrete application of the principle of functional equivalence in the concrete individual case. It must judge whether the alternative digital action chosen by the parties (e.g. the transfer of ownership of a vehicle or the sale of crypto currencies) via a SC actually results in the desired legal result (here the acquisition of ownership of the vehicle or the crypto currency).
- 46 With the judicial examination of functional equivalence, a dispute about the legally binding nature of a transaction thus focuses precisely on the question that is also central to users and those affected by digital services: are their expectations of the existence of functional equivalence subjectively and objectively justified? In this sense, functional equivalence is also an expression of the principle of good faith (Art. 2 para. 1 SSC).
- 47 This judicial decision naturally relates to this specific individual case. Nevertheless, general conclusions can be drawn from case law, e.g. with regard to the controversial question of whether ownership of crypto currencies is possible or whether the technical-organizational framework conditions of a certain platform permit the transfer of ownership of a vehicle.
- 48 The above explanations also show that the principle of functional equivalence has increasingly found application and recognition in various areas of law. In the classical dogma of the rules of interpretation, it can be understood as an expression of the teleological interpretation method (enriched by technological aspects), because it identifies the objectives and functions behind a rule and applies them to the new legal question or the digital function with legal effect. Of course, the other rules of interpretation must also be taken into account. From this point of view, the principle of functional equivalence must ultimately be regarded as part of the law of evidence within the meaning of Article 8 SSC.⁵⁷

⁵⁷ Vgl. hierzu Kap. 3.2.2.

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- 49 The legislator will always have the option of specifying or limiting this principle to individual legal issues by defining the specific technical and organizational prerequisites that guarantee functional equivalence. This step has already been taken by the legislator, for example in line with the legal situation within the EU⁵⁸ within the framework of the electronic signature.⁵⁹
- 50 This shows that the principle of functional equivalence is a fundamental principle of general private law, which can be substantiated in particular by contractual agreements and limited by the legislator. For each specific legal question, both the judge and the legislature must define the specific framework conditions under which transactions at the digital level must be recognized as functionally equivalent to transactions at the classical legal level.
- 51 The principle of functional equivalence avoids a deterioration of digital transactions without endangering the legal protection functions guaranteed by classical law. At the same time, this prevents the legal system from continuing to lag behind the de facto technical development and thus behind actual practice. This avoids a deterioration of legal transactions via digital instruments and optimally implements the principle of contractual freedom.

3 Functional equivalence in Switzerland

3.1 Principle of functional equivalence in Swiss teaching

- 52 Recently, JANINA LOH referred to the fundamental work of Wendell Wallach/Colin Allen⁶⁰ on the principle of functional equivalence in order to investigate and strongly limit the question of assuming the responsibility of robots as subjects of action.⁶¹

⁵⁸ EU-Verordnung 910/2014 über elektronische Identifizierung und Vertrauensdienste für elektronische Transaktionen im Binnenmarkt und zur Aufhebung der Richtlinie 1999/93/EG (ABI 2014 L 73 ff.).

⁵⁹ Bundesgesetz über Zertifizierungsdienste im Bereich der elektronischen Signatur und anderer Anwendungen digitaler Zertifikate vom 18. März 2016 (Bundesgesetz über die elektronische Signatur, ZertES; SR 943.03).

⁶⁰ Wendell Wallach/Colin Allen, *Moral Machines. Teaching Robots Right from Wrong*, Oxford 2009.

⁶¹ Janina Loh, *Verantwortung und Roboterethik – ein kleiner Überblick – Teil 2*, InTeR 2018, S. 29 ff., S. 35.

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- 53 The term is also used as a procedural maxim in family law,⁶² in company law,⁶³ in competition law,⁶⁴ in international law,⁶⁵ in broadcasting law,⁶⁶ in commercial criminal law⁶⁷ or in the area of CISG⁶⁸.

3.2 Scope and relevance of "functional equivalence" in Switzerland

3.2.1 Respecting the basic operating principles of the applicable law

- 54 The Recognition of the principle of functional equivalence should be placed at the same level as the other basic principles mentioned above. The above explanations have shown the effects that recognition of the principle of functional equivalence can have:
- It will primarily be the task of doctrine and jurisprudence to assess the fulfillment of the conditions for the recognition of functional equivalence. This development has already begun in day-to-day legal transactions, in that, for example, ownership of so-called crypto-currencies and the possibility of transferring ownership are recognized and practiced on a daily basis;

⁶² Samuel Zogg, «Vorsorgliche» Unterhaltszahlungen im Familienrecht, FamPra.ch 2018, S. 47 ff., S. 53 ff

⁶³ Vgl. etwa mit Blick auf die Vinkulierung von Aktien: PETER NOBEL, Berner Kommentar, Das Obligationenrecht, Das Aktienrecht – Systematische Darstellung, 4. Teil: Besondere Aspekte / § 9 Corporate Governance / VI. – VII., S. 608 ff., Rz. 210; HANS CASPAR VON DER CRONE, Aktienrecht, Bern 2014, S. 155; Zur Sachübernahme: HANS-UELI VOGT/ANNE PETER, Aktienrechtliche Rahmenbedingungen einer finanziellen Sanierung, insbesondere das Verbot der Einlagerückgewähr, GesKR 2011 S. 228 ff., S. 236 f.

⁶⁴ Vgl. etwa mit Blick auf Bindungswirkung als funktionale Äquivalenz zu einem Vertrag: SONJA BLAAS Entstehung und Nachweis der angebotspflichtigen Gruppe, 821/2016, S. 135 ff., Rz. 409; CHRISTOPHH LÜSCHER

⁶⁵ Funktionale Äquivalenz zwischen Delegation und dynamisch-präziser Aussenverweisung: LUZIUS MÄDER/ CATHERINE KROPF Verweisungen auf das Recht der Europäischen Union in der Bundesgesetzgebung – Vom Fotografieren und Filmen, in: Institut für Europarecht der Universität Freiburg (Hrsg.), Die Schweiz und die europäische Integration: 20 Jahre Institut für Europarecht, Zürich 2016, S. 86 ff., S. 100.

⁶⁶ URS SAXER, Die Online-Aktivitäten der SRG und ihre rechtlichen Grenzen, sic! 2011, S. 693 ff., S. 695.

⁶⁷ MARK PIETH, «Funktionale Äquivalenz», Praktische Rechtsvergleichung und internationale Harmonisierung von Wirtschaftsstrafrecht, ZSR 2000 I, S. 477.

⁶⁸ Bspw. im Bereich der Lückenfüllung, vgl. EYLEM DEMIR, Die Schadensersatzregelung im UN-Kaufrecht, Übereinkommen der Vereinten Nationen über Verträge über den internationalen Warenkauf (CISG), ASR 812/2015, S. 37 ff., S. 51 f.

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- The legislator will have to examine whether and to what extent a legislative intervention is necessary, be it to create legal certainty, to enforce legislative objectives or to correct case law; and
 - Finally, interest organizations will also have to examine whether they should/want to give their members suggestions in the form of guidelines and/or GTC recommendations as to how the requirements for functional equivalence in their specific business area can be fulfilled.
- 55 Recognition of the principle of functional equivalence must strike a balance with other general principles:
- Blockchain technology, for example, with its individualizable information such as Bitcoin, can represent the ownership of an object. The principle of the numerous clauses of ownership rights must be weighed against the principle of functional equivalence. It must also be decided whether the term "*object*" can be applied to crypto currencies:⁶⁹ It can be asserted that exclusive access to Bitcoins via the private key and the definability of Bitcoin via the Bitcoin protocol establish a functionally equivalent legal relationship to ownership. This establishes an exclusive right of disposal over an individualizable digital entry (e.g. Bitcoins). From a function perspective, this does not differ in any way from ownership of a "object" (except for the interpretation of the concept of the "object").
 - If, according to Art. 919 para. 1 SSC, possession is defined as "actual power over an object" and Art. 930 SSC establishes the presumption that the owner and all previous owners own the object, then the private key can certainly be regarded as the technical power of disposal as equivalent to the legal power of disposal (possession). This means that not only the ownership of Bitcoins gives rise to the presumption of ownership and a transfer of control over Bitcoins leads to a transfer of ownership.
 - It must also be examined whether on this basis, possession of an object (e.g. a gold ingot) can also be justified by an entry in a blockchain ledger, insofar as the power of disposal has been contractually secured on a functionally equivalent basis to possession. However, this requires proof that the deposited item is also safely stored: whether this, for example, is only possible by a warehouse keeper in accordance with Art. 482 ff. SCO or whether it would have to be finally decided by a court without concretizing laws.
- 56 This can justify (partial) ownership of the object. Whether and to what extent the concrete setting fulfils the requirements for functional equivalence would ultimately have to be decided

⁶⁹ Vgl. hierzu bereits GRAHAM-SIEGENTHALER/FURRER (FN. 56); BENEDIKT SEILER/DANIEL SEILER (FN. 56).

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by the judge, just as the judge also has to decide whether, in the concrete case, the presumption of ownership under Art. 919 para. 1 SCC can apply.

- In the same sense, all functions of ownership (legitimation, tradition, defensive, offensive and initiation functions)⁷⁰ can be checked to see whether and to what extent they can be technically mapped to a blockchain.
- The formal requirement can also be examined on the basis of functional equivalence in the sense that the digital system used is functionally equivalent to the requirement of written form. For this purpose, the reasons for the choice of written form must be examined. The legislator has, for example, already defined more far-reaching technical prerequisites with regard to written form, which in this case must be observed as concrete legal prerequisites of functional equivalence to be complied with. This example also shows that comprehensive and centralized regulation such as ZertES can ultimately have an inhibitory effect on technical progress if it makes it impossible to apply the principle of functional equivalence through final regulation.

- 57 These basic principles can be applied to many other legal institutions, for example to the question of the legality of digital securities or the fulfilment of the requirement of written form at assignment (Art. 165 para. 1 CO). Unfortunately, these issues cannot be further explored in this context.
- 58 A clear decision in favor of new technical developments will therefore be taken on the basis of this general principle without any loss of legal certainty. The law continues to fulfil its protective function without hindering the introduction of innovative technologies. The legislator, in turn, does not have to work out individual case-related solutions for the entire breadth of the law, rather it can focus on the most important questions. This corresponds to the liberal legal understanding of our Swiss legal system.

3.2.2 Functional equivalence as a legislative approach

- 59 The principle of functional equivalence could also be enshrined in the law as a legislative principle. Systematically, a corresponding provision can be regarded both as a concrete expression of the principle of good faith (Art. 2 para. 1 SSC) and of the law of evidence (Art. 8 SSC).
- 60 The addition of a functional equivalence formulated under positive law to Article 2 SSC would emphasize the substantive content of this principle and thus the substantive extension of these protective provisions of written law into the digital world. In contrast, the incorporation of this principle into Article 8 SSC would emphasize more strongly the evidential nature of

⁷⁰ Vgl. Kap. 2.1.

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the principle of functional equivalence. The authors tend towards the second solution because the question of evidence is the linchpin for the application of the principle of functional equivalence.

- 61 Following the above definition of the principle of functional equivalence, Art. 8a SSC (if applicable Art. 2a SSC) could have the following wording:

Art. 8a SSC

“Insofar as Swiss law links the validity of legal transactions or the existence of a legal institution to substantive or formal requirements, these requirements are deemed to be fulfilled if a digital system replaces the legal protection concerns behind these requirements on a functionally equivalent basis. The legislator can specify the requirements for functional equivalence at the level of laws and regulations.”

- 62 As shown above,⁷¹ the German legislator has opted for exactly this approach when regulating the German maritime bill of lading in § 516 Paragraph 2 HGB/D. The competence to issue specific regulations has been delegated to the Federal Ministry of Justice and Consumer Protection in agreement with the Federal Ministry of the Interior.

3.2.3 Functional equivalence as an expression of the Swiss liberal legal system

- 63 The principle of functional equivalence guarantees, irrespective of whether it is recognized as a general principle or enshrined in law, in the sense of a liberal legal system, that the legislator only has to intervene where it is necessary to protect legislative policy objectives. This also corresponds to our liberal legal system, as guaranteed in Art. 27 of the Federal Constitution (BV)⁷² as a guarantee of economic freedom.
- 64 In addition, functional equivalence also reflects the principle of contractual freedom⁷³. It should ultimately be left to the contracting parties to recognize a functionally equivalent legal effect within the framework of the legal transaction agreed between them. It also protects the trust that users of digital systems place in the legal validity of transactions.
- 65 At the same time, Switzerland will be promoted as an economically liberal and technology-open location, which will remain an important location factor in the future.

⁷¹ Vgl. Kap. 2.2.5.

⁷² Bundesverfassung der Schweizerischen Eidgenossenschaft vom 18. April 1999 (BV; SR. 101).

⁷³ Vgl. zum Bezug zur Wirtschaftsfreiheit, KLAUS VALLENDER, in: Bernhard Ehrenzeller/Benjamin Schindler et.al., Die Schweizerische Bundesverfassung, 3. Auflage, Zürich 2014, Art. 27, Rn. 37 ff.

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4 Summary and Outlook

- 66 The authors are of the opinion that the Gordian knot regarding the legal obligation of legal transactions via digital media cannot be solved (or at least not in time to remain competitive) with individual legal measures across the entire legal system. On the contrary, the principle should be recognized that such legal transactions at digital level should acquire legal validity without hindrance, unless there are special reasons to make the legal effect dependent on additional conditions.
- 67 Recognition of the principle of functional equivalence would make this approach a reality. The existing protection system consisting of legal requirements and general principles will be extended to digital systems, as long as no functional disadvantages are expected. The legislature can thus limit itself to its actual function of legislating on additional legal requirements to protect regulatory goals in individual questions.
