RAFAEL CEZAR BASTOS

AN ANALYSIS OF BLOCKCHAIN: SMART CONTRACTS UNDER BRAZILIAN LAW

CURITIBA

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Orientador: Dr. Martinho Martins Botelho

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Autorizo a submissão da monografia supranominada à Comissão/Banca Avaliadora, responsabilizando-me, civil e criminalmente, pela autoria e pela originalidade do trabalho apresentado.

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To my grandparents, Olinda and José,
the owners of my longing.

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Only very few men have the gift of thinking new
and original ideas and of changing the
traditional body of creeds and doctrines.

Pouquíssimos homens têm o dom de pensar em
ideias novas e originais e de mudar o corpo
tradicional de credos e doutrinas.

(Ludwig von Mises, 1998, p. 46)

RESUMO

A presente pesquisa tem como objetivo tecer considerações acerca de *Blockchain* e *smart contracts*, examinando-os sob a ótica da teoria dos negócios jurídicos e da teoria geral dos contratos. A metodologia é de cunho qualitativo descritivo, vez que trata de aspectos subjetivos da utilização dos *smart contracts* do *Blockchain* como contratos em sentido jurídico. Viabiliza-se este processo de compreensão através de pesquisa teórica sobre os fenômenos do *Blockchain*. Para tanto, utiliza-se a técnica de coleta de informações através de pesquisa aos delineamentos principiológicos, científicos e doutrinários, bem como normais legais do direito brasileiro. Inicialmente, aborda-se a teoria geral dos negócios jurídicos aplicada aos contratos. Após a verificação das noções gerais acerca dos contratos, investiga-se as características dos contratos eletrônicos. Posteriormente à explanação, o estudo converge para o reconhecimento do *Blockchain*, bem como a sua relação com o *smart contract*. Em seguida, busca-se descrevê-los, elencando-se características que possibilitam o exame do *smart contract* como contrato eletrônico. Ao final, respondem-se questões acerca do seu reconhecimento como uma nova maneira de contratar, bem como seu enquadramento e validade à luz do sistema jurídico brasileiro.

Palavras-chave: Blockchain. Smart Contracts. Contrato Eletrônico.

ABSTRACT

The purpose of this study is to discuss Blockchain and Smart Contracts, examining them from the perspective of the Brazilian Theory of Contracts and the Theory of Legal Business. The methodology used is the qualitative and descriptive, since it deals with the subjective aspects of the use of Blockchain smart contracts as valid contracts in Brazil. This process of analysis is possible through theoretical research involving the Blockchain phenomenon. To this end, a technique of information collection is used, based on principiological, scientific and doctrinal researches and, mainly, legal norms of Brazilian law. Initially, the Brazilian Theory of Contracts and the Theory of Legal Business in the Brazilian Legal System is approached. After verifying the general notions about contracts, the characteristics of electronic contracts are investigated. After the explanation, the study converges to the recognition of the Blockchain, tracing a relation with the smart contract. Next, it seeks to describe them, listing characteristics that enable the examination of the smart contract as an electronic contract. To conclude, questions about its acceptance as a new form of contracting, as well as its classification and validity are answered according to the Brazilian legal system.

Key-words: Blockchain. Smart Contracts. E-Contract.

LIST OF PICTURES

LIST OF ABBREVIATIONS AND ACRONYMS

AED	*Análise Econômica do Direito*
ANAC	*Agência Nacional de Aviação Civil*
Art.	Article
Byte	Binary Term
CERN	European Organization for Nuclear Research
CPqD	*Centro de Pesquisa e Desenvolvimento em Telecomunicações*
CVM	*Comissão de Valores Mobiliários*
Dapps	Decentralized Applications
DLT	Distribuited Ledger Technology
ETH	Ether
EVM	Ethereum Virtual Machine
IBGE	*Instituto Brasileiro de Geografia e Estatística*
IBM	International Business Machines
ICP-Brasil	*Infraestrutura de Chaves Públicas Brasileira*
IoT	Internet of Things
ITTT	If this, then that
MP	*Medida Provisória*
NIE	New Institutional Economics
p.	*Página*
P2P	Peer-to-peer
PKI	Public Key Infrastructure
PLC	Power Line Communications
PLS	*Projeto de Lei do Senado*
PNAD	*Pesquisa Nacional por Amostra de Domicílios Contínua*
PoS	Proof-of-Stake
PoW	Proof-of-Work
RTD	*Registro de Títulos e Documentos*
TTP	Trusted-Thid-Party
URL	Uniform Resource Locator
WWW	World Wide Web

SUMMARY

INTRODUCTION

Dealing with the impacts of technological innovations in Brazilian law is not an easy task.

As a matter of fact, capturing this change and presenting concepts and functionalities is a Herculean mission, since by doing so we risk committing serious faults by assuming them to be perfect and complete or, even, by trying to simplify them in favor of didactics so that possible omissions make them too simple.

Without wishing to incur these misconceptions, the present work is based on the axiom that legal business are intensely esteemed to meet the desires of the human person, in addition to the economic actions of *homo economicus*[1], as the means of contracting expand and improve in the 21st century.

In view of this, it is gradually noticed that the world wide web has been facilitating economic transactions, and that these go through a process of mitigation in relation to conventional means, towards the greater use of virtual platforms, which gain prominence for representing a way to improve the legal relations through the electronic "ecosystem".

As in other institutes, contracts follow the directions of the system to which they belong and, with a certain degree of speed, they are shaped and regulated according to reality, with the dynamism of society, almost always in relation to the time, place and interests of people.

In this sense, for some time now, it has been possible to verify, for example, contracts concluded through applications, where legal transactions are negotiated and concluded with unprecedented facilities, as can be seen in virtual platforms such as 'Airbnb', 'Uber', 'TaskRabbit' and the like.

It is also observed that the Law has not moved away from the social and economic transformations but, above all, it has emerged before the Brazilian legal system new and complex challenges, which imply, with a certain degree of frequency, substantial changes related to new realities, especially when it comes to the conception and execution of contracts.

In view of this, it is important to point out that the contract should be constantly updated because, referring to the concepts of Arnoldo Wald (2013) and Caio Mario da Silva Pereira (2008) consolidated in the Brazilian civil doctrine, the contract is the effective instrument that allows the development of our economy due to technical progress, without which our livelihood would certainly be damaged to the point of regressing to the primary moments.

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[1] The experimental concept 'homo economicus', attributed to John Stuart Mill, preaches the ideal economic man who always seeks to maximize profits and minimize costs, always acting rationally. Following the ideas of Ludwig von Mises and Nobel Prize winner Richard Thaler, one cannot exclude the possibility that men fail, are negligent, are undervalued, influenced or ill instructed. Human, as he really is, is not infallible and sometimes chooses means that cannot bring the ends he desires.

However, with modernization there are also new challenges and, in fact, there is no way to avoid the innovations of the technological world today, because we are going through a complex moment, where much has been done to optimize, solve and facilitate our lives, notably in business relations.

In the context of innovation, assuming the contract as the most important source of obligations of Brazilian civil law, much attention is drawn to the Blockchain technology, which has not rarely been presented as a large "toolbox" aimed at the economy and, eminently, at legal business, to the extent that it supposedly tends to intensify security and confidence in legal relations.

The emergence of this technology took place in mid-2008, when it was accompanied by criticism of the financial system and the mistrust installed at the height of the world financial crisis, through an article officially published on the Internet in 2009, entitled "Bitcoin: A Peer-to-Peer Electronic Money System", to which is attributed the authorship of the illustrious stranger "Satoshi Nakamoto" (NAKAMOTO, 2008).

It is extracted from the author's ideals, among other notions, that through the elimination of intermediaries (*in casu* the financial institutions) and the use of collaborative economy[2] it would be possible to achieve the reduction of transaction costs[3] and also feed the strengthening of trust among the users of the system.

Thus, "Satoshi Nakamoto" developed a protocol for storage and validation of records with support in cryptography, which then began to provide authenticity to economic transactions of a system. In the latter, information was recorded in blocks that, in turn, began to integrate a true chain of transactions, accessible by all those connected to a software through the Internet.

In Blockchain, peer-to-peer architecture system (or P2P), each 'point' of the network - which can be represented by a person - simultaneously becomes a client and a miner, since at the same time the user can include a new block the chain - and visualize all the others - can also validate other blocks coming from the universality of the chain. Therefore, you have a ledger, where the transactions and the validation of these transactions occur throughout the network, in a distributed way.

Also, this system can only be modified due to the alteration of all the registered and distributed blocks in the chain, which provides a certain degree of digital confidence.

Moreover, it is through the polymorphic characteristics of immutability, decentralization and ease of access that the Blockchain has become useful for the recording of any values.

For this reason, particularly as a result of technological advances - especially the advent of the Internet - the private law sector is going through a stage of rapprochement with various digital

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[2] Collaborative economy, also called sharing economy, in a broad sense, is a proposal to maximize the use or exploitation of resources, in order to increase the benefits derived from them.
[3] One of the largest contributions assisted by the New Institutional Economics (NIE) is the observation that the companies with the highest economic performance are those that have institutions capable of reducing transaction costs, such as information, negotiation, decision, inspection and even sanction costs in certain cases.

or electronic platforms, which are progressively gaining relevance due to their impact on various approaches to daily life, to the point of rising to the category of fundamental right of fifth generation, as argued Antonio Carlos Wolkmer (2009).

This is the case of the Blockchain technology, which since its creation has provided several waves of innovation around the world.

In law, a fertile field has opened up. Among the utilities explored in Blockchain are several objects, for example, real estate registers, intellectual property registers, creation of virtual identities, voting and bidding systems and a wide range of other applications.

In practice, Blockchain is a new platform, still highly concentrated in the context of Western Europe and the United States of America, capable of making significant changes in various institutes.

The number of incipient applications of Blockchain with the scope of social change is therefore increasing in the legal field, also generating repercussions for the institute of contracts, which inevitably needs speed, accessibility and security in view of the rapid and global experiences that are faced, above all, in the field of Private Law.

The fact is that after Blockchain went through a relatively short period of diffusion, new possibilities arose, such as the creation of contractual instruments unimaginable 30 years ago, now known as smart contracts.

This new way of contracting suggests the creation of contracts by means of algorithmic codes, and promises to change the traditional concept of execution of obligations, offering legal certainty, speed and efficiency to contracts concluded over the Internet.

Smart Contracts derive from Blockchain technology, and can be described as algorithmic protocols that can be self-executed when the conditions previously established in cryptographic protocols of a Blockchain network are met.

Naturally, it is observed that, together with its emergence, the technology gained relevance for contract law, especially drawing the attention of researchers, who began to deduce from its applicability an alleged deconstruction or growth of the institute of the contract, in order to reestablish trust and security related to the effects of the contract.

On the other hand, due to the lack of specialized doctrine and, especially, of specific legal rules, several embarrassments emerge in relation to their validity in the legal system, since *a priori* smart contracts are nothing more than codes that support the contracts.

In this regard, it is known that in Brazil, contracts must be subject to contract law and current legislation.

Considering this premise, the present work intends to answer if the smart contracts can be recognized as contracts in light of the Brazilian Law, as well as will seek to perform its analysis before the legal system, describing it and classifying it, in order to verify if they have legal validity.

Several issues may arise in an attempt to refute or adjust the proposal of this work, such as its adequacy to the Brazilian legal system: issues affecting data protection, the possibility of vices or defects in the legal business, vulnerability to flaws or errors in the programming code of an smart contract, (im)possibility of judicial interpretation of codified clauses, (in)effectiveness of judicial decisions on codes, embarrassment related to competencies and identification of laws governing each contract, possible (dis)balances between the contracting parties and (im)possibility of return to *status quo ante*, possible violations of fundamental rights, need to create new mechanisms for conflict resolution, among other risks and challenges inherent to the modernization of a society in technological leap.

Due to the need to improve legal science, the present work aims to make considerations about Blockchain and smart contracts, examining them from the perspective of Brazilian Theory of Contracts and the Theory of Legal Business in the Brazilian Legal System, considering their prominent use in the new legal scenarios that are established in the present and, more reiterated, in the near future.

Indispensable issues arising from the ramifications of the contracts will be addressed, although some other discussions will be ruled out due to the need for extensive comments, which would not be exposed here in a necessary manner.

The present work is guided by an exploratory approach, seeking to identify and present the aspects and functionalities of this new ecosystem, bringing it closer to the Brazilian general theory of contracts and the Theory of Legal Business, in order to adhere the smart contracts as electronic contracts.

The methodology is qualitative and descriptive in nature, since it deals with the subjective aspects in the use of smart contracts of Blockchain as contracts in the legal sense, allowing to bring information and some complexities about the context to which it is inserted.

This process of understanding is made possible through theoretical research on the phenomena[4] of the Blockchain, which came in large part from the supedanium of whitepapers and scientific articles.

The data collection technique was based on bibliographic and documentary research on smart contracts and Blockchain, as well as on legal doctrines and norms, which is still emerging.

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[4] Facts or events observable and describable, explainable from the scientific point of view.

1. CONTRACTUAL RELATIONSHIPS: NOTIONS AND GENERAL THEORIES

In the words of Silvio de Salvo Venosa (2006, p. 357), when the human being uses his manifestation of will with the main intention of generating juridical effects, the expression of this will constitutes a legal business.

Thus, it is clear in general terms that the legal business deals with a structure that must be analyzed in view of the need to modernize private law, at the risk of not achieving the legal effects desired by the society which, in most cases, are achieved through the signing of contracts.

In this regard, according to Carlos Roberto Gonçalves (2012, p. 26), being the contract a legal business that regulates the economic operations that enable the circulation of wealth and technical progress, this chapter seeks to address the Theory of Legal Business, listing factual assumptions, crossing the study of the Brazilian general Theory of Contracts, observing generalities, principles and elements of formation of contracts, to enable the analysis and recognition of smart contracts.

1.1 Theory of Legal Business applied to Contracts

The Brazilian Civil Code of 1916, following the French model (which excelled in the principles of equality and freedom), did not distinguish legal act from legal business. This distinction only came into existence in Brazil due to the influence of the Germanic system, with into force of the Brazilian Civil Code of 2002.

Thus, it is possible to verify that the Civil Code of 2002 was altered in relation to the generic expression "legal act" that existed in the Code of 1916, and that it was transformed into "legal business", given the need for detailed regulation and its vast content.

According to Arnoldo Wald (2013, p. 229), the 2002 Civil Code simultaneously deals with legal transactions and legal acts in a single article, namely: "Art. 185. Aos atos jurídicos lícitos, que não sejam negócios jurídicos, aplicam-se, no que couber, as disposições do Título anterior"[5].

Therefore, legal transactions are regulated in Book III, Title I, of the General Part of the Brazilian Civil Code of 2002, and legal acts in Title II of the same book.

However, unlike the old code, the Civil Code of 2002 does not conceptualize legal business. Therefore, the doctrine had the task of conceptualizing it, based on two currents, namely: (i) voluntary current and (ii) objectiveist current.

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[5] Art. 185. The lawful legal acts which are not legal transactions, apply, what fits, the provisions of the previous title.

While the former defends legal business as "[...] um ato de vontade autorizado pelo ordenamento jurídico a perseguir um fim seu"[6] (SANTORO-PASSARELI, 1981, p. 26), the latter, in Emilio Betti's words, understands that the law recognizes private autonomy[7], and:

> A manifestação precípua desta autonomia é o negócio jurídico, o qual, precisamente, é concebido como um acto de autonomia privada, a que o direito liga o nascimento, a modificação ou a extinção de relações jurídicas entre particulares. (BETTI, 1969, p. 98).[8]

Thus, when we deal with legal transactions, either as a manifestation of the will or as a manifestation of private autonomy, we refer to an act (unilateral, bilateral or plurilateral) that has as its purpose the acquisition, modification or extinction of obligations.

The contract, on the other hand, is a type of legal business, and originates by means of bilateral[9] volitional acts to create, modify or extinguish obligations related to an asset content (according to the principle of consensualism in contractual relations).

For Arnoldo Wald (2013, p. 230), since his emergence in Roman law and his respective firmament in canon law, the contract has served to ensure the human will the possibility of creating rights and obligations.

In this bond, the theory of the autonomy of will emerged from the canonists, which affirms the obligatory nature of the conventions, equating them, for the contracting parties, to the law itself.

This is the principle *pacta sunt servanda*, a Latin brocard attributed to Ulpiano, in the Digesto, which means "agreements must be kept". And just ahead, Arnoldo Wald concludes:

> [...] foram os jusnaturalistas que levaram o contratualismo ao apogeu, baseando num contrato a própria estrutura estatal e fazendo com que, em determinadas legislações, o contrato não mais se limite a criar obrigações, podendo criar, modificar ou extinguir qualquer direito, inclusive os direitos reais. (WALD, 2013, pp. 230-231).[10]

This freedom[11] in relation to the autonomy of the will is presented in two different forms, which are: (i) freedom to contract and (ii) freedom of contract. The first has the possibility to

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[6] [...] an act of will authorised by the legal order to pursue an aim of its own. (Literal translation).

[7] With the creation of Provisional Measure No. 881 (Provisional Measure of Economic Freedom), converted into Law No. 13.874 of September 20, 2019 (Declaration of Economic Freedom Rights), it seeks to reinforce the "free initiative", the "free exercise of economic activity" and also enshrine the principle of "minimum State intervention", reserving as exceptional the contractual review determined outside the parties, probably with the intention of avoiding "contractual reviews" that result in excessive changes to the agreement signed between the parties. In addition to other modifications, the Declaration of Economic Freedom Rights provides on the interpretation of the contracts and implements new provisions to the General Part and General Theory of the Contracts.

[8] The main manifestation of this autonomy is legal business, which is conceived precisely as an act of private autonomy, to which law links the birth, modification or extinction of legal relationships between private individuals. (Literal translation).

[9] In this sense, it is important to assert that the rule does not admit the so-called contract with oneself (also called self-contract), where a single person appears in the formation of the contract as proponent and acceptor, simultaneously.

[10] [...] it was the "natural" justicians who took contractualism to its height, basing it on a contract the very state structure and making it so that, in certain laws, the contract is no longer limited to creating obligations, being able to create, modify or extinguish any right, including the rights in rem. (Literal translation).

[11] The contractual freedom experienced by the history of civilization is due to the presumption of formal equality and freedom between subjects, which can be especially observed in the eighteenth-century codifications, among them the

contract or not to contract, while the second refers to the possibility of establishing the content of the contract.

In this scope, it is worth pointing out that it is by virtue of the first that the creation of atypical contracts is allowed; due to the second, there is the basis for the object of the contract to be subject to extensive restrictions, especially when they arise from adhesion contracts.

However, with the improvement of contracts, due to the reaction to the individualistic liberalism of the nineteenth century contained in the Napoleonic Code, the "contractual mystique formula"[12] that reduced state interference to a minimum began to be relativized by the effects of the constitutionalisation of law in Brazil.

Thus, in addition to the mere contemplation of the autonomy of the will, the duty to observe the minimum principles was inaugurated, such as the principle of good faith, which allows to achieve the flexibility of private law and seek the protection of trust, requiring the action of the parties in accordance with the usual standards and creating accessory duties of protection (such as the duties of information and loyalty).

Thus, the contractual dirigisme that accompanied the hypertrophy of the State passed through public order rules to protect the economically weaker elements, interpreting it as *rebus sic stantibus* or "things thus stading", that is, while the situations of the parties do not undergo substantial changes.

Therefore, in the case of transformations, it was allowed the revision or readjustment of the terms of the contract, avoiding true situations of abuse of rights - provided for in article 187 of the Civil Code[13]-, especially in relation to the economically less favored and other distortions.

For these reasons, it is clear that for the contract to take effect, it is not enough that the element of autonomy of will, alone, is sufficient.

As for almost all things, its full recognition requires compliance with the legal system and, also, the observance of essential elements, which are: able agents, lawful object, possible, determined or determinable, in addition to valid consent and in the form prescribed or no defence in law, as provided for in art. 104 of the Civil Code of 2002.

Next, with ballast in the General Part of the Brazilian Civil Code of 2002, we will pass on the establishment and exposure of these elements so that, at the appropriate time, it is possible to discuss the validity of smart contracts.

Brazilian Civil Code of 1916, whose project dates back to 1899. By virtue of this current, the declaration of will became extreme by the national doctrine through the famous placement that "the contract makes law between the parties".

[12] In this historical context, it is said that there was a contractual mystique in relation to contractual supremacy, where the decision of all economic issues was left to the discretion of each one.

[13] Art. 187. Also commits tort the holder of a right, to exercise it, manifestly exceeds the limits imposed by its economic or social order for the good faith or morals.

1.1.1 Trichotomy of Legal Business

The Theory of Legal Business applies to contracts that fall into this category because, although every contract is a legal business, not every legal business is a contract.

For a long time, the brazilian doctrine consolidated in the field of the subject, to explain them, has been pointing to the existence of three plans in the legal business, namely: (i) plan of existence, (ii) validity plan and (iii) effectiveness plan.

In a concise manner, it is said that the plans of the legal business are necessary to perform the analysis of the formalization of the contract, as well as its enforceability.

This theory stems from a construction of Pontes de Miranda on the legal business, also called the "ponteana ladder"[14]. For the brilliant jurist:

> [...] existir, valer e ser eficaz são conceitos tão inconfundíveis que o fato jurídico pode ser, valer e não ser eficaz, ou ser, não valer e ser eficaz. As próprias normas jurídicas podem ser, valer e não ter eficácia. O que se não pode dar é valer e ser eficaz, ou valer, ou ser eficaz, sem ser; porque não há validade, ou eficácia do que não é. (PONTES DE MIRANDA, 1974, p. 15).[15]

The legal business, therefore, is an act by which the parties express their will on the business aspects. In addition to the manifestation of the will, other requirements must be observed in order for them to exist and be valid. These requirements are nothing more than the very steps of the "ponteana ladder", eternalized in the legal world.

According to Silvio de Salvo Venosa, these elements can be seen through the generic prism of legal contracts, as follows:

> São nulos os contratos a que faltar qualquer dos elementos essenciais genéricos. Cada contrato, porém, pode requerer outros elementos essenciais, específicos de sua natureza: assim, para a compra e venda são elementos essenciais específicos a coisa, o preço e o consentimento (há outros contratos que também necessitam desses elementos; é essencial para o contrato de depósito a entrega da coisa ao depositário e assim por diante. (VENOSA, 2006, p. 429).[16]

Therefore, it can be said that legal business in general also obeys natural elements and accidental elements. However, we must always take into consideration the plans of existence, validity and effectiveness, because the contract in theory may exist, having a material aspect of a

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[14] The methodological option for the "ponteana ladder" theory in the present study is useful, also because of its didactic nature, since it allows analyzing the legal business from its structure.

[15] [...] to exist, validate and be effective are such unmistakable concepts that the legal fact can be, validate and not be effective, or be, not valid and be effective. The juridical norms themselves can be, validate and not be effective. What cannot be given is to be valid and effective, or to be valid, or to be effective, without being effective, because there is no validity, or effectiveness, of what is not. (Literal translation).

[16] Contracts lacking any of the generic essentials shall be void. Each contract, however, may require other essential elements, specific to its nature: thus, for the purchase and sale are essential elements specific to the thing, the price and the consent (there are other contracts that also need these elements; it is essential for the contract of deposit the delivery of the thing to the depositary and so on. (Literal translation).

legal business, but it is not valid because it lacks, for example, a capable agent. Or even, a contract may exist, be valid but ineffective, when for example, pending a suspensive condition.

At the plan of existence, the very existence of the legal business is listed, without which, there is no valid or invalid, effective or ineffective legal business.

Therefore, the minimum requirements of the legal transaction are those listed in article 104 of the Civil Code of 2002 (old article 82 in Civil Code of 1916): the agent, the object and the form. Once the elements of the plan of existence actually exist, its validity is analyzed. In order to contract, an agent with in fact capacity is required as an indispensable condition for the validity of the contract. Therefore, relative incapacity[17] matters in nullity of the legal transaction, while absolute incapacity in nullity.

In relation to the subject matter of the contract, it shall be lawful, possible, determined or determinable. We must also remember that the contracts are of an economic nature, and because of this they must be susceptible to economic appreciation. The illegality or absolute impossibility of the object is important in the nullity of the contracts. It is worth saying that the object must comply with the legal norm, and also respect morality and good customs: the Civil Code of 2002 prohibits agreements as to succession (art. 426) and the sale of family property (art. 1.717), for example.

Furthermore, contemporary law - abandoning formalism - only requires a special form in certain contracts, such as legal transactions that deal with real rights.

Thus, it is said that the freedom of forms is limited by law: as long as the law does not provide otherwise, the validity of legal transactions is subject to the consent of the parties.

In this sense, the will of the parties can be expressed in a written, verbal manner, through gestures, signs or mimics, or also, tacitly, when there is silence or a gesture/attitude by which the contracting party starts the execution of the contract, thus proving its intention to fulfill it.

However, as Arnoldo Wald (2013, p. 259) asserts, the Civil Code of 2002 expressly contains in art. 110 and 111 the following rules regarding the expression of will of the parties:

> Art. 110. A manifestação de vontade subsiste ainda que o seu autor haja feito a reserva mental de não querer o que manifestou, salvo se dela o destinatário tinha conhecimento.
> Art. 111. O silêncio importa anuência, quando as circunstâncias ou os usos o autorizarem, e não for necessária a declaração de vontade expressa. (BRASIL. Lei nº 10.406 de janeiro de 2002).[18]

That said, the legislator wanted even the interpretation of silence as an expression of will to be derived from the legal text, custom and usage, commercial practices, or the contract itself. Thus, in legal transactions in which it is not customary to tacitly accept (by behavior), there must

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[17] In Brazil the incapacity can be met through institutes of "representation" and "assistance".
[18] Art. 110. The manifestation of will remains the author there is made a mental reservation of not wanting what they expressed, unless the recipient had knowledge.
Art. 111. The silence matter consent, when the circumstances or the uses the permit, and is not required the Declaration of wishes expressed.

be express acceptance, observing article 432 of the same law. In certain cases, the law itself does not require express acceptance; this is what happens with regard to the mandate and donation in certain situations, as provided in articles 659 and 539 of the Civil Code.

The will in the legal business must be, as a rule[19], free, conscious and voluntary. Vice of will in contracts authorize their annulment in general hypotheses foreseen in relation to the annulment of legal transactions in general.

Therefore, once one of the above requirements has been violated, the provisions on nullity or invalidity, set forth respectively in the *caput* and in the clauses of articles 166 and 171 of the Civil Code of 2002, can be applied.

Finally, after verifying and validating the essential elements, the study should start with the repercussion of the legal transaction at the social level, then identifying its effectiveness or the material effects produced by the legal transaction.

In this plan, it deals with the elements related to the suspension and resolution of rights and duties of the parties involved, the main elements being called accidental (because they are optional), namely: the condition, the term and the burden.

The condition is regulated by art. 121 *usque* 130 of the Civil Code, and relates to future and uncertain events, on which the effectiveness of the legal transaction depends. It may occur by virtue of a fact alien to the will of the parties, as well as by natural event or the will of a third party.

The conditions are classified as suspensive or resolutive. The former has the effect of making it impossible to start producing effects until the future and uncertain event ceases to be one. Therefore, the effects only operate after the implementation of the condition. In a diametrically opposed manner, the resolutive condition is that which ceases for the one who acquires guaranteed rights from the occurrence of a future and uncertain event.

The term, in turn, can be described as the moment when the effectiveness of the legal transaction begins - or is extinguished. In general, it is measured by year, month, day and hour. Its effect is not to suspend the acquisition of the right, but to advance its exercise, since there is conviction on the occurrence of the event.

On the other hand, the burden, also expressed in an accessory clause, generally burdens the beneficiary with respect to the use of an assep. The burden is coercive in this sense, and may be revoked by liberality.

It is worth saying, at this point, that in relation to the effectiveness of the contract against third parties, the act of transcribing it in the Registry of Titles and Deeds (RTD) is still important.

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[19] Or not tainted by vices of consent, such as error, fraud, damages or duress.

1.2 Contracts: Overview

This chapter deals with the concept of a contract, its principles, as well as its formation and elements to enable the examination of electronic contracts.

Analyzing our daily lives, we can see that at all times we are hiring or receiving the effects of contracts, which are responsible for the function of instrumentalization of economic operations, carrying out the human will: turning on the lights, turning on the tap to use water, using public transportation, buying, selling, etc.

The Civil Code of 2002, however, does not conceptualize what the contract is, even though it provides for the contractual figures and their essential elements of subjective and objective order.

In this respect, the doctrine also had the task of conceptualizing it: going back to the Roman origin to the present time, Paulo Nader (2018, n.p.) articulates that over time the contract underwent a significant change.

The author states that the concept of contract formulated by the *Code Napoléon*, under the influence of the French jurisconsults Domat and Pothier, came from *Jurisprudentia* when distinguishing the contract from the convention, although this was linked to the source of obligations and the first to the means to modify or terminate them.

In this regard, it follows that after great debates about the precept set forth in art. 1.101 of the *Code Napoléon*, notably by the distinctions made by Demolombe and Giorgio Giorgi, weighted in Brazil by Darcy Bessone, other stages emerged in the evolution of the concept of contract, mainly by the definition brought by art. 1.098 of the Italian Civil Code of 1865, where the Italian legislator advanced on the discussion and, not holding the Roman distinction between convention and contract, admitted the contract as a source of contractual termination or agreement of rescission.

From this evolution, the consolidated doctrine recognizes the contract as the meeting of the minds that aims to produce legal effects through the creation, modification or termination of obligations.

In this sense, the contract is the legal means created to represent an obligation (personal, positive, negative) and also to allow its enforcement.

Therefore, the pact becomes a contract when it allows the other party to demand the consideration.

In addition, doctrinators often extend to linking the notion of contract to the principle of relativity of contracts, also encapsulated by the Italian law in precepting by art. 1,372 that "il contratto ha forza di legge tra le parti"[20].

In the words of Paulo Nader:

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[20] "The contract has the effect of law as between the parties". (Literal translation).

> Setores da doutrina distinguem três conceitos de contrato. Um deles é amplíssimo e significa o *acordo de vontades para produzir efeitos jurídicos os mais diversos*. Nesta acepção lata, a noção de contrato alcança as diversas províncias do Direito Privado, Direito Público Interno e Internacional. Em sentido menos amplo, quer dizer *acordo de vontades que visa a obter resultados jurídicos de conteúdo econômico*. Tal definição restringe o sentido, desconsiderando os vínculos contraídos sem finalidade patrimonial, como o do casamento e adoção, mas alcança os estabelecidos no âmbito do Direito das Coisas, Direito do Trabalho, entre outros. Finalmente, a acepção mais restrita: a que designa por contrato apenas *a reunião de vontades, que tem por objeto a produção de efeitos jurídicos na órbita do Direito das Obrigações*. (NADER, 2018, n.p.).[21]

Following as a precept its meaning in a broad sense, specifically when dealing with Private Law, it is seen that the contractual rules are configured through clauses, in order to enable the production of legal effects agreed between the parties.

Therefore, it is clear that the contract is the most used legal business to enable human relations, being characterized as the main source of obligations of private law.

Also for this reason, the regulation of contracts is governed by the Civil Code, especially by the general clauses of the social function of contracts and objective good faith, applicable to all types of contracts. While the first principle applies intrinsically to the relationship between the contracting parties (endogenously), the second principle is linked to the effects produced by the contracts and third parties alien to the contractual bond (exogenously).

That said, it is important to stress that the contracting parties have the autonomy to establish their wills. However, this autonomy is not unlimited, which is why the parties must respect the legal rules, due to the State's interference on private business, a phenomenon known as contractual dirigisme.

Thus, below we will move on to a more vertical analysis of the contracts, due to the social purposes and the presupposed requirements of the common good.

1.2.1 General Principles: Content and Scope

It is known that the notion of individualism in contracts, which influenced the Brazilian Civil Code of 1916 (also known as the Beviláqua Code), is no longer present in the current Civil Code of 2002. In this sense, under the social-democratic ideology, the supposed omnipotence of the citizen within the contractual plan was removed, preventing that the will of each one was the faithful of the balance when dealing with economic decisions.

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[21] Sectors of the doctrine distinguish three concepts of contract. One of them is very broad and means the agreement of wills to produce the most diverse legal effects. In this broad sense, the notion of contract reaches the various provinces of Private Law, Domestic and International Public Law. In a less broad sense, it means agreement of wills that aims to obtain legal results of economic content. Such definition restricts the meaning, disregarding the bonds contracted with no patrimonial purpose, such as marriage and adoption, but it reaches those established in the scope of Property Law, Labor Law, among others. Finally, the narrowest meaning: the one that designates by contract only the meeting of the minds, which has as its object the production of legal effects in the scope of the Law of Obligations. (Literal translation).

According to Arnoldo Wald (2013, p. 232), in a certain phase, the ingerence of public order led to the law to contractual dirigisme, expanding the area of public order norms. The contract, in turn, began to have a content of public law, arising from the *legis*.

Even contractual freedom was limited, since it is verified nowadays a kind of projection of contractual freedom in time: in certain cases, for example, it is possible to interpret the mandatory nature of contracts from the lenses of the principle *rebus sic stantibus*, allowing the adjustment of the contract, which most often occurs through the judicial means.

Contemporary law, in this sense, has limited the mandatory nature of the contract, allowing a review to occur in cases of excessive onerosity, according to article 478 of the Civil Code.

This occurred, above all, because it was verified with the evolution of the State that the contracts can reach even people who were not parties to it, as it happens in the collective labor agreement.

For Wald (2013, p. 232 et seq.), the contractual dirigisme is the result of the socialization of contracts[22], the extent to which it restricts individual freedom by setting minimum principles that can not be ruled out, such as the minimum wage, the setting of percentage of interest, etc.

In contractual matters, among others principles, the following basic principles apply: autonomy of will, private autonomy, supremacy of public interest, relative effect of contracts, obligation of contracts and good faith.

The following is a detailed analysis of each one.

1.2.1.1 Autonomy of Will

At the contractual plan, the so-called autonomy of will has its origins in the French Code, based on the notion that the contract makes law between the parties. Part of the Brazilian doctrine bases that, after the "disappearance of liberalism"[23], this notion that places the will as the center of all agreements was limited, in theory, by the norms of public interest. This is due to state interference in the private contractual relationship. However, in practice, it is known that limitations of the economic order also direct this will.

This freedom, as Silvio de Salvo Venosa (2006, p. 371) teaches, concerns two hypotheses: (i) the freedom itself to contract or not to contract and, also, through the prism of (ii) choice of the type of contract. The latter is the one that currently allows the parties to make use of the so-called typical or atypical contracts according to their needs.

Contrary to the analysis made in the nineteenth century, where the notion of autonomy of will was limited to the analysis of free consent, it is now explicit that the analysis revolves around

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[22] This socialization stems from the evolution of contractual theory, which conceives a social function to contracts, where the economic and social condition of the people involved in the contract gained importance.
[23] Classical liberal ideology was mitigated because of contractual legal theory, under the social ingenuity of statism.

the social function of the contract and, because of this, there is no need to speak only of autonomy of will, but also of private autonomy[24]. In this sense, the legal system includes cogent rules that cannot be touched by the will of the parties, and others, which in their silence will help them.

According to Daniel Sarmento:

> [...] é evidente que se trata de uma autonomia fortemente limitada por uma série de outros valores constitucionais e interesses públicos, e que pode ser objeto de restrições legislativas, desde que proporcionais. E, naturalmente, tal autonomia também se sujeita ao controle judicial, fundado em regras jurídicas cogentes ditadas pelo legislador com fundamento na Lei Maior, em cláusulas gerais interpretadas à luz da normativa constitucional ou, ainda, na aplicação direta dos princípios da própria Constituição. (SARMENTO, 2005, p. 209).[25]

From this standpoint, mainly, it is that there has been judicial control of the content of the contracts. The Civil Code emphasizes and expresses this position in article 421, when dealing with the general clause in objective good faith.

For this reason, it is said that the judicial control is not only in the examination of the contractual clauses, but also in the root of the legal business.

Therefore, by the principle of autonomy of will, it can be seen that the individualistic view of utility for the contracting parties is mitigated by the social sense of utility for society.

Therefore, the contract that does not fulfill its "social function" may be restrained in the name of social interest.

1.2.1.2 Obligation of Contracts

In brazilian everyday life it is common to hear that "the contract makes law between the parties": *pacta sunt servanda*! This principle derives from another, namely, the principle of intangiblity of the contract.

By this principle, a contract cannot be unilaterally altered in relation to its content, nor can it be done by the judge.

Thus, the valid and effective contract must be fulfilled by the parties, but its diction cannot be taken in a peremptory manner, because this premise is eminently conflicting with legal certainty.

According to Sílvio de Salvo Venosa (2006, pp. 372-373), this obligation forms the basis of contract law. According to the author, the legal system itself should grant the party judicial

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[24] In the Brazilian doctrine, the principle of autonomy of will had its aspects renewed, resulting in the principle of private autonomy, mainly because of the overcoming of the dogma of unlimited and supreme will, with the advent of the constitutionalisation of civil law, which resystematized this branch of law from the interpretation of the Code as the Constitution of the Federative Republic of Brazil.

[25] It is clear that this autonomy is severely limited by a series of other constitutional values and public interests, and that it can be subject to legislative restrictions, provided that they are proportional. And, of course, such autonomy is also subject to judicial control, based on cogent legal rules dictated by the legislator based on the Major Law, on general clauses interpreted in light of the constitutional rule or, even, on the direct application of the principles of the Constitution itself. (Literal translation).

instruments to oblige the contractor to comply with the contract or to indemnify for losses and damages, after all, "[...] não tivesse força obrigatória estaria estabelecido o caos"[26].

Nevertheless, the will can sometimes be questioned. If, on the one hand, the contract must be maintained because the parties have expressed their will, on the other hand, the revision of the contract may be suggested, mainly by the distortion of a supervening and unpredictable fact (theory of unpredictability), since the purpose of the contract is precisely to constitute an agreement that satisfies both parties.

For this reason, it is extracted from the principle of mandatory nature of contracts, in its most modern conception, that private autonomy is linked to the social interest, the latter prevailing.

1.2.1.3 Supremacy of Public Interest

According to this principle, the interest of the community should prevail over the interests of individuals, in what they collide. Silvio de Salvo Venosa (2006, p. 231) notes in his work that the origin of the principle was due to the individualistic liberalism of the 19th century, which consecrated the postulate of the freedom of men for the unrestricted freedom to contract, in the administration and availability of all goods.

As a reaction, the State intervened in the "contractual mystique," placing public order as an object to be protected in order to ensure economic equality.

In this regard, the sole paragraph of art. 2.035 of the Civil Code of 2002 states that: "Nenhuma convenção prevalecerá se contrariar preceitos de ordem pública, tais como os estabelecidos por este Código para assegurar a função social da propriedade e dos contratos"[27].

Therefore, it is inferred from this principle that the autonomy of the will is relative, as well as subject to the law and the principles of morality and public interest.

1.2.1.4 Relative Effect of Contracts

When we conceptualize contracts, previously, we understand that it is a legal transaction between two or more parties where, through a pact that binds the will of the parties, a binding effect is generated.

In principle, the parties through the contracts cannot harm or include third parties, because the contract is *res inter alios acta, aliis neque nocet neque potest*[28]. Therefore, the general rule is that the contract only binds those who participate in it; an exception, for example, is the one protected by articles 436 *usque* 438 of the Civil Code.

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[26] [...] "without mandatory force, chaos would be established". (Literal translation).
[27] No Convention shall prevail if contradict public order regulations, such as those laid down by this code to ensure that the social function of property and contracts.
[28] Latin brocard for "a thing done between others does not harm or benefit others".

However, as Silvio de Salvo Venosa (2006, p. 373) states, "[...] temos que ter em mente ser o contrato coisa palpável, tangível, percebido por outras pessoas que dele não participaram"[29] an aspect that is more evident in consumer relations.

Thus, it is perceived that there are obligations that extend their external effects to third parties, but no one can become a creditor or debtor against his will, to bear them.

This principle, therefore, concerns the non-effectiveness in relation to third parties, except in cases provided for by law, and also those who suffer reflex repercussions, such as those who draft the contract or advise signing it, because they are not exempt from the effects of the contract.

1.2.1.5 Good Faith

According to Arnoldo Wald (2013, p. 233), in contractual matters one of the most important changes brought by the Civil Code of 2002 was the express mention, in art. 422, of the obligation of the contractors to act in accordance with the general clause of probity and good faith, which must be observed both in the conclusion and in the execution of the contract.

The good faith referred to by the legislator is objective good faith, i.e., that which is configured as a general clause, aimed at ensuring the relationship between the law and the social reality, enabling to achieve fair and adequate results.

In fact, it is a legislative technique that seeks to remove the rigidity of the content of the rules that would make it impossible to adapt them to the needs of concrete situations.

For this reason, it is said that the general clause in good faith allows the participation of the jurisprudence in the completion of the content of the concepts set forth in the rules and also in the establishment of the consequences in the cases of violation to the cases. Thus, in addition to the interpretation of the law, there is also the complementation based on the jurisprudence, filling in values for extralegal contents.

To this end, the decision of the concrete case involving a general clause of good faith is given by empiricism, and the control of its content is done by the courts themselves.

On the other hand, in relation to subjective good faith, it is said that this implies a state of knowledge of the subject, assuming ignorance of the real factual situation. Arnoldo Wald (2013, p. 235), in this sense, explains that in subjective good faith is analyzed the knowledge or ignorance of a given situation, taking into account the diligence that is expected of the "middle man".

Thus, subjective good faith is more related to the factors and care of the subject in his relationship with third parties, while objective good faith is related to the search for the protection of trust, requiring the parties to act according to the usual standards. Therefore, in general, the principle of good faith has a supplementary and instrumental function.

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[29] [...] we have to keep in mind that the contract is something palpable, tangible, perceived by other people who did not participate in it. (Literal translation).

In the most common sense, says Arnoldo Wald (2013, p. 237) that good faith is "[...] certeza de agir com amparo da lei, ou sem ofensa a ela"[30], i.e., a legal notion that the contract is consistent with justice.

1.2.1.6 Social Function of Contract

In general, the doctrine has presented the principle of the social function of contracts, highlighting the advent of the Constitution of the Federative Republic of Brazil (CFRB), which since then has included the conception of private property and the resulting social aspects listed in items XXII and XXIII, of art. 5.

Caio Mario da Silva Pereira discusses the subject:

> A função social do contrato é um princípio moderno que vem a se agregar aos clássicos do contrato, que são os da autonomia da vontade, da força obrigatória, da intangibilidade do seu conteúdo e da relatividade dos seus efeitos. (PEREIRA, 2008, p. 15).[31]

Among its general aspects is the supposed consolidation of collective interest. This principle must necessarily be observed in legal transactions, since the principle of human dignity is extracted from the systematic analysis of the contract (article 1, item III of the CFRB).

In contractual matters, the social function of the contract can be easily visualized under the notion of prohibition of excessive onerosity, disproportion and social injustice.

When violated, in cases in which the contract will harm the social interests or third parties, there is a lack of attention to the social function.

In practice, it occurs when a service goes beyond the normal scope of the contract, when there is an exaggerated advantage for one of the contracting parties and also when the objective or subjective basis of the contract is broken.

The *caput* of article 421 of the Civil Code of 2002 reads as follows: "A liberdade contratual será exercida nos limites da função social do contrato"[32]. Therefore, it is perceived that the social function of the contract is also a requirement of validity, which brings some degree of legal certainty to the contracting parties in the sense that neither of the parties has any other violated principle.

It is, therefore, a general rule of public policy, which requires the interpretation of the contract according to the context in which it is inserted and which, at the same time, limits the freedom to contract, subordinating its exercise to the consonance with the social purposes of the contract.

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[30] [...] certainty of acting under the law, or without offense to it. (Literal translation).
[31] The social function of the contract is a modern principle that comes to be added to the classics of the contract, which are the autonomy of the will, the mandatory force, the intangibility of its content and the relativity of its effects. (Literal translation).
[32] The freedom to hire will be exercised on the basis and within the limits of the social function of the contract.

1.2.2 Formation of The Contract

For the formation of the contract to occur, it is assumed that before the effective agreement of wills a contract proposal must be made, from one party to the other.

In this sense, the proposal is the moment when a will is externalized by the bidder to the oblate, who will take notice.

This manifestation of will can be expressed (when the law requires it) or tacit. Thus, silence - as an appreciation of the circumstances of the case - can also be interpreted as a tacit manifestation when the circumstances of the concrete case and customs so authorize.

Even before acceptance, the parties may point out information about the contract by making, for example, possible inquiries, minutes, visits, and other steps called preliminary negotiations, which may or may not cause the contract to be improved. As a result of these preliminary negotiations, either party may depart on the grounds of disinterest and not be liable for loss or damage.

However, preliminary negotiations may result in so-called pre-contractual liability if one of the parties, acting culpably, causes the other party harm.

In this regard, Arnoldo Wald (2013, p. 261) states that this liability arises from the principle of objective good faith, provided for in Article 422 of the Civil Code, which states: "Os contratantes são obrigados a guardar, assim na conclusão do contrato, como em sua execução, os princípios de probidade e boa-fé"[33].

This means that the violation of these duties, depending on the analysis of the concrete case, may result in liability for damages arising from the "breach" in the contractual formation, as for example, in the situation of unjustified breach of agreement by the party that created - in the injured party - a fair expectation of hiring.

Consequently, there is no doubt that after the negotiations and, with the acceptance of the proposal, the oblate becomes acceptable. Therefore, it is clear that the proposal and the acceptance are essential elements to the formation of the contract.

As a rule, the manifestation of will in the sense of giving life to a contract obliges the bidder, if the opposite is not the result of its terms, the nature of the business, or the circumstances of the case.

Also as a general rule, the proposal made without a time limit the person present ceases to be binding if it is not immediately accepted. If the proposal is made to absent person and this person does not respond within the stipulated (or reasonable) period of time, or, If prior to the arrival of the proposal (or simultaneously to the arrival of the proposal) comes the retraction to the knowledge

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[33] The contractors are obliged to keep, on conclusion of the contract, as in its execution, the principles of probity and good Faith.

of the other party, the bidder is no longer bound by the proposal (according to articles 427 and 428, both of the Civil Code).

It is worth asserting that the proposal must be serious and conscious, containing the essential elements of the proposed business, such as price, quantity, delivery time, form of payment, etc.

The public offer is equivalent to the proposal under the terms of article 427 of the Civil Code, provided that it contains all the essential requirements of the contract, and provided that the uses and circumstances do not establish the contrary, and may be revoked by the same means of its disclosure, under the terms of article 429 of the same law. In this sense, an express clause that exempts the obligation of the proposal by the proponent is allowed.

As for the offer and acceptance, Arnoldo Wald asserts:

> Quanto às demais formas de contratar, para verificar o momento exato da formação do contrato é preciso distinguir os contratos entre presentes e entre ausentes. Nos primeiros, não há maior dificuldade para fixar o momento da criação do vínculo contratual, porque normalmente a aceitação segue imediatamente a proposta e a falta de aceitação imediata desvincula o policitante, salvo quando a proposta é apresentada como válida para determinado prazo. (WALD, 2013, p. 262).[34]

Therefore, there is no doubt as to the formation of contracts between presentes persons, given that they relate to the situation in which the contract is performed by people who are properly in the same physical space or also those established by representatives, attorneys, and even by telephone or other similar means of communication.

In relation to contracts between absentees (performed via the Internet, for example) the doctrine is divided between four theories, namely: information theory, declaration theory, expedition theory and reception theory.

As for the first two theories, the civilist doctrine classifies them as subjective, because they depend on difficult facts of proof, such as the science of acceptance or the decision to accept.

For the theory of information, the agreement is made when the bidder becomes aware of the acceptance by the other bidder; for the theory of declaration, the contract is made when the bidder declares to accept the proposal.

On the other hand, in a more objective manner, the theory of expedition (adopted by the Civil Code of 2002) places acceptance at the time of the expedition of the response, leaving the reach and control of the oblate.

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[34] As for the other forms of hiring, in order to verify the exact moment of the contract formation, it is necessary to distinguish the contracts between gifts and absentees. In the former, there is no greater difficulty in establishing the moment of creation of the contractual bond, because normally the acceptance immediately follows the proposal and the lack of immediate acceptance disengages the bidder, except when the proposal is presented as valid for a certain period. (Literal translation).

Also, by the theory of reception, it is required that there is the receipt of the communication from the acceptor by the bidder; therefore, it is considered the moment when the response is delivered to the bidder.

According to Arnoldo Wald (2013, p. 263), in order to avoid litigation, the Brazilian legislator adopted, as a general principle, the establishment of the contractual link at the time of issuance of the acceptance, except for some exceptions to which the theory of reception applies.

In relation to the place of the formation of the contracts, the contract in which it was proposed is deemed to have been entered into, according to article 435 of the Civil Code.

The author, however, points out that the problem is of greater importance in private law because "to qualify and govern the obligations, the law of the country in which they are constituted shall apply", and "the obligation resulting from the contract is deemed to be constituted in the place where the bidder resides", as established in paragraph 2 of art. 9 of Decree-Law 4.657/42 (Introduction Act to Brazilian Law Rules). Furthermore, the doctrine states that if there is a counter-proposal, it will be considered the place where it was made.

The question as to the application of the theory of expedition or reception since long ago is the subject of discussion in doctrine and jurisprudence.

We have already seen that, as a rule, contracts do not have a solemn form. As an exception, in some situations a written document or public deed is required as an indispensable public instrument for the validity of the legal transaction, as provided for in article 108 of the Civil Code on real estate rights in excess of thirty times the minimum wage in force in the country.

In the case of a business that requires a special form, article 212 of the Civil Code of 2002 states that the legal fact may be proved by a confession, document, witness, presumption and expertise. In addition, article 221 of the same law states that:

> Art. 221. O instrumento particular, feito e assinado, ou somente assinado por quem esteja na livre disposição e administração de seus bens, prova as obrigações convencionais de qualquer valor; mas os seus efeitos, bem como os da cessão, não se operam, a respeito de terceiros, antes de registrado no registro público.
> Parágrafo único. A prova do instrumento particular pode suprir-se pelas outras de caráter legal. (BRASIL. Lei nº 10.406 de janeiro de 2002).[35]

Arnoldo Wald (2013, p. 264) points out that in the case of a verbal contract, there is nothing to prevent the test being carried out by presenting a document called "começo de prova por escrito"[36], as is the case with receipts.

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[35] Art. 221. The particular instrument, made and signed, or signed by who's on free disposition and administration of their property, conventional obligations evidence any value; but its effects, as well as the sale, don't operate, the respect of others, before registered in the public registry.
Sole paragraph. The evidence of the particular instrument can meet the other legal character.
[36] "Beginning of written proof". (Literal translation).

In relation to the interpretation of the contracts, if the contract has the force of law between the contracting parties, it is necessary that every manifestation of will be interpreted to determine its meaning and its scope in relation to the situations it predicted and the effects it intends to have. This occurs through contractual hermeneutics.

In the same way that the judge interprets the law so that it is applied to the concrete case in the event of conflict of interests, the contractual will to have concrete effects should also, in theory, go through hermeneutic work by the parties themselves, in their legal relations.

According to Arnoldo Wald (2013, p. 265), "[...] o problema assume ampla importância prática pelo número de pleitos que se originam de divergências na interpretação contratual"[37] mainly because of the "falta de técnica com a qual são feitos os contratos"[38]. As direct consequences of this problem, there are numerous contradictions and essential points without adequate regulation.

Still with respect to the formation of contracts, it is peaceful that the general principles of the interpretation of the law apply to legal transactions, however, specific hermeneutic rules apply specifically to contracts. This means that contrary to the legal hermeneutics (where what is written in the law prevails, and not the will of the legislator), in the contractual hermeneutics the will of the contracting parties is superimposed on what is foreseen in the contract, according to the autonomy established in art. 112 of the Civil Code, thus described: "Nas declarações de vontade se atenderá mais à intenção nelas consubstanciada do que ao sentido literal da linguagem"[39].

According to Arnoldo Wald, due to the increasing complexity of contracts resulting from the development of modern technology, more modern codes prefer to let the judges decide the conflicts that arise in each case, according to the general principles.

For this brilliant jurist:

> O problema preocupa, todavia, a doutrina, que, desde os grandes jurisconsultos anteriores ao Código Napoleão, como Domat e Pothier, fixou alguns princípios de hermenêutica contratual que os Códigos do século XIX, especialmente o francês e o italiano, incorporam aos seus textos. (WALD, 2013, p. 266).[40]

In this bias, Pothier's rules, for example, constitute a vision in which one must attend more to the will of the parts than to the words used by them. In this way, we can see that the interpretation of the clauses is authentic, ensuring their execution, according to the country's uses.

In Brazil, some of these principles are part of the homeland law, hypotheses in which the interpretation must be based on the objective data of the contract, in order to seek the true will of the contracting parties.

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[37] [...] the problem is of great practical importance because of the number of claims arising from divergences in contractual interpretation. (Literal translation).

[38] Lack of technique with which contracts are made. (Literal translation).

[39] In the if statements will meet more the intention embodied in them than the literal sense of the language.

[40] The problem worries, however, the doctrine, which, since the great jurisconsults before the Napoleon Code, such as Domat and Pothier, set some principles of contractual hermeneutics that the Codes of the nineteenth century, especially the French and the Italian, incorporate into their texts. (Literal translation).

The Civil Code of 2002 has some rules related to contractual hermeneutics, namely: articles 112, 113, 114 and 819, in addition to those already addressed principles of the social function of the contract, and of good faith, expressly provided in articles 421 and 422 of the same code.

In other words, these principles establish that the real will of the parties must be pursued, objectively, and the contract must be interpreted according to the behavior of the parties until the moment of the litigation, because, diverging the conduct of the words, it is up to the judge to meet the reality.

However, it has been understood that the interpretation should not aggravate the situation of the debtor because, in doubt, the clause should be understood in the sense that it is less burdensome for the debtor.

The civilist Arnoldo Wald (2013, p. 268) points out long ago that "[...] quando determinada interpretação leva ao absurdo, isto é, impossibilita a execução do contrato, deve ele ser interpretado de tal modo que possa prevalecer e ser exequível"[41].

It is worth saying that any complementary interpretations of the contract are called as integrative interpretation, and can only occur in relation to the secondary elements or not essences of the contract.

Finally, in relation to the interpretation of the contract and consumer law, the Civil Code incorporated the principles of Law No. 8.078/90 (Code of Consumer Defense and Protection) in articles 423 and 424, establishing that when there are ambiguous or contradictory clauses in the contract by adhesion, the interpretation most favorable to the adherent should be adopted and, further, that are null the clauses that stipulate the early waiver of the adherent right resulting from the nature of business.

The Code of Consumer Defense and Protection also prescribes:

> Art. 46. Os contratos que regulam as relações de consumo não obrigarão os consumidores, se não lhes for dada a oportunidade de tomar conhecimento prévio de seu conteúdo, ou se os respectivos instrumentos forem redigidos de modo a dificultar a compreensão de seu sentido e alcance.
> Art. 47. As cláusulas contratuais serão interpretadas de maneira mais favorável ao consumidor. (BRASIL. Lei n. 8.078, de 11 de setembro de 1990).[42]

Therefore, in the analysis of the contracts, the meaning extracted from the will of the contracting parties must be considered, since they supposedly include the will of the bidder and the acceptor.

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[41] [...]when a certain interpretation leads to absurdity, that is, makes it impossible to perform the contract, it should be interpreted in such a way that it can prevail and be enforceable. (Literal translation).
[42] Art. 46. Contracts that regulate consumer relations will not oblige consumers, if to the consumer is not given previous knowledge of the content or if the text is worded so as to hinder comprehension of meaning or scope.
Art. 47. Contract clauses will be interpreted in the way that is most favorable to the consumer.

2. E-CONTRACTS: FORMATION AND SPECIFIC PRINCIPLES

It cannot be denied that one of the main concerns of civil law, such as science, is to monitor scientific development and evolve in relation to contractual instruments.

With the agglutination of the lines between the physical and the digital, post-Industrial Revolution humanity started to connect in a way never seen before, through the Internet.

In Brazil, the use of the Internet has been growing exponentially and already reaches about 70% of the Brazilian population, as shown by data from the Continuous National Household Sample Survey – Continuous PNAD, conducted in 2017 by the Brazilian Institute of Geography and Statistics (IBGE, 2018).

Consequently, through the Internet and with the development of new technologies, there is a significant increase in the number of economic operations by electronic means.

With great accuracy, Sílvio de Salvo Venosa (2006, p. 521) argues that "[...] a maior riqueza das nações e dos produtores de bens ou serviços está constituída pelo conhecimento estratégico das informações"[43].

In this sense, it is said that information is mass produced in the same way that industrialized countries produce consumer goods.

This is mainly due to the manifestation of the will to contract, as well as the appearance of obligations, through electronic contracts or e-contracts[44] (nomenclature usually used by a wide range of scholars).

In fact, there are longstanding operations involving machines. Many of these operations were already operated by electronic means, such as vendors (or vending machines), which tried to operate purchase and sale, through a company's machine, directly to the acquirer, although they were not confused with the electronic contracts known in the contemporaneity.

Giving depth to the study, it can be said that electronic contracts are those entered into through electronic means, or through intercommunication between electronic means, which caused the Italian doctrine to call "disumanizzazione del contratto"[45] (OPPO apud MARQUES, 2004, p. 65).

However, with respect to the various authors who call it "dehumanized" and following the dominant doctrine, one disagrees with the nomenclature "dehumanized contracts", because it is more than evident that the human being is the one who handles the machine, using it as a means to express his will, and not the opposite.

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[43] [...] the greatest wealth of nations and producers of goods or services is constituted by strategic knowledge of information. (Literal translation).
[44] The brazilian doctrine lists several *nomen iuris* to refer to electronic contracts, among them: computer contracts, telematic contracts and digital contacts.
[45] "Dehumanized contracts". (Literal translation).

Moreover, if it were dehumanized, there would be no need to talk about contract, given the absence of the manifestation of will (and consensus) of the subject of law, element of existence and legal validity of contracts, as always stated by the memorable brazilian jurist Darcy Bessone de Oliveira Andrade (1987, p. 147).

As can be seen, much more than the mere migration of paper to digital platforms, electronic contracts began to transform concepts and bring more legal certainty.

With its advent, the handwritten signature was changed to digital ones, the concept of the "cártula"[46] was mischaracterized, the possibility of fixing the geolocation in contracts was instituted, "logs" began to settle dates, as well as the records became true "e-signatures".

The issue becomes more relevant to us because today when someone uses a hardware and connects to the Internet - or another network - they almost instantly receive information that is at their disposal.

It is through the Internet[47], the network of computers and other hardware that software develops protocols and allows communication to be shared for the various users.

Thus, just search what interests you and, when agreeing to the conditions set, hire: all in a matter of a few "clicks".

In practice, for example in purchase and sale contracts, just indicate what you want, indicate the price, choose the method of payment and delivery, and wait for the shipment. All thanks to the electronic enviroment, which has been breaking down barriers and triggering the narrowing of business relations.

For this reason, the Civil Code of 2002, as to the proof of the legal business of an electronic contract, expressly adopted that:

> Art. 225. As reproduções fotográficas, cinematográficas, os registros fonográficos e, em geral, quaisquer outras reproduções mecânicas ou eletrônicas de fatos ou de coisas fazem prova plena destes, se a parte, contra quem forem exibidos, não lhes impugnar a exatidão. (BRASIL. Lei nº 10.406 de janeiro de 2002).[48]

Thus, it can be seen that, as in contracts formed by traditional means, *mutatis mutandis*, electronic contracts are also instruments of execution of an agreement of wills with the intention of obtaining a legal effect.

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[46] Piece of paper wich presentes a discretion, in Portuguese.

[47] Since 2009, Brazil has had regulations regarding power line communications (PLC) technology, which enables the use of radio frequencies by Broadband Systems through Electric Power Networks, as well as the use of electric power distribution facilities as a means of transportation for digital or analog communication of signals, according ANATEL Resolution No. 527 and ANEEL Resolution No. 375.

[48] Art. 225. The photographic reproductions, cinematographic works, sound recordings and, in General, any other mechanical or electronic reproductions of facts or things make full proof of these, if the party against whom they are displayed, they impugn the accuracy.

Perhaps because of this, recent scientific investigations point out that electronic contracts do not represent a new category of contract, as Rodrigo Fernandes Rebouças demystifies in his book entitled "Contratos Eletrônicos – Formação E Validade – Aplicações Práticas".

However, despite obliging the parties, some characteristics of electronic contracts differ from those created by traditional means, such as the means and place of their enforcement.

The brazilian Judge Semy Glanz, quoted by Arnoldo Wald, provides the following definition for electronic contracts:

> [...] o contrato celebrado por meio de programas de computador ou aparelhos com tais programas. Dispensam assinatura e exigem assinatura codificada ou senha. A segurança de tais contratos vem sendo desenvolvida por processo de codificação secreta, chamada de criptologia. (WALD, 2013, pp. 305-306).[49]

However, recently stimulated by the Internet, the combined and optimized use of various communication technologies has been somewhat frequent, such as Blockchain, which does not exclude the possibility of electronic contracting between presents.

For this reason, without prejudice to other concepts, electronic contracts must also be understood as contracts between absentees and between presentees, because even if they are concluded by hardware, it is entirely possible that an electronic contract is established between people who are in the same physical space.

In this regard, if electronic is the means and technique used by the parties to formalize the contract as stated by Sheila do Rocio Cercal Santos Leal (2007, p. 79), we must consider in these cases that, to be considered electronic, the contract must be electronically consented to at the time of its formation.

Therefore, substantially, an electronic contract differs little from the other contracts, except in relation to its formation: a purchase and sale contract will continue to be a purchase and sale contract regardless of the means used for the formation of the contract and, also, the *nomen iuris* assigned by the contracting parties.

Fábio Ulhoa Coelho (2012, p. 44), in this document, defines the electronic medium necessary for the formation of an electronic contract as "[...] o suporte de qualquer informação (desde uma fotografia ou musica até um contrato) em que esta é traduzida para uma sequência binária"[50].

All this reminds us that there are also contracts that are not only between trader and consumer, but also between traders, and that in this sense there can be various problems in relation to evasions, control and fences.

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[49] [...] the contract concluded by means of computer programs or apparatus containing such programs. They do not require a handwritten signature and require an encrypted e-signature or password. The security of such contracts has been developed through a secret encryption process, called cryptology. (Literal translation).

[50] [...] the medium of any information (from a photograph or music to a contract) in which it is translated into a binary sequence. (Literal translation).

Moreover, in relation to international contracts (or the involvement of more than one legal system), rules of private international law or rules of anti-nomy should be applied, which depend on the adhesion of each country.

The doctrine, in this sense, does not have a consensus on the matter, and it is undeniable that the issue has been debated by the casuistry.

However, it is evident that with respect to public order[51], such contracts must observe the provisions contained in article 17 of the Introduction Act to Brazilian Law Rules, especially in relation to the effectiveness of the declaration of will in relation to national sovereignty, public order and good customs.

Regarding the proof of the electronic contract, Arnoldo Wald (2013, p. 308) states that in the case of the Internet there are elements that facilitate the proof, if there is no fraud, so "[...] cada parte deve ter elementos de identificação ou endereço eletrônico (e-mail), conhecida pela URL (*Uniform Resource Locator*) para os casos da *Web* (*World Wide Web* ou "www", que significa teia mundial)"[52].

Therefore, one should avoid addresses or elements that could be misleading or that are similar to existing ones.

To avoid fraud, coded signatures consisting of a set of alphanumeric characters, resulting from mathematical operations of cryptography, should be used.

This type of system guarantees the integrity of the information by means of a system of public verification. In this system, contracting parties can usually verify authenticity by means of a decoder, which tends to create greater legal certainty.

It is also known that electronic contracts suffer some natural limitations: it is "insufficient" today, for example, to improve contracts that depend on tradition or in which solemn form is required, as prescribed in article 108 of the Civil Code, aiming at achieving greater legal certainty.

In view of the foregoing, it is increasingly necessary to carry out a vertical study on the subject.

2.1 Formation of E-contracts

For a long time the validity of electronic contracts was questioned by the brazilian doctrine that, in today's times, understands that the lack of handwritten signature does not represent an

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[51] There are several hypotheses that come up against this discussion, evidently in relation to consumer law, which is based on articles 5, XXXII and 170, V of the Constitution of the Federative Republic of Brazil. For this reason, identifying the legal relationship of consumption is a determining condition for the application of Brazilian law in international conflict.

[52] [...] each party must have elements of identification or electronic address (e-mail), known as the URL (Uniform Resource Locator) for cases of the Web (World Wide Web or "www", which means worldwide web). (Literal translation).

impediment to link to the terms of the contract, given that with the use of electronic resources it is fully possible to express will and validate it in an electronic contract.

Therefore, it should be noted that the Civil Code of 2002 does not provide for contracts signed electronically. On the other hand, it also does not prohibit them, and this does not indicate that we are far from bringing technology closer to law institutes, as demonstrated by the legislator in the draft of the new Commercial Code[53] (PLS 487/2013).

As seen, the element that characterizes the contract as electronic is the means and the technique of exteriorization of the manifestations of will.

In relation to the manifestation of will in electronic contracts, it has been understood that it does not matter the means by which the will is expressed, as long as it is efficient and reaches the part for which it is intended. Consequently, the electronic means are eminently written and/or by the activation of commands, such as pressing a physical or virtual key.

Regarding the electronic signature, in Brazil, the legal validity of the tools for collecting and storing digital evidence is regulated by ICP-Brazil and is expressed in article 1 of Provisional Measure 2,200-2 of 2001, transcribed below:

> Art. 1º. Fica instituída a Infraestrutura de Chaves Públicas Brasileira (ICP-Brasil), para garantir a autenticidade, a integridade e a validade jurídica de documentos em forma eletrônica, das aplicações de suporte e das aplicações habilitadas que utilizem certificados digitais, bem como a realização de transações eletrônicas seguras. (BRASIL. Medida Provisória nº 2.200-2, de 24 de agosto de 2001).[54]

Therefore, in order not to repudiate the authorship and integrity of the content, such digital certification is instituted.

Thus, the signature effected by means of private keys and recognized by public keys is valid before third parties, and is presumed to be true in relation to the signatories, pursuant to Article 219 of the Civil Code.

However, it is important to note that the certificate issued by ICP-Brasil is not a requirement of validity in electronic contracts.

When it comes to the validity of electronic contracts, as well as any contracts, it is necessary that the capacity and legitimacy of the parties be present, as well as that the object of the contract be suitable and lawful.

In this regard, in order to analyze its validity, it is necessary to go into the study of the classification of the manifestation of the will, which according to Érica Brandini Barbagalo (2001,

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[53] It is worth mentioning that the new code will provide for e-commerce and also for the use of digital electronic signatures in the context of the Brazilian Public Key Infrastructure (ICP-Brazil).

[54] Art. 1. The Brazilian Public Key Infrastructure (ICP-Brazil) is instituted to guarantee the authenticity, integrity and legal validity of documents in electronic form, support applications and qualified applications that use digital certificates, as well as the performance of secure electronic transactions.

p. 53 and following) occurs in three levels of manifestation of will, namely: interpersonal, intersystemic and interactive, which we will analyze in the following topics.

2.1.1 Interpersonal Contracts

In contracts that use the interpersonal medium, the proposal and acceptance are operated through the hardware, which instrumentalizes the agreement. Classic examples of this type of contract are those that are performed by videoconference, e-mail and chat.

It should also be noted that the hardware in interpersonal hiring is used as a means of communication between the parties, and more than that, it helps in the instrumentalization of the contract. In other words, it is not only about communication and declaration of will.

In the words of Érica Brandini Barbagalo:

> Como interpessoais podem ser entendidos os contratos celebrados por computador quando este é utilizado como meio de comunicação entre as partes, interagindo na formação da vontade destas e na instrumentalização do contrato, não sendo apenas forma de comunicação de vontade. Essa categoria se caracteriza principalmente pela interação humana nos dois extremos da relação. (BARBAGALO, 2001, p. 53).[55]

This electronic contract medium can be subdivided into two categories, namely simultaneous or non-simultaneous. While the first concerns the celebration in real time and with immediate effect, as it occurs via videoconference, the second deals with the hypothesis that the time gap between the manifestation of the will and the acceptance of the other party is greater, as it occurs via e-mail.

With respect to the place of formation of electronic contracts, the law that shall govern it shall be that of the place where the contract was proposed. If the contracting parties are in different places, it will be the place where the bidder expresses his will.

In interactive contracts, from the moment the information is inserted in the network, the proposal is characterized.

In interpersonal and simultaneous contracts, the location of the bidder must be identified.

If it is not possible to do so precisely, the place indicated shall be considered. Furthermore, when the bidder is in transit, it is considered proposed the contrat at the place where the bidder's last residence.

However, in order to ensure legal certainty, the parties must expressly stipulate or indicate the place of formation.

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[55] Interpersonal contracts can be understood as contracts concluded by computer when it is used as a means of communication between the parties, interacting in the formation of their will and in the instrumentalization of the contract, not being only a form of communication of will. This category is characterized mainly by human interaction at both ends of the relationship. (Literal translation).

In relation to the moment of formation of the electronic contract, it is considered the one in which the acceptor receives the acknowledgment of receipt of the acceptance, sent by the bidder, and confirms that it received it. Therefore, it is considered received when it can be accessed.

In intersystemic electronic contracts, because they are considered accessories, each intersystemic communication is considered as negotiation of the main contract. Therefore, there is no need to speak at the moment of formation of the contract.

In interpersonal electronic contracts, the moment in which the declaration of will is expressed, when simultaneous, is considered. In this sense, it is equivalent to signing a contract between presentes parties. Therefore, it is formed from the moment when the acceptance is issued, since the bidder is also made aware; in non- simultaneous contracts, the moment to be considered is the expedition of the acceptance.

In interactive electronic contracts, when the system contains a serious proposal, the acceptance of the oblate is enough to form the legal bond.

On the other hand, if the information consists of an invitation to tender, it depends on the party accessing it to create the link. In this case, the party must access the invitation and issue a proposal, considering the parties as absent.

2.1.2 Intersystemic Contracts

In contracts that use the Intersystemic medium, the hardware is used only as a means of communication.

It is said that its use is accessory, because the contract is usually constituted through traditional means, and later transcribed to the equipment, previously programmed.

For this reason, it is not necessarily an electronic contract, since the manifestation of will may have been subject to formalization by physical means.

In the words of the author:

> São assim caracterizados os contratos eletrônicos formados utilizando-se o computador como ponto convergente de vontades preexistentes, ou seja, as partes apenas transpõem para o computador as vontades resultantes de negociação prévia, sem que o equipamento interligado em rede tenha interferência na formação dessas vontades. (BARBAGALO, 2001, p. 51).[56]

Note that there is no interference of the equipment in the formation of these wishes, but only uses it for the exchange of information occurs. A classic example of this type of contracting is that which occurs via electronic data exchange - formerly known as the EDI (Electronic Data

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[56] Thus, the electronic contracts formed using the computer as the converging point of pre-existing wills are characterized, that is, the parties only transpose to the computer the wills resulting from prior negotiation, without the equipment interconnected in the network having interference in the formation of these wills. (Literal translation).

Interchange) system -, where computers connected to the same system enable direct communication between customers and suppliers.

Usually, this method interlinks supplier hardware, inventory, management hardware, and so on, always eliminating interference from third parties.

In other words, in Intersystemic Electronic contracts, the hardware is only responsible for the transmission of the wishes already expressed, since the hardware itself does not determine the terms and conditions of a contract automatically.

2.1.3 Interactive Contracts

In electronic contracts that use Interactive means, there is an interaction between a legal subject and a system that processes information, made available to another person, in a public or private way, through the Internet. It is, in fact, a "middle ground" between the other two previous hypotheses.

The communication occurs by means of previously programmed systems, without a party being connected at the time of contracting or even being aware of the contract. They are generally considered to be absent.

Generally, they are contracts with pre-established clauses in a unilateral manner (by adhesion), where the peculiarities of the normative microsystem of Law No. 9,098/1990 apply, as well as other legal developments, such as the theory of risk.

The classic example of this type of contract is the purchase/sales contracts via Internet, where a person interacts with a sales application, connected to a database, with multiple functions. In the words of the author:

> Temos, portanto, que os contratos eletrônicos via Web site podem ser considerados ou como 'contratos de adesão', quando se apresentarem ao contraente como instrumento contratual cuja aceitação se dará pela anuência deste às regras já estabelecidas, ou como 'condições gerais dos contratos', quando se apresentarem ao contraente como cláusulas gerais que integrem e regulem sua relação contratual. (BARBAGALO, 2001, p. 57).[57]

Once the distinction between one and the other is overcome, the specific principles applicable to electronic contracts are analyzed.

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[57] We have, therefore, that the electronic contracts via Web site can be considered either as 'adhesion contracts', when they are presented to the contracting party as a contractual instrument whose acceptance will be given by the agreement of the latter to the already established rules, or as 'general conditions of contracts', when they are presented to the contracting party as general clauses that integrate and regulate its contractual relationship. (Literal translation).

2.2 Specific Principles of E-Contracts

Although there is no specific regulation in Brazil, it is not possible to think that electronic contracts do not follow informative principles of the contracts, because, in this case, the general principles of contract law are also applied to electronic contracts, and provide them with legal certainty.

But, because of their peculiarities, specific principles apply on electronic contracts, among them those listed by Sheila do Rocio Cercal Santos Leal (2007, pp. 79-81), namely: (i) principle of functional equivalence of contracts made in electronic means with contracts made by traditional means, (ii) principle of neutrality and continuity of the regulatory rules of the digital environment, (iii) principle of conservation and application of existing legal rules to electronic contracts and (iv) principle of objective good faith and electronic contracts.

From an *en passant* analysis, the following understandings can be extracted from the following principles:

As for the principle of functional equivalence, the effects of a contract made in the virtual world must be considered as a contract made in a physical manner.

In the words of Fábio Ulhoa Coelho:

> […] o princípio da equivalência funcional é o argumento mais genérico e básico da tecnologia jurídica dos contratos virtuais. Afirma que o registro em meio magnético cumpre as mesmas funções do papel. Assim as certezas e incertezas que podem exsurgir do contrato-e não são diferentes das do contrato-p. (COELHO, 2007, p. 39).[58]

Therefore, the rules that give legal validity to physical contracts are also applicable to electronic contracts.

In this sense, says Sheila do Rocio Cercal Santos Leal (2007, p. 90), it is the "[...] garantia de que, aos contratos realizados em meio eletrônico, serão reconhecidos os mesmos efeitos jurídicos conferidos aos contratos realizados por escrito ou verbalmente"[59].

As for the principle of neutrality and continuity of the rules governing the digital environment, it is understood that due to the development of new technologies, the rules should not create embarrassment, nor should they be recreated at each advance. The rules must be flexible in the face of legal changes.

In this order, in relation to the principle of conservation and application of existing legal rules to electronic contracts, it is understood that the electronic contract has the equivalence to a common contract, it cannot be treated differently.

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[58] [...] the principle of functional equivalence is the most general and basic argument of legal technology for virtual contracts. It states that registration in magnetic medium fulfills the same functions as the role. Thus, the certainties and uncertainties that may arise from the e-contract are not different from those of the p-contract. (Literal translation).

[59] [...] guarantee that the same legal effects will be recognized for contracts made in electronic media as for contracts made in writing or verbally. (Literal translation).

It is a logical consecretary of the first principle, which assists mainly in cases of legal gaps in relation to electronic contracts.

In practice, the creation of a specific law would have the effect of complementing the pre-existing rules.

Finally, the principle of objective good faith and electronic contracts refers to objective good faith itself, already seen in **Topic 1.2.1.5**, which also apply to electronic contracts, since in these, unlike from others, the contracting parties are exposed to new risks and vulnerabilities, such as electronic fraud.

3. BLOCKCHAIN AND SMART CONTRACTS: CONCEPT, FORMATION AND GENERAL OBSERVATIONS

Going back in time, in the 1990s, Tim Berners-Lee (1990, n.p.), while working at the European Organization for Nuclear Research (CERN), published his proposal for an information management system, which was initially conceived for sharing scientific information.

Soon after, the scientist developed - through coding - what became the World Wide Web (WWW).

Since then, besides the expansion of the number of browsers and of users "browsers" of the Internet, the society started to count on the distributed power propitiated by the net to develop diverse activities, many of them fruit of the proper technological improvement, to the example of the electronic contracts, that had emerged in result of the production, the interchange and the storage of data and digital documents.

Since then, there has been a proliferation of new networks and related technologies, which, in general, have overcome barriers by bringing people and information closer together, creating global communication networks that are increasingly decentralized and disintermediate.

Focused on the idea of innovation, unimaginably powerful instruments have been gaining notoriety among the scientific community that, in general, has been concerned with the original democratic ideal of the Internet, where users can freely create, manage and maintain the ownership of their data, as indicated in the report of the World Wide Web Foundation (ORTIZ et al, 2018).

One of these instruments, target of new studies involving commercial, political and collective purposes, is the Blockchain. Through this technology, it seeks to decentralize data and information as a way to ensure their safety and integrity, including the creation of so-called smart contracts.

The latter, within the model of private law, face the strong crises of confidence in contracts and can be seen as an opportunity to expand the capacity to conduct legal business, maximizing results, for example by reducing costs and increasing the speed of transactions.

Indeed, it is clear that meeting the interests of society requires constant evolution, as well as detachment from physical records in order to address guarantee and effectiveness issues.

However, the adoption of smart contracts does not necessarily depend on specific legislation and regulation, since they can be objectively disciplined from the standpoint of the material law in force, especially by the extensive structural supedanum of the Brizilian Civil Code of 2002, the General Theory of Contracts and the General Principles of Private Law.

This is not to be confused with the purist view[60] that "Code is Law", nor does it exclude the need to categorize electronic contracts, for example, in relation to the contracting parties or,

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[60] We refer as a purist to the reinterpreted view that smart contracts should be sovereign and immune to regulations, or even substitutes for the law, as verified in the metaphor "Code is Law" of Lawrence Lessig's work (2006, p. 5), at the

also, in relation to international contracts and adhesion contracts, in spite of the latter having to be subject to great caution due to the targeting of consumption that is made through the Internet, via unbridled advertising, without the user having control over it.

Moreover, due to the speed of the transformations experienced in modern times, any attempt to regulate the contracts will be in disagreement with reality.

In this sense, the moment of silence has meanings as important as any manifestations about the matter.

Perhaps for this reason political-legislative actions should still happen with more caution, serving the Civil Code, especially as a general regulator of smart contracts.

Having made the necessary considerations, we move on to the specific study of the object of this monographic work.

3.1 Concepts

It is not reasonably possible to understand the numerous opportunities of smart contracts if we neglect the technical details of Blockchain technology.

Thus, through hermeneutic activity, the following topics are dedicated to the treatment of its general outline in an attempt to accommodate it further on in the legal institute of the contract.

3.1.1 Blockchain

The Blockchain is a current theme, especially among those who associate it with the freedom of intermediaries.

Thus, one cannot deny the numerous ways of understanding what Blockchain is, and this has been happening due to the lack of standardization of the various existing systems of chain of blocks.

However, to start from a safe concept, it can be said that if considered in itself, Blockchain is a catalytic phenomenon in progress.

For William Mougayar, an expert in Blockchain, the technology can be described as follows:

> Um banco de dados, uma aplicação de software, um conjunto de computadores conectados uns aos outros, clientes para acessá-lo, um ambiente de software para desenvolvê-lo, ferramentas para monitorá-lo e outras partes. (MOUGAYAR, 2017, p. 10).[61]

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turn of the century, going back to the notion of "Lex Informatica" in Joel Reidenberg (1998). Thus, from a pragmatic point of view, one cannot confuse the notion of (a) code as a technical element of deterministic nature of the performance of a contract and (b) code as a law in a material sense of public order, as extracted from Lawrence Lessig (1999, p. 530).

[61] A database, a software application, a set of computers connected to each other, clients to access it, a software environment to develop it, tools to monitor it and other parts. (Literal transaltion).

According to the teachings of Mougayar (2017, p. 11), one way to understand what is Blockchain is through the idea of "combustion" between a triad of fields of knowledge, which are, the field of game theory[62], the science of cryptography[63] and software engineering.

For the author, Blockchain links the theory of games in relation to the method it uses to achieve the security of transactions; cryptography to ensure that these transactions are made through "public-private hegemony"[64] and software engineering to mitigate the apparent uncertainty and mathematical certanty involved in this process.

In its simplest technical form, Blockchain can be defined as a type of Distributed Ledger Technology (DLT), i.e. a large shared and permanent database composed of encrypted entries.

Its name derives from the "blocks", true linear storage spaces that are added in chronological order (or by historical record), constantly maintained and updated, in a similar way to a transaction record chain, to which you can only add.

The register of transactions in the Blockchain, with these characteristics, would take the form represented in **Figure 1**.

Figure 1: Illustration of a Chain of Blocks
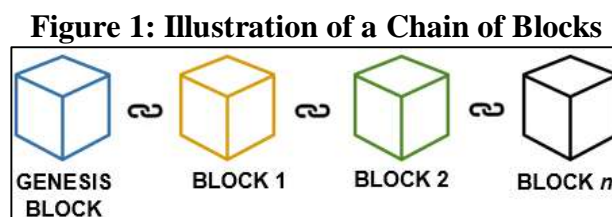
Source: own authorship.

Under a corporate perspective, it is an instrument capable of decentralizing and simplifying transactions, facilitating management from a common source. If it is connected to another technology, such as Artificial Intelligence or the Internet of Things (IoT), its capabilities are expanded, leveraging efficient social and economic change through reductions in transaction costs (e.g. malicious exceptions) and increased payoffs[65].

At the legal and pragmatic level, and as the object of this work, technology allows through a Public Key Infrastructure (PKI)[66] to decentralize transactions and distribute them in a

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[62] Game theory can be conceptualized as the study of mathematical models of conflict and cooperation between rational and intelligent decision makers. For more information, see MYERSON, 1991.

[63] Encryption is the name given to the science or art of encoding messages using a formula, which is also used to decode the same message. The doctrine of the technical area usually associates it with ensuring the privacy of communications, especially in public networks such as the Internet.

[64] MOUGAYAR (2017, p.13) defines it as "yin-yang do Blockchain" for its public visibility and private inspection characteristics. Its aspects are confidentiality, integrity and intelligibility of information.

[65] In Economic Theory, the term "payoff" corresponds to a gain in reward or utility by acting on your own choices and those of other players.

[66] This is a cryptographic concept. According to International Business Machines - IBM, "PKI (Public Key Infrastructure) is a system of resources, policies, and services that support the use of public key encryption to authenticate the parties involved in the transaction. In Brazil, the legal validity of digital evidence collection and storage tools is regulated by ICP-Brazil, "in order to guarantee the authenticity, integrity and legal validity of documents in electronic form, support applications and qualified applications that use digital certificates, as well as the performance of secure electronic transactions (according article 1 of Provisional Measure 2,200-2/2001)".

synchronized manner over the world wide web in an encrypted manner, creating a highly reliable public registry, through which transactions are made possible without the need for an intermediary "centralized authority", eliminating bureaucracy, costs and other barriers such as arbitrariness.

These characteristics bring to the society of the "Internet of Values" the possibility of building trust in processes without depending on the individual trust between the intermediate agents of this process - or in the jurisdiction of the State[67] - because, with the greatest number of interactions (through mining activity, rewarded by "production") the verisimilitude and robustness of information in a way diametrically opposed to asymmetry is expanded, privileging people and institutions, leading us to a more inclusive, transparent and just era.

In concise terms, Blockchain is a database maintained by a distributed network of hardware, where copies of the database are spread and replicated in a random manner at all times.

In Blockchain, public-private key cryptography and consensus rules ensure that information is recorded among network users, making the characteristics of confidentiality, integrity and intelligibility effective.

In general, the implementation of this technology varies greatly, but this basic idea applies to all types (and versions) of Blockchain.

Therefore, Blockchain goes far beyond what can be described, because its use is eclectic and can supposedly be used for the creation and execution of the contract, object of study of the science of Law.

In this sense, Don Tapscott and Alex Tapscott:

> Este novo livro-razão digital das transações econômicas pode ser programado para gravar praticamente tudo o que for de valor e importância para a humanidade: certidões de nascimento e de óbito, certidões de casamento, ações e títulos de propriedade, diplomas de ensino, contas financeiras, procedimentos médicos, créditos de seguros, votos, proveniência de alimentos e tudo o mais que possa ser expresso em código. (TAPSCOTT, 2016, n.p.).[68]

Therefore, to its fullest extent, the *raison d'être* of the Blockchain goes beyond the basic intention of reducing costs and improving efficiency, allowing the exploration of numerous technical possibilities.

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[67] Courts generally act as trusted third parties in resolving disputes of all kinds.
[68] This new digital ledger of economic transactions can be programmed to record virtually everything of value and importance to humanity: birth and death certificates, marriage certificates, stocks and bonds, educational diplomas, financial accounts, medical procedures, insurance credits, votes, food sources, and anything else that can be expressed in code. (Literal translation).

3.1.1.1 Types of Blockchains

We are moving towards a phase in which the Blockchain can be characterized by two major elements: (i) a Peer-to-Peer Transmission Communication P2P network[69] "point-to-point", which consists of a hardware architecture whose main characteristics are based on simplicity, economy and efficiency derived from the sharing of tasks, works and files, and (ii) a distributed and decentralized database, which aims to make the possibility of fraud and money laundering difficult, for example.

Blockchain types can be classified into three, which are centralized, decentralized, and distributed. These three types would take the forms shown in **Figure 2**.

Figure 2: Illustration of Blockchain Types

Source: own authorship.
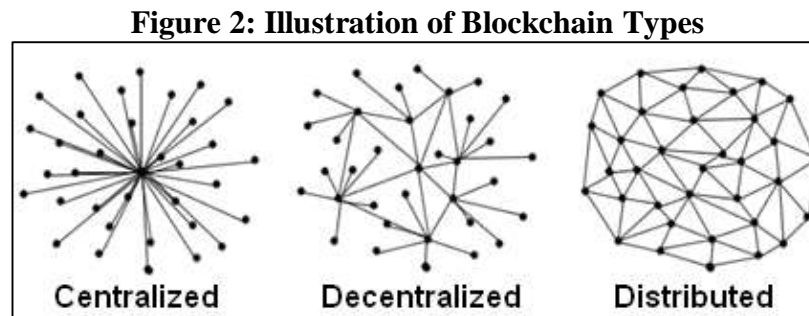
As for its characteristics, in terms of similarity, both are P2P networks and each of the nodes of the system (represented by points/nodes) are responsible for protecting and storing the ledgers. Also as a similarity, both need a consensus mechanism to establish a ledger.

In terms of differences, the types of Blockchain networks are distinguished by the way in which decision making occurs and by the way in which information is shared through the system nodes.

Thus, centralized systems are those that offer less security in relation to the data stored due to the characteristic of information centralization, whose trust is mainly based on regulation and auditing; *a priori* they allow greater control of the network because they always include the figure of an intermediary (known authorities) and dispense fewer resources for its operation given its less complex infrastructure.

Decentralized systems, as Vitalik Buterin (2017, n.p.) explains in his white paper, consist of a subset of distributed systems; systems of this type do not use intermediaries and offer a higher degree of security through the possibility of mining. Therefore, in addition to political decentralization, such decentralization refers to the decentralization of the Blockchain architecture

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[69] In the definitions of Mougayar (2017, p.137): "is the set of computers with us in a topology in eternal expansion. It is a basic element of Blockchain. Every node runs the same software, providing redundancies inherent to the entire network, which means that if one node stops working or not responding, the work of the other nodes will compensate. (Literal translation).

(where there is no central point of failure). However, they spend more resources during their operation and, because they are public, are likely to reveal information about any network participant (anyone in the network can read and send information).

As Jonathan Waldman (2018, n.p.) explains, in practice they are logically centralized, because "há um estado comumente acordado, e o sistema se comporta como um computador único"[70].

These distinctions are essential for the understanding of the functioning of the Blockchain, which moves on to the elementary study in the following topic.

3.1.1.2 Elements and Operation

As seen, Blockhain is constituted essentially through a distributed database, where each individual can access in an integral way a book of digital events (database) and verify records, transactions and their values without the figure of intermediaries, communicating directly between the points (peers of the P2P network), either in a pseudonymized way[71] or through verification of their identity.

To the extent that Blockchain networks are independent of central servers, they cannot be arbitrarily disconnected by a single party (unless it is programmed in their code).

Anyone capable of configuring a kind of account (which involves a public address and a private password) can participate in a transaction, which necessarily involves another user's public key and an electronic signature, which guarantee authentication.

When the transaction is effected (and this may occur simultaneously with other transactions), the information is recorded in a block.

Thus, the Blockchain allows all those who have access to the system the possibility of viewing and verifying the transactional information contained in each block through "alphanumeric addresses" called "hash", regardless of the full operation of the network.

In a more detailed analysis, it can be said that each integrated block of the chain has three elements: data, hash of the block and hash of the previous block, shown in **Figure 3**.

Figure 3: Illustration of the Basic Elements of a Block
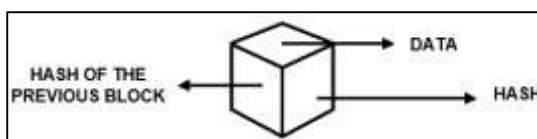
Source: own authorship.

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[70] [...] "there is a commonly agreed state, and the system behaves like a single computer". (Literal translation).
[71] According to art. 13, §4 of the General Law on the Protection of Personal Data (Law no. 13.709/2018), "[...] pseudonymization is the treatment through which a data loses the possibility of association, direct or indirect, to an individual, other than the use of additional information maintained separately by the controller in a controlled and safe environment.

The information stored in a block varies according to the type of block string. Like the prominent Bitcoin chain of blocks[72], a block can store details about the financial transaction, such as sender, recipient, amount, date and time, etc., verifiable by concrete and irrefutable proof of the timestamp algorithm.

The hash (or hash value, hash code, or digest) corresponds to an element that identifies the block and the stored content generated from the block information. In other words, the hash is the encryption of the data contained in the header of the block, which transforms any text message (metadata) into a block of text of fixed length, measured in bits[73].

It is always a single algorithmic composition (metaphorically similar to a fingerprint), sensitive to any change within the block. In technical terms, according to Jonathan Waldman (2018, n.p.), the use of this structure is useful in identifying any changes to the existing information in a block, through the Merkle Tree Proof (MTP), illustrated in **Figure 4**.

Figure 4: Illustration of the Merkle Tree Proof
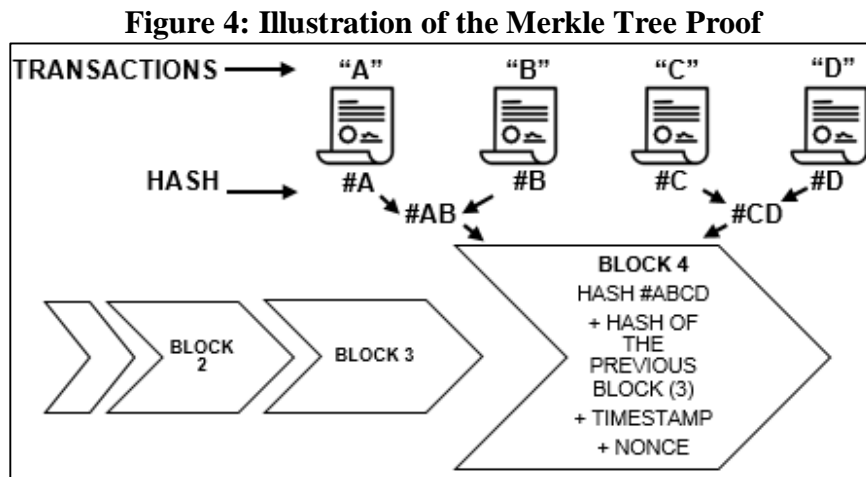
Source: own authorship.

The hash of the previous block is a technical element included in each new block, being responsible for creating the chain and for ensuring the validity of the information of the following blocks.

Once any transaction is concluded (recorded in the database), the blocks in the chain are updated and, due to their union with other blocks, they can hardly undergo changes or suppression, even because they integrate an electronic chronological order, assuming the aspects represented in an exemplary way in **Figure 5**.

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[72] Usually the word Bitcoin is used, with capital letter, to refer to the decentralized payment network or the technology in general. When written in lower case letters, the word refers to "virtual currency" or simply to a utility because, according to the brazilian jurisprudential understanding, bitcoin does not have the nature of currency or securities, and is not regulated by the legal system (according to STJ - CComp 161.123 - 3rd Section - j. 12/12/2018 - judged by Sebastião Reis Júnior - DJe 12/05/2018).

[73] Each hash has a size of 32 bytes, and its complexity in relation to the search in Merkle Tree grows O(log2(N)) in the notation "big-Θ", being N the number of transactions, according to AGNER, 2018.

Figure 5: Illustration of the Sequence of Blocks
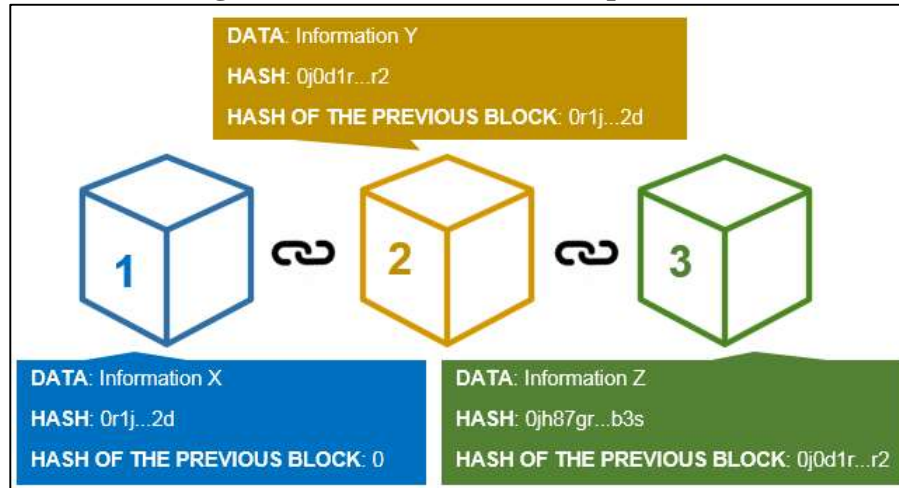
Source: own authorship.

Since the "hash of the previous block" technical element is not able to fully ensure that a block is not manipulated and that all the hashs of the following blocks are recalculated for string validation, a "proof-of-work" (PoW) is usually required.

In general, the PoW consensus mechanism is a heuristic method procedure whose purpose is to slow down the creation of new blocks, while at the same time checking whether each block contains validated transactions and a valid hash. In this process, it is said that the members of the network exercise the function of mining, forcing them to "spend" time, electricity and other resources (as in relation to the hardware itself) to reach consensus and prove their honest intentions.

More often than not, to encourage miners to "follow the rules of the game," the network offers an incentive to the one who adds a block to the Blockchain. This occurs after the validation of all transactions, followed by the resolution of a cryptographic puzzle.

It is important to assert that this mechanism corresponds to a new way of establishing trust through electronic means.

The subject is dealt with more fully in the next section, where we will discuss the current phase of mistrust between economic agents and also how Blockchain can help us to strengthen the elements of good faith and trust in legal relationships.

3.1.1.3 Good Faith and Trust in Blockchain Moulds

With the increase of social interactions through the Internet, the visual culture (of valuation of appearance, the informed, the declared and the factual results) brought a loss of efficiency to the principle of good faith, according to Claudia Lima Marques (2007, p. 21).

For the author, in post-modern virtual times[74] it was necessary to evolve to the use of a paradigm of more sociality[75] and collective repersonalization[76], in order to rediscover the principle of trust (*fides*), model-mother of good faith (*bona fides*), as she argues:

> Efetivamente, parece-me que a fase atual da pós-modernidade está a necessitar uma resposta de valorização do paradigma da confiança, pois nossos tempos parecem fadados ao aumento dos litígios e da desconfiança entre os agentes econômicos (classes e instituições), com claros reflexos no direito privado. (MARQUES, 2007, p. 21). [77]

In this sense, society seems to dematerialize, while the products, services, contracts, licenses, registrations and the "currency" itself - such as Bitcoin, Dash, Ethereum, Litecoin, Iota, among others[78] – have become technically virtualized.

It is not uncommon to notice that, due to this virtualization, the interaction and communication between people goes through a historical period where mistrust is very evident, especially in private law, in relation to the electronic media.

In the case of contracts, for example, the *a priori* theory of Thaísa da Silva Borges (2014, n.p.) indicates that in electronic contracts "[...] a probabilidade de induzimento ao erro é muito maior e por isso a honestidade dos contraentes tem caráter de imprescindibilidade"[79].

And there is no doubt that trust is a vital foundation of human relationship. It is worth saying that the Code of Consumer Defense and Protection in Brazil, Law 8.078/90 - in coexistence and dialogue with the Civil Code of 2002 - values the interpretation of contracts according to trust, treating it as a guide of human conduct.

However, in general, it is known that people in society tend to face several problems related to mistrust in their daily lives.

For this reason we are vulnerable to conventions, laws and hierarchies of our society, which intrinsically seek to establish trust (*vertrauen*) as an immanent principle of all law, as stated by Karl Larenz:

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[74] We understand that MARQUES (2007, p. 21 et seq.) refers, in this context, to the emergence of social rights, after the Second World War, which influenced the codifications of private law and changed the way of interpreting contemporary law, including the Civil Code of 2002.

[75] Sociality is the principle that guides the overcoming of individualism, which was intensely present in the Civil Code of 1916, and which today represents the vision that we must favor collectivism, ensuring human dignity, the common good and social justice. Ex: The principles of social function and social function of property.

[76] Repersonalization, as extracted from MARQUES (2007. p. 21 et seq.), means having the human person as the center of private law, above the patrimony, because one recognizes his dignity. One form of repersonalization is to visualize rights and legitimate expectations in the contract, which must be maintained, especially by virtue of the appreciation of the information stated, valuing the information deficit of the community.

[77] Indeed, it seems to me that the current phase of postmodernity is in need of a response that values the paradigm of trust, as our times seem doomed to increased litigation and distrust among economic agents (classes and institutions), with clear reflexes in private law. (Literal translation).

[78] Cryptocurrencies are not currently recognized as currency under Law 9,069/95 and Decree-Law 857/69, nor may they be used as financial assets for the purposes of Article 2, V, of CVM Instruction 555/14.

[79] [...] "the probability of inducing error is much higher and therefore the honesty of the contracting parties is indispensable". (Literal translation).

> Ein anderes Rechtsprinzip, das das Bundesverfassungsgericht ebenfalls aus dem Rechtsstaatsprinzip hergeleitet hat, ist das Vertrauensprinzip im Verhältnis des Bürgers zur Gesetzgebung. Es verbietet im allgemeinen eine Rückwirkung von Gesetzen auf bereits abgeschlossene Tatbestände, wenn und soweit der Bürger auf die Fortdauer der bisher für ign bestehenden Rechtsposition vertrauen durfte. Das Vertrauensprinzip ist ein imanentes Prinzip unserer Rechtsorndung, das in den ihm jeweils zu ziehenden Grenzen auf allen Rechtsgebieten Beachtung beanspruchen kann. Jedoch verdient nicht jedes Vertrauen Schutz, sondern nur ein solches, das durch die Umstände gerechtfertigt erscheint. (LARENZ, 1991, p. 312).[80]

To this end, decisions taken by agents must be based on the responsibility to predict, in a reasonable manner, their outcome. Hence the idea that trust, protected by good faith (*Treu und Glauben*), is closely linked to the responsibility and ethics of the free, social, rational and responsible person, which generate fair expectation, object of the theory of declaration.

Under a pragmatic perspective, not even the great extension of an agreement (sufficient to make a true work of various volumes) would be able to predict and avoid conflicts of this nature.

It is enough for us to see the massification of contracts, which do not rarely try to supply the absence of trust by means of complex forms and clauses, but which nevertheless move a real battlefield in the Judiciary.

Therefore, it is eminent that society lacks mechanisms capable of increasing the degree of trust in human relations and, in the opposite way, reducing unwanted consequences in the face of scarce resources, as occurs with contractual and extra-contractual damages.

Trust, therefore, is an essential element that must be protected.

In general, people have lost confidence in institutions, in the public and private sectors, in the effectiveness of their own law and even in democracy, mainly because of many assumptions or unspoken things.

The social problem linked to mistrust in human relations has been illustrated for many years by the dilemma of the "Hume's Farmers" of the Scottish philosopher David Hume (1975), by the essay "Tragedy of the Commons" popularized by Garrett Hardin (1968) and also by the "the war of all against all" by the famous work "Leviathan" by Thomas Hobbes (2003).

In each of these stories, the lack of trust could be compensated by the guarantee of cooperation; in other words, if we cannot trust each other, cooperation falls apart.

Faced with this situation, many societies then create various laws and systems to solve the problem of trust.

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[80] Another legal principle that the Federal Constitutional Court has derived, in the same way, from the principle of the rule of law is the principle of trust in the citizen's relationship with the law. This principle generally prohibits the retroactivity of laws to legal hypotheses that have already been verified, as much as and to the extent that the citizen should trust in the permanence of the legal position that derives from it for himself. The principle of trust is an inherent principle of our legal system, which, within the limits of each case, can aim to be taken into account in all branches of law. Not all trust deserves protection, but only that which seems to be justified by circumstances. (LARENZ, 2005, p. 603). (Literal translation).

Blockchain tends to be one of them, since the technology seeks to achieve some degree of predictability between what is programmed and the result of the performance of the system. This is only possible through the form used to establish trust, by a distributed network.

Blockchain has the characteristic of being a trustless trust system that results in an extraordinary achievement: the recreation of the scarcity of the physical world in the digital world.

As our interactions began to be governed by software, more and more we gain confidence in technology as a means of imposing rules and restricting actions in a direct way, in a constructive and social way, always aiming at its concretization.

This has occurred mainly through the incorporation of values in technological objects, an opportunity in which the structuring of laws[81] in code is glimpsed, as Samer Hassan and Primavera De Filippi expose when referring to Langdon Winner:

> On the one hand, in contrast to traditional legal rules, which must be appreciated by a judge and applied on a case-by-cases basis, code-based rules are written in the rigid and formalized language of code, which does not benefit from the flexibility and ambiguity of natural language. On the other hand, the architectural implementation of online platforms ultimately depends on the specific choices of platform operators and sof tware engineers, seeking to promote or prevent a certain type of actions. Just like any other technological artifact, code is not neutral, but inherently political: it has important societal implications, insofar as it might support certain political structures or facilitate certain actions and behaviors over others. (HASSAN *et al.,* 2017, p. 89).

In this sense, Blockchain has the advantage of eliminating the need for the intervention of a third party, *post factum*, in order to punish those who infringe the rule, i.e., the intervention of the magistrate to force any of the parties to comply with the agreed obligation.

But this view does not necessarily concern the opening of a loophole to avoid examining contractual practices or removing the judge's power to find the fairest and most equitable solution in order for the purpose of covering up abuses, but rather to strengthen[82], sociality[83] (or the predominance of the social over the individual) and the operability of the contract, through the Blockchain.

According to the authors' view, unlike traditional legal rules (which are inherently flexible and ambiguous) technical rules are highly formalized, leaving little or no room for ambiguity.

In this way, it also seeks to reduce the need for judicial intervention.

And, in this sense, it seems to us that trust is more related to ethics, to sociality and operability, than to the social results of the contract, not making much sense to say that the idea of "removing" the need for intervention by a third party is a perverse idea.

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[81] This sentence adopts the concept of Law in a broad sense.
[82] The principle of ethics is linked to justice and good faith in civil relations. In the contractual field it is vehement in relation to *pacta sunt servanda* and also in relation to the principle of objective good faith in relation to the economic equilibrium of all phases of the contract.
[83] In this sense, we refer the reader to note no. 75 of this work.

According to Pedro Martins (2018, p. 12), low levels of confidence or the lack of confidence in a society may make the functioning of several institutions unviable.

In general, it is identified that the current developed societies have intermediary agents (trust depositories) with more powers than the citizens, since so far the possibility of direct trust between agents in open systems is low.

As a result, dependence is to a large extent characterized by slowness - as a series of tasks are assumed along a chain of events -, increased costs and vulnerability to failures (just look credit operations to prove it).

This can be avoided through decentralization and elimination of intermediaries.

The *a priori* solution, in this sense, can rest under the consensus mechanism and in the Blockchain's infrastructure network.

As seen in the previous topics, to participate in a Blockchain system it is necessary that the user owns and runs software that connects his hardware to that of the other participants in the network.

Once connected to the network, it is generally possible to have full access to Blockchain data, from the genesis block to the most recent block.

The inputs incorporated in the block chain are "immutable" and transparent, mainly based on consensus. Once the information block has been validated by its participants (through voting, electronic signature or similar), no information can be changed without the knowledge of all network members, as shown in **Figure 6**.

Figure 6: Illustration of PoW in Block Coordination
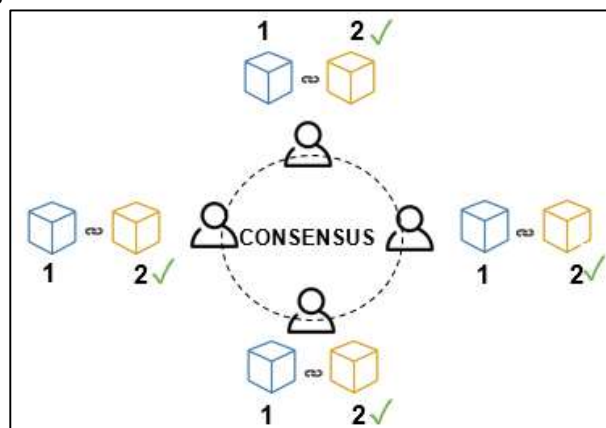
Source: own authorship.

In this sense, by creating a distributed consensus layer, Blockchain remodels our trust system: if before we trusted the information made available by intermediaries (such as a bank on a user's balance, for example), today we can reach the consensus by directly consulting the Blockchain network.

Therefore, the human role is restricted to the autonomy of the will and, also, the good faith of hiring.

This changes the historical relationship encamped by the agency theory[84], where until then actors used centralized sources maintained and controlled by third party Trusted-Third-Party (TTP) intermediaries[85].

For William Mougayar (2017, p. 25), Blockchain is a "state machine", that is, a device that remembers the status of something at a given moment, that is, based on some (several) entries, this data tends to change.

In this sense, through the hash system, PoW and P2P tampering with a block - in favor of a possible collusion - becomes an extremely difficult and costly task, because for this it is necessary great capacity in relation to the hardware and also the participation of more than half of the P2P network (51 percent) making the changes simultaneously, and redoing the proof of work (PoW) of each block. Although this is not possible in a federated network, this is how Blockchain deals with the "Byzantine Generals Problem"[86].

In the meantime, researchers from the Research and Development Center in Telecommunications (CPqD) add that:

> Toda operação ou transação dentro da Ledger é protegida por tecnologias criptográficas de assinatura digital, inclusive para identificar os nós emissores e receptores das transações. Quando um nó deseja adicionar ao Ledger um fato novo, é necessário um consenso entre todos ou alguns nós previamente determinados da rede, para decidir se o fato vai poder ser registrado no Ledger. Havendo consenso, o fato será escrito e nunca mais poderá ser apagado, em tese, um processo levemente semelhante à escritura e registro de um imóvel no Brasil. (FORMIGONI FILHO *et al.*, 2017, p.6).[87]

Thus, in terms of Blockchain, the evident relationship of trust is the starting point for a society based on facts, which cannot and should not be rejected by virtue of the "rules of consensus".

An example of this is the situation that is established when one of the nodes in the network receives simultaneously two conflicting data or two authentic data. In this case the solution based on the time of receipt (priority) is not enough since different nodes can receive data in different orders, which could generate instability, since each participant would be working on his version of the truth.

It turns out that Blockchain has an auto repair mechanism: due to the latency of the network, the solution lies in the possibility that two blocks are added 'almost' at the same time by

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[84] On this subject, see PINHEIRO FILHO et al., 2011, pp. 97-109.

[85] In economics, the reason for reliable third parties is often exemplified through a monetary system, related to Yap Island, where an elder kept a record of transactions.

[86] The consensus in Blockchain must be reached regardless of the existence of malicious processes, such as those related to failures and omissions in the sending of information. The reader interested in further study of the problem of Byzantine generals is referred to the work of LAMPORT et al., 1982, indicated in the references.

[87] Every operation or transaction within the Ledger is protected by cryptographic digital signature technologies, including to identify the nodes issuing and receiving transactions. When a node wishes to add a new fact to the Ledger, a consensus between all or some previously determined nodes of the network is required to decide whether the fact can be registered in the Ledger. If there is consensus, the fact will be written and can never be erased, in thesis, a process slightly similar to the deed and registration of a property in Brazil. (Literal translation).

different nodes, creating a bifurcation (fork, in terms of Blockchain) in the chain. This creates a consensus rule that allows block recognition and validation by the "longest chain rule".

And this is how, in general terms, the consensus process takes place in Blockchain: the greater the number of registry confirmations of new blocks and, consequently, the greater the accumulation of proof of work, the greater the confidence in the network.

Hence the importance of its wide adherence.

Therefore, given the main concepts that underlie the Blockchain technology, as well as its operation and its close connection with the relationships of trust and good faith, in the following chapter the so-called smart contracts will be presented, describing their emergence, presenting characteristics and their operation.

3.1.1.4 Blockchain & Lawyer 4.0

Strictly speaking, operations caused by electronic means are binary, of the "yes or no" type. If we want to incorporate Blockchain to the Law, we must prepare ourselves to develop the technology from several "yes or not", already known.

But it is not only about processing data. Blockchain technology involves a different structure, which presents something much closer to how we think, through artificial intelligence.

This is especially useful for the Law, since within legality, Blockchain can be used to identify patterns, make predictions and contribute to a precise management of resources, since the legal area is full of complex and systemic data and information.

In this sense, any event registered in the Blockchain network will serve as a source of data that will open up a world of opportunities, surrounded by objectivity.

It is up to the legal departments to identify them, mainly based on the assumption of the search for greater connectivity, optimization, mobility, automation, assertiveness, control, predictability and security, that is, the desired efficiency.

In Brazil, technology is a reality and has been repeatedly experienced. This is the case of the Digital Government[88] in relation to digital identities, the development of digital voting platforms, the debureaucratization of services and the automation of customs operations, the ANAC Registries after the use of this methodology was foreseen by Resolution No. 511/2019[89], the World Trade in relation to the operation of ports in Latin America[90], the Public Registries in relation to copyright[91] and even hospitals, which began to use Blockchain as a basis for birth certificates of Brazilians[92].

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[88] It is suggested to read Ministério da Economia (2019) and Agência BNDES de notícias (2019), indicated in the references.

[89] For more information, see Agência Nacional de Aviação Civil (2019), indicated in the references.

[90] It is recommended to read DIGITAL (2019), indicated in the references.

[91] In this sense, see ACHUTTI (2018), indicated in the references.

[92] On this subject, see BELMIRO (2019), indicated in the references.

And this is likely to occur in a number of other sectors.

3.1.2 Smart Contracts

It dates from the end of the twentieth century the first research on chain of blocks and cryptography, through an article entitled "How to Time-Stamp a Digital Document", written by physicists Haber and Stornetta (1991, pp. 99-111), whose purpose was very modest: to safeguard information from the dangers of adulteration, since the storage of files on personal computers, growing at the time, brought insecurity to data and, consequently, to future generations.

For Amy Whitaker (2018, n.p.) the critical point analyzed by the two researchers was the way to prevent the alteration of a historical record without the need to establish a relationship of (dis)trust with a central authority; this time, after a "eureka moment", it was realized then that maintaining scattered and interconnected copies through a book of digital events could be a way to generate data security, including everything we know about the past.

To this end, they developed the still primitive idea of Blockchain using cryptography, digital books and the network, as a way to verify records without necessarily revealing their content.

A few years later, after the publication of more articles on the subject, Haber and Stornetta created the timestamp service for any type of information, through a block of transactions.

It is noted that the contribution of the co-authors was so valuable that years later, in 2008, "Satoshi Nakamoto" published the founding document of Bitcoin, citing them for three - out of a total of eight - previous works, adding the concepts of cryptocurrency and mining to the results already known.

But it was also in 1994, a year of discoveries, that jurist and computer scientist Nick Szabo (1996, n.p.) coined the term "smart contracts", doing so with the intention of avoiding the exposure of his business to legal scrutiny and other external interference.

For the author, the smart contract would arise from an agreement between parties and could be executed "automatically"[93], making pre-programmed steps be fulfilled, similar to what happened with the "smart contracts" of a vending machine, although the vending machines are not confused with the electronic contracting, as seen before.

In these vending machines, information allocated in the internal code triggered the delivery of the good after the fulfillment of the conditions of the contract; such technology dates back to the 1st century and the machine of Heron of Alexandria, besides so many other "machines" capable of performing economic transactions that are known in the world.

Although the technological environment at the time in question was inappropriate to make an "smart contract" as it is known today, Nick Szabo defined them as follows:

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[93] It is also possible to find in technical works the use of the term "automated".

New institutions, and new ways to formalize the relationships that make up these institutions, are now made possible by the digital revolution. I call these new contracts "smart", because they are far more functional than their inanimate paper-based ancestors. No use of artificial intelligence is implied. A smart contract is a set of promises, specified in digital form, including protocols within which the parties perform on these promises. (SZABO, 1996, n.p.).

Nick Szabo, *a priori*, knowing the limits of an "smart" contract, warned that it should not be seen as a "tool" capable of analyzing the subjective requirements of a contract, a challenge still current.

Reinforcing this notion, William Mougayar (2017, p. 45) also asserts that smart contracts are closer to a construct commanded by events than by artificial intelligence.

For this reason, it can be stated that the smart contract is, as a contract created by traditional means, a kind of legal business, formed by the agreement between parties to create, modify or terminate a legal bond, as established by the Brazilian doctrine, a dominant supporter of the voluntary current.

In this sense, Orlando Gomes:

O negócio jurídico é a mencionada declaração de vontade dirigida à provocação de determinados efeitos jurídicos, ou, na definição do Código da Saxônia, a ação da vontade, que se dirige, de acordo com a lei, a constituir, modificar ou extinguir uma relação jurídica. (GOMES, 1993, p. 280).[94]

In fact, what used to represent a distant ideal has been reworked over several years and today is capable of representing the greatest technological innovation after the "internet of information".

Today, smart contracts are structured to guarantee their full performance through the administration and execution of an agreement through Blockchain technology, being able to replace common contracts or complement them in order to guarantee their full development and, consequently, preventing conflicts from reaching the courts, although you can build a conditional appeal to the courts, if you wish.

According to Winston Maxwell and John Salmon (2017, p. 6), currently the term smart contract is used to describe the computer code, maintained by the "nodes" that constitute a Blockchain network, and that "is able to facilitate, execute and enforce negotiation or execution of an agreement on the occurrence of predefined conditions".

With all due respect to the authors, it is understood that more correctly the terms "computer code" should be replaced simply by "codes", given that today other hardware has the ability to read codes.

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[94] The legal transaction is the aforementioned declaration of will aimed at provoking certain legal effects, or, in the definition of the Saxony Code, the action of will, which is intended, according to the law, to constitute, modify or extinguish a legal relationship. (Literal translation).

More. This new way of hiring can be described as the use of "ricardian contracts"[95], as it is also readable by those with the expertise to do so.

In other words, the smart contract is an electronic contract, consisting of terms "translated" from a natural language to a formal language, endowed with deterministic characteristics[96] – if this, then that - where its performance is entrusted to the technology itself.

In this way, possible intermediaries can be eliminated and the so-called 'efficient breach' of the contract and other possible costs of litigation and renegotiation can also be made impossible (or even more difficult).

Occasionally, it should be noted that smart contracts are true "grey masses" in legal systems, and generate concerns in several countries, including Brazil, because it is not known what should - and should not - be considered in the legal sense of the word "contract".

In countries with a common legal system, for example, the construction of broader applications using smart contracts, such as those linked to the Internet of Things[97], is already being conjectured, which will enable the formation of smart cities and infrastructures.

Knowing that the theme is controversial and poorly understood, the operator of the law should seek to move away from biased views - such as the various "crypto" tendencies - and, at the same time, seek to understand the legal impact of the implementation of this new form of contract in the daily life of relations.

This does not mean, however, that smart contracts constitute a problem to the legal system, but that their recognition and applicability require challenges in relation to their integration with the existing legal and principiological frameworks.

Nowadays, smart contracts can be understood as a "new" form of contracting, and they must be guided by the existing legal and doctrinal supedantry of legal business.

According to Rodrigo Fernandes Rebouças:

> A "nova" forma de contratos eletrônicos denominados de *Smart Contrats*, tal como os demais contratos eletrônicos, não se trata de uma nova classificação e/ou modalidade contratual, mas tão somente de uma nova forma de contratação, ou seja, uma nova forma de aceite (exteriorização da vontade de contratar e da autonomia privada) e execução das obrigações contratuais. (REBOUÇAS, 2018, p. 129).[98]

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[95] On this subject, it is recommended to read GRIGG, [ca. 1996].

[96] This aspect is linked to contractual hermeneutics. From a semantic point of view, smart contracts tend to reduce the scope for ambiguities. So literalness is also a feature of smart contracts. With this, one must start demanding increasingly precise contracts, and their applicability will tend to contracts with a lower degree of uncertainty. However, we must stick to the fact that contracts are often endowed with non-deterministic notions, general clauses of "good faith" and "reasonableness", real challenges to be faced.

[97] ALBERTI et al., 2013 should be read on this subject.

[98] The "new" form of electronic contracts called Smart Contracts, like the other electronic contracts, is not a new classification and/or contractual modality, but only a new form of contracting, that is, a new form of acceptance (exteriorization of the will to contract and private autonomy) and execution of contractual obligations. (Literal translation).

In the following topic, we will discuss the characteristics of smart contracts from the operation of Blockchain, since without each other they are like safes without keys.

3.1.2.1 Features of Smart Contracts

As traditional knowledge starts to share space with an avalanche of innovations, Blockchain has been opening the way for technological innovation, spreading its influence over several types of transformations, such as the possible transmutation of traditional contracts into smart contracts, where the coded conditions can be auto executed, making the obligations remain unencumbered from interference of intermediaries.

Thus, the operator of the law must understand that smart contracts obey the logic of programming mechanisms, and for this reason can be used to create any describable contract.

In the same way, the operator of the right should be able to articulate the technology in relation to the Right, without waiving the compliance with the content enshrined in the legal system.

In the words of William Mougayar (2017, p. 48) the smart contracts "[...] são um pedaço da arquitetura do Blockchain"[99], and for this reason, it seems plausible to us that at some point the smart contracts will be standardized, as occurs with a "traditional" contract, where the phenomenon of mass contracting is emphasized, celebrated according to pre-established models, that is, where the contracting parties will choose to adapt the legal business the way of contracting previously fixed.

The term "smart contract" has often been used to describe the codes that "automatically" execute, in whole or in part, a contract stored in a Blockchain platform, conferring greater autonomy to the parties, so it is defended the existence of a higher degree of trust between them.

However, it can be said that, even in rudimentary forms, smart contracts are not always technically executed automatically, as enthusiasts say.

This is due to the fact that, on some platforms, these contracts require payment of a transaction fee in order to be added to a data chain, such as Ethereum[100] - created by Vitalik Buterin (2014) and Gavin Wood (2014).

Specifically in this circumstance, smart contracts will only be executed on the Ethereum Virtual Machine - EVM[101] after payment via ether - ETH (virtual currency). The value, in turn,

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[99] [...] "are a piece of the architecture of the Blockchain". (Literal translation).

[100] Ethereum or "Blockchain 2.0" is a generic purpose network that, unlike the first generation blockchain networks that use Script language, has universal computational language Solidity, which is why, in principle, is the only way to fully implement the functional specifications of an smart contract in Blockchain.

[101] In the Mougayar settings (2017, p. 138): "The virtual machine describes the part of the protocol that handles the internal state and processes it. It can be thought of as a large decentralized computer (actually made up of many P2P machines) that contains information about the millions of accounts, that update an internal database, execute codes and interact with each other.". (Literal translation).

arises by "consumption" and should possibly vary according to the complexity, storage, time, speed and other aspects of the contract to be executed.

In the same context, the payment also has the function of ensuring that an smart contract does not consume network resources on account of undefined requirements.

For this reason Pedro Martins warns that the Ethereum network is very similar to other Blockchain databases, except for a fundamental difference, which is the implementation of the balance, as the author states:

> Adicionalmente à lista de transações, os blocos da rede Ethereum registrados na base de dados contêm o estado das contas Ethereum. Desta forma, o mecanismo de consenso presente na rede permite não só criar uma visão única entre participantes da história das transações efetuadas na rede, como também da história de execução de *smart contracts* e dos resultados obtidos com a sua computação. (MARTINS, 2018, p. 117).[102]

In Ethereum, still taking it as an example, the consensus mechanism (Ethash) works through a mining process combined with a model of economic incentives, similar to Bitcoin's PoW.

On average, this network registers a new block every 15 seconds. In addition, the Proof-of-Stake (PoS) mechanism can provide the network with greater efficiency, since it allows the deterministic choice of the mining company responsible for the registration of the next block, according to the author:

> Ao contrário do *Proof-of-Work* que recompensa qualquer *miner* que em competição com todos os restantes *miners* consiga registra o próximo bloco através da resolução do p*uzzle* criptográfico, o *Proof-of-Stake* permite a escolha determinística do *miner* responsável pelo registro de próximo bloco. Com *Proof-of-Stake* a probabilidade de um *miner* ser selecionado para registrar o próximo bloco é proporcional ao interesse que esse *miner* tem comprometido com a rede, medido sob a forma de riqueza acumulada em ether. (MARTINS, 2018, pp. 118-119).[103]

Most of the time, smart contracts place the new in the old one because, from the Blockchain, it is possible to elaborate an electronic contract with the guarantees of PoW and also with the necessary strength to demand the fulfillment of the negotiations, which are recorded in a secure way and, in theory, are immutable.

Therefore, smart contracts have as their main characteristics the electronic means by which they are created. At this point, it is important to say that the smart contract is not an "auxiliary

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[102] In addition to the list of transactions, the Ethereum network blocks recorded in the database contain the status of Ethereum accounts. This way, the consensus mechanism present in the network allows not only to create a single vision among participants of the history of transactions made in the network, but also of the history of execution of smart contracts and the results obtained with their computing. (MARTINS, 2018, p. 117). (Literal translation).

[103] Unlike the Proof-of-Work that rewards any miner who in competition with all other miners can register the next block by solving the cryptographic puzzle, the Proof-of-Stake allows the deterministic choice of the miner responsible for registering the next block. With Proof-of-Stake, the probability of a miner being selected to register the next block is proportional to the interest that the miner has had in the network, measured in the form of accumulated wealth in ether. (Literal translation).

contract", but in itself, the contract itself created and implemented from the direct reduction of the consensus to an executable code.

In this regard, Rodrigo Fernandes Rebouças (2018, p. 29) categorically states that a contract formed by traditional means cannot be termed electronic even if its preliminary phase (pre-contractual) or its execution phase itself are performed electronically, since in these cases we would be facing a contract of execution by electronic means and, if so, there would be no sense such discussion regarding the plans of the legal business.

From the positivist bias of traditional legal theory, especially of consumer contracts, being the contract a negotiation that generates value, an instrument for reducing uncertainties, a means of efficient allocation and distribution of wealth, it is possible to model it using a chain of blocks, programming information and enabling processing as smart contracts, prepared through a language that hinders multiple interpretations and meanings (ambiguity), unlike the natural language, in the case of Brazil, the Portuguese language.

In spite of this characteristic demonstrates the stiffness of the performance of the contract, it means, on the other hand, that the inadequate interpretation will be reduced by the contractual hermeneutics itself, because the parties need a certain degree of certainty/predictability to ensure the execution of a condition established, forcing the attachment of the parties to the obligations assumed and consequently remedying the basic distrust between people.

Thus, making a methodological cutout to enable the research, it stands out in this study, that the functioning of smart contracts bring the notion of deepening a facet of the contract mechanism as we know by the modern view.

This is the codification of the stages of the contract and the terms and conditions of the agreement that allows its "self-execution" (total or partial) after the consensual phase that establishes it, following the logic of prescriptive programming "if this, then that" (ITTT), so as to be executed to the extent that the fulfillment of the condition occurs, triggering the result.

Therefore, no algorithm can bring different results from those that satisfactorily adjust to the situation foreseen in the contract.

An interesting example of this is the fact that, as in many regions of the world, flight delays in Brazil represent frequent situations, mainly due to climatic adversities.

Despite the inconvenience caused to passengers, as well as to the companies involved in the operation, such delays entail extra costs.

For this reason, in order to "minimize" the discomfort caused to the passenger by the delay of his flight, the National Civil Aviation Agency (ANAC)[104] – federal regulatory agency whose responsibility is to regulate and supervise the activity of civil aviation in Brazil - disciplines some

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[104] The reader is referred to the publication regarding Delays, Cancellations and Material Assistance made available at the Agência Nacioanl de Aviação Civil, 2017, indicated in the references.

obligations to companies, such as the maintenance of information, material assistance, accommodation, full reimbursement, among others.

However, the enforcement of these obligations can become a major headache for the passenger, since it is often necessary to claim the obligation of the company, which is often not promptly met. Such operation is costly, involves the articulation of resources, forms, documents and some waiting time.

Smart contracts can simplify such an operation, especially if they are linked to off-chain resources[105]; this requires cultivating various skills such as sensitivity, creativity, patience and intuition.

Therefore, in order to resolve the issue raised, it could be stipulated in a smart contract that, whenever there are delays in relation to flights, passengers could receive a kind of reward 'automatically' for as long as the situation lasts.

Such a clause, if expressed in an air transport smart contract, could be developed in various ways, including within some financial compensation plan or in a similar way to the already known mileage/point system of credit cards.

If the lines that follow sound too abstract, it is suggested to start by reading the example, once understood, allows the resumption of the concepts described so far, with greater security.

The smart contracts are, therefore, a new contractual form, fast, precise, verifiable and manageable through algorithms.

Their adoption can result in efficiency in relation to the results of the contract, and also in relation to the assurance that the obligations will be fulfilled as established.

However, it is important to remember that Blockchain is not able to eliminate the vulnerability of the code itself. Therefore, possible human failures can reveal major embarrassments.

However, nothing removes the responsibility of each contractor, who chooses to submit to a particular contract. Therefore, it is essential that people evaluate possible breaches of contract, preferably through a lawyer.

In short, Blockchain can be seen, for example, as the primary guarantor of payment in a transaction and the smart contract as a guarantee that the entire transaction will be fulfilled.

In this sense, under the lens of *a priori* theory, several transactions known through the Brazilian contract theory can be transformed into code and become part of a Blockchain ecosystem.

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[105] According to Pedro Martins (2018, p. 117): "Off-chain" are the resources coming from oracles (Software Oracles, Hardware Oracles, Inbound Oracles and Outbound Oracles). Examples of these resources are news, weather forecasts and location data. The weak point of off-chain resources is precisely the inversion of the decentralization proposal in the face of the need to seek data from reliable third parties, which may bring undesirable eventualities to smart contracts, such as asymmetry of information. The strength of off-chain resources is that their data can be executed instantly, and because it comes from outside the chain of blocks, has no transaction fee, and because of this there is no mining fee. Moreover, this type of transaction protects the data transmitted with a kind of "anonymity" to the participants, because the details are not transmitted in a public way. (Literal translation).

As a consequence, possible contractual insufficiencies or inefficiencies can be addressed, such as difficulties in the execution of contracts, various interpretations and various meanings of contractual clauses, etc.

3.1.3 Smart Contracts and the Brazilian Legal System

In the current legal scenario there are rumors about what the notorious and prominent Blockchain smart contracts are.

However, in an effort to clarify their ideas, legal operators find only technical and biased information concerning such contracts, the vast majority of which is in a foreign language, which makes it difficult to understand a portion of them.

Moreover, this is also due to the fact that part of the content linked to them comes from global scientific developers focused on the Information Technology (IT) branch, as is verified by the growing publications coming from International Business Machines (IBM)[106] and Microsoft[107], companies that started to devote themselves - from mid-2008 - to the development of disruptive technology[108] known as Blockchain.

Therefore, as more than a decade has passed since its creation, dissemination and use, there should be scientific studies in brazilian law - albeit incipient - on the subject, but what we see is that there are very few authors who have solid contributions on this subject.

This fact is curious to say the least, given that contracts are eminently objects of study of the dynamic science[109] of Law.

In practice, therefore, it is not clear what are the so-called smart contracts or smart contracts.

On the other hand, it is known what contracts are, and that smart contracts are similar to what is known as electronic contracts, given that they are improved by electronic means.

In this context, due to the technological progress experienced in the contemporary world, it is clear that this new form of contracting has emerged with great speed before the legal system, putting in doubt its recognition, its classification, as well as its validity and effectiveness.

Considering this premise - facing the historical moment of the rise of Blockchain technology and also the consolidated understanding arising from the Brazilian civilist theory - and far from longing or seeking to recognize the insufficiency of the contracts entered into through traditional means, which as we know fulfills the function for which they were created, and not

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[106] It is recommended to read, in full, the content for developers prepared by GULHANE et al., 2019, available in the IBM community, duly indicated in the references.

[107] Likewise, it is recommended to read the content for Microsoft developers, authored by GRAY, 2017, included in the references of this research.

[108] Term derived from the concept "creative destruction", coined by Joseph Schumpeter, to explain business cycles, suggesting that innovation processes work at the expense of previous creations.

[109] Law is immersed in a context that shapes and conditions it: socially, culturally and historically.

seeking to contain the technical development of the novel smart contract, we passed the analysis of the recognition of this new form of contracting.

As portrayed, smart contracts present themselves as an "innovation", bringing changes in the way of hiring and, mainly, of executing the obligations assumed in the most varied contracts.

Because of the prominence of the Blockchain ecosystems to which they are incorporated, there is an enormous rhetoric and preconception about what smart contracts should be, because they tend to allow several modifications and improvements in relation to the already known contracts.

Among these changes, we must consider that smart contracts are formed by information and procedures written in programming language, stored by the points of a Blockchain network - which serves as a database - and that because of this share many of its characteristics, including those related to the immutability and perpetuity of information.

In this sense, what makes a contract only a contract, and not any other activity, are not only its deterministic forms *a priori*. Thus, it can be said that although smart contracts make explicit the possible performance of a contract, its aspects as to its form, formation and content remain implicit.

From the above, we can already point out that there is a mutual dependence and complementarity between law and society, including in relation to the limitation of the sphere of conduct of individuals in order to avoid social conflicts.

As consolidated by doctrine and jurisprudence, the validity of a contract must always meet the general and indispensable requirements that go beyond those listed in art. 104 of the Civil Code, such as the observance of the principle of sociality, a corollary of the prevalence of collective values over individual values.

On the other hand, due to the fact that the social being is involved in a process of constant interaction, conflicts in relation to contracts represent a common phenomenon.

In this sense, such conflicts may gain new reasons due to the use of smart contracts, among them those related to errors in the contractual code or, even, those resulting from the incorporation of provisions poorly drafted or executed in a manner not intended by one or both of the parties. Regardless of the hypotheses that could be listed here, the fact is that there will be those who will turn to the current legal system to resolve the contractual dispute, mainly encamped by the Theory of Imprevision.

Simple transactions, such as those in which property and asset rights are transferred in response to "if this, then that" conditions do not seem likely to raise major legal issues.

On the other hand, with the passage of time and the increasing complexity and risks associated with transactions made through smart contracts, the possibility of new litigation also tends to increase.

This would be the case, for example, with an algorithmic language guided by a complexity that goes far beyond "if this, then that" conditions.

In this regard, it is intuitive to deduce - based on the risk theory of Ulrich Beck (2014) in "Risk Society: Towards a New Modernity" - that with the increased complexity of the transaction, the risks inherent in the errors of treatment of information and/or functionalities also increase.

For this reason, it is also necessary to analyze the smart contracts before the legal system, under the bias of the social function of the contract.

Fortunately, in the current stage of development, it can be said that smart contracts are supported by the Brazilian standards in force.

On the other hand, because it "lacks" specific regulation, it is intuitive to state that, in order for smart contracts to be recognised, they must follow the rules and general principles of legal transactions, in particular complying with the principle of the social function of contracts[110].

Therefore, due to the social function of the contract, which emerges explicitly from the Civil Code of 2002, it is understood that the contract should seek to serve the interests of the human person, as a way to protect their dignity in the individual or collective dimension by limiting the autonomy of the will of the contracting parties.

> É possível afirmar que o atendimento à função social pode ser enfocado sob dois aspectos: um individual, relativo aos contratantes, que se valem do contrato para satisfazer seus interesses próprios, e outro, público, que é o interesse da coletividade sobre o contrato. Nesta medida, a função social do contrato somente estará cumprida quando a sua finalidade – distribuição de riquezas – for atingida de forma justa, ou seja, quando o contrato representar uma fonte de equilíbrio social. (GONÇALVES, 2012, p. 106).[111]

Thus, it is understood that the individualistic and purely patrimonial perception that prevailed during the validity of the Beviláqua Code - the Civil Code of 1916 - was removed from the private sphere, since the legislator recognized that the effects referred to as extra-contractual may also fall on third parties unrelated to the contractual relationship, according to the subsumption that is made from the principle of relativity to the already mentioned principle of the social function of contracts.

It is no coincidence that the current Brazilian civil law has other legal categories that limit the scope of the autonomy of the will, among them the principle of objective good faith, excessive onerosity in onerous contracts of continued or deferred performance - provided for in art. 478 of the Civil Code -, the defects of consent[112], the exception of the unfulfilled contract - provided for

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[110] Open standard and principle of public order, without which the usefulness of the contract - to achieve full effectiveness - is rendered unviable.

[111] It is possible to affirm that the attendance to the social function can be focused on two aspects: one individual, relative to the contractors, who use the contract to satisfy their own interests, and another, public, which is the interest of the community on the contract. In this measure, the social function of the contract will only be fulfilled when its purpose - distribution of wealth - is fairly achieved, that is, when the contract represents a source of social balance. (Literal translation).

[112] Refers to those provided for in articles 138 and 165 of the Civil Code, namely: error (or ignorance), fraud, coercion, danger state, lesion and Fraud Against Lender.

in art. 475 of the same code -, the prohibition of unjust enrichment and the prohibition to abuse of rights.

In this sense, Paulo Nader:

> O Código Civil de 2002 criou diversas categorias jurídicas que limitaram mais ainda o alcance do princípio da autonomia da vontade. Entre elas, o princípio da boa-fé objetiva (v. 8.5), que confere ao juiz o poder de reequacionar as condições do negócio jurídico, visando a eliminar distorções existentes, comprometedoras do equilíbrio que deve prevalecer entre o quinhão que se dá e o que se recebe (arts. 113 e 422). O art. 478 prevê a resolução do negócio jurídico à vista de onerosidade excessiva. No capítulo sobre defeitos dos negócios jurídicos surgiram dois vícios de consentimento: estado de perigo (art. 156) e lesão (art.157), que tutelam o equilíbrio econômico dos contratos. A vedação do enriquecimento sem causa, previsto nos arts. 884 e 885, contribui, igualmente, para a eliminação do coeficiente de injustiça que o princípio da autonomia da vontade pode abrigar. (NADER, 2018, n.p.).[113]

Therefore, expanding the principle of relativity of contracts, the social function of the contract establishes a true limitation on the freedom to contract, which is why it is possible to invalidate the effectiveness of contracts that do not comply with it.

Because of this, in addition to the stages of formation and execution, it is important to visualize that the smart contracts have a social role, since they are likely to harm the interests of the community as any traditional contract (even if fortuitously), in which case it would give rise to the civil liability of contractors, without prejudice to other spheres.

Otherwise, as explained by Arnoldo Wald (2013, p. 231), the individualism of the nineteenth century, which inspired the slightest state interference, would again open paths for the admissibility of the dominant spirit and the omnipotence of the citizen - without there being any interference on the part of society -, putting us at risk of disorder public.

Thus, given the contractual dirigisme that supposedly expanded the protection of citizens, smart contracts should be subject to the contingency rules of the autonomy of the will, setting minimum principles on what they can not remove, which are, the rules of law, ethical and moral standards, as well as collective and social interests, which in most cases can be translated into the common good.

In the words of Paulo Nader (2018, n.p.), "[...] na gestão de seus interesses, as pessoas gozam do direito de contratar e de não contratar"[114]. Moreover, the will is free to take obligations, as well as to determine its modality, object and conditions as desired, from concrete situations and without the imposition of the law. However, the author adds:

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[113] The 2002 Civil Code created several legal categories that further limited the scope of the principle of autonomy of will. Among them, the principle of objective good faith (v. 8.5), which gives the judge the power to rethink the conditions of the legal business, aiming to eliminate existing distortions that compromise the balance that must prevail between the share that is given and that which is received (articles 113 and 422). Article 478 provides for the resolution of the legal transaction in view of excessive onerosity. In the chapter on defects in legal transactions, two vices of consent emerged: danger state (art. 156) and lesion (art. 157), which protect the economic balance of contracts. The prohibition of unjust enrichment, provided for in articles 884 and 885, also contributes to the elimination of the coefficient of injustice that the principle of autonomy of will may contain. (Literal translation).

[114] [...] "in the management of their interests, people have the right to hire and not to hire". (Literal translation).

> [...] nem sempre as condições contratuais correspondem, exatamente, ao querer íntimo da parte, pois a negociação às vezes é permeada de renúncias e transigências. Tais circunstâncias não significam, porém, qualquer restrição ao princípio da autonomia da vontade, uma vez que a parte, avaliando as perdas e ganhos, decide livremente pela celebração do contrato. (NADER, 2018, n.p.).[115]

For this reason, autonomy - a principle that gives vitality to contracts in the legal order - finds limits in the laws of public order and good customs, which are based on social morality and those dictated by the legal order directly.

The jurist affirms that "a filosofia individualista do século XIX reforçou a importância dos contratos na organização jurídica das sociedades"[116] so that the principle of freedom should be the rule or basis for all actions, but by becoming aware of the social function of the contract and the economic balance to be preserved, the autonomy of the will began to give way to sociality.

Notably, Fábio Ulhoa Coelho brings three examples about which the contracting parties do not meet the social function, whose execution may sacrifice, compromise or harm, in any way, metaindividual interests:

> É o caso, por exemplo, da empreitada, em que o dono de gleba de terra vizinha a um rio contrata a construção de edifício fabril com a derrubada da mata ciliar; do mandato, em que o anunciante incumbe à agência de propaganda a tarefa de produzir e providenciar a veiculação de publicidade abusiva; da locação de imóvel urbano tombado pelo patrimônio histórico, em que o locatário é autorizado a promover eventos que exponham a risco o bem a preservar, como ruidosas *raves* ou insalubres exposições de animais. Nesses três exemplos, interesses públicos, difusos ou coletivos acerca dos quais não têm os contratantes a disponibilidade são negativamente afetados pelo contrato. O dano ambiental, a publicidade enganosa e a sutil forma de impor degradação ao imóvel tombado são efeitos dos contratos que violam o meio ambiente, os direitos dos consumidores e o patrimônio histórico. Desatende-se, nesses casos, à função social exigida dos negócios contratuais. (COELHO, 2012, pp. 84-85).[117]

In addition to the Constitution of the Federative Republic of Brazil determining the fulfillment of the social function of property (art. 5, XXIII), which also includes the contract, it expressly provides for the wording of art. 170, *in verbis*:

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[115] [...] the contractual conditions do not always correspond exactly to the inner will of the party, because the negotiation is sometimes permeated by waivers and compromises. Such circumstances do not mean, however, any restriction to the principle of autonomy of will, since the party, assessing the losses and gains, decides freely for the conclusion of the contract. (NADER, 2018, n.p.). (Literal translation).

[116] [...] "the individualistic philosophy of the nineteenth century reinforced the importance of contracts in the legal organization of societies". (Literal translation).

[117] It is the case, for example, of the contract, in which the owner of a land adjacent to a river hires the construction of a factory building with the felling of the riparian forest; of the mandate, in which the advertiser entrusts to the advertising agency the task of producing and providing the propagation of abusive advertising; of the lease of an urban property that is listed by historical heritage, in which the tenant is authorized to promote events that expose to risk the property to be preserved, such as noisy raves or unhealthy animal exhibitions. In these three examples, public, diffuse or collective interests about which the contractors do not have the availability are negatively affected by the contract. Environmental damage, misleading advertising, and the subtle way to impose degradation on the listed property are effects of contracts that violate the environment, consumer rights, and historical heritage. In these cases, the required social function of the contractual business is disregarded. (Literal translation).

Art. 170. A ordem econômica, fundada na valorização do trabalho humano e na livre iniciativa, tem por fim assegurar a todos existência digna, conforme os ditames da justiça social, observados os seguintes princípios:
I - soberania nacional;
II - propriedade privada;
III - função social da propriedade;
IV - livre concorrência;
V - defesa do consumidor;
VI - defesa do meio ambiente;
VII - redução das desigualdades regionais e sociais;
VIII - busca do pleno emprego;
IX - tratamento favorecido para as empresas brasileiras de   capital nacional de pequeno porte.

Parágrafo único. É assegurado a todos o livre exercício de qualquer atividade econômica, independentemente de autorização de órgãos públicos, salvo nos casos previstos em lei. (BRASIL. Constituição Federal de 1988).[118]

Therefore, it should be possible to modulate the effects of the contract by virtue of the overlapping of public interests on private individuals, as occurs in the judicial protection related to the economic-contractual balance and even its termination.

This is what Article 421, *caput*, of the Civil Code refers to: "A liberdade contratual será exercida nos limites da função social do contrato"[119]. Thus, in addition to observing the general rules related to the business itself, the contracting parties must keep the public interest.

In this respect, it is important to reinforce the notion that smart contracts have the characteristics of immutability in their distributed character and also self-execution. More intensely than other forms of contracting, these contracts seek to comply with the *rebus sic stantibus* clauses (things thus stading).

On the other hand, these contracts do not have a coactive force[120], since it is only legitimized by the State, through the Judiciary Power, which has not rarely directed the contracts - with civilizing function - to enable the conciliation of conflicting interests.

Hence the importance of recognizing that the smart contracts, although created with the purpose of ensuring the performance of the contract without interference of intermediaries, does not exclude the possibility of stipulating a clause that instrumentalizes this adjustment, as well as

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[118] Article 170. The economic order, founded on the appreciation of the value of human work and on free enterprise, is intended to ensure everyone a life with dignity, in accordance with the dictates of social justice, with due regard for the following principles: (CA No. 6, 1995; CA No. 42, 2003) I – national sovereignty; II – private property; III – the social function of property; IV – free competition; V – consumer protection; VI – environment protection, which may include differentiated treatment in accordance with the environmental impact of goods and services and of their respective production and delivery processes; VII – reduction of regional and social differences; VIII – pursuit of full employment; IX – preferential treatment for small enterprises organized under Brazilian laws and having their head-office and management in Brazil. Sole paragraph. Free exercise of any economic activity is ensured to everyone, regardless of authorization from government agencies, except in the cases set forth by law.
[119] Art. 421. The freedom to hire will be exercised on the basis and within the limits of the social function of the contract.
[120] Although it is not a visible scenario still in Brazil, a contract could only force the parties to comply with it from the full use of the Internet of Things. Example: Imagine the situation, in a very simplified way, in which a tenant who does not carry out the main obligation of the rent, which is the payment of the rent. With an smart contract, capable of self-execution, it would not only be unnecessary to file an eviction lawsuit against the tenant, but also the lease agreement itself could generate the effect of restitution of ownership to the landlord, of changing the access codes of the locks of the property, removing the access to the garage, and generally making the use of the property unfeasible.

does not prevent the appreciation by the Judiciary Power, nor does it exclude the possibility of being rendered unusable by it.

Therefore, even if the individual interests of the contracting parties differ at the time of execution of the contract, it is possible to modulate the effects of the contract even if the platform sees the influence of external factors not adjusted to the code of its creation, *maxime* the State.

It should be made clear that the direction of a possible judgment is to the legal subject and not to the code of the contract, which in any such case would be the object and/or means of proof to be ventilated.

Following this reasoning, under the Civil Code, no convention - and the consequent conditions stipulated by the contracting parties - will prevail if it contradicts public order precepts, such as the principle of the social function of the contract, as provided in article 2.035, sole paragraph of the Civil Code, *in verbis*:

> Art. 2.035. A validade dos negócios e demais atos jurídicos, constituídos antes da entrada em vigor deste Código, obedece ao disposto nas leis anteriores, referidas no art. 2.045, mas os seus efeitos, produzidos após a vigência deste Código, aos preceitos dele se subordinam, salvo se houver sido prevista pelas partes determinada forma de execução.
> **Parágrafo único. Nenhuma convenção prevalecerá se contrariar preceitos de ordem pública, tais como os estabelecidos por este Código para assegurar a função social da propriedade e dos contratos.** (BRASIL. Lei nº 10.406 de janeiro de 2002. Grifamos.).[121]

Without going into the merit of the discussion that involves the possible difficulty of understanding in relation to algorithmic language to the detriment of natural language (Portuguese language), which can certainly be solved through the exercise, it is important to point out that any smart contracts in disagreement with the legal system could be legally invalid.

The issue becomes even more relevant when the current discussion in the consumer sector regarding contracts by adhesion and the removal of unfair terms is raised.

Therefore, it is not necessary to talk about the (in)effectiveness of the judicial sentence, because the contracts, even if controlled through security keys and other protocols, would be susceptible to invalidation, as from a judicial sentence/decision.

Thus, as from the invalidation, the replicated data will be transmitted to the peers of the network, in the same way that it was created, but this time granting it the character of invalid.

So, the issue should not be confused with the (dis) compliance of a court order that modulates the effects of a smart contract.

It remains to be considered that the legal system often has a repairing character, and because of this is not restricted to ensure the execution of *ex ante* contracts, but aims to assist

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[121] Art. 2035. The validity of business and other legal acts, acquired before the entry into force of this code, in compliance with the provisions of the previous law, referred to in art. 2045, but its effects are produced after the term of this code, to his subordinate regulations, unless there's been foreseen by the parties determined the form of execution. Sole paragraph. No Convention shall prevail if contradict public order regulations, such as those laid down by this code to ensure that the social function of property and contracts.

possible claims arising *ex post*; and the smart contracts clearly do not have the scope based on the welfare state, but on the Liberal state.

In fact, the ability to examine transactions is what makes technology so attractive. It risks saying, in order to elevate the discussion, that in this regard off-chain (or even side-chain[122]) resources can be an alternative to enable judicial intervention or, also, through private systems of conflict resolution and arbitration. This is because, due to what is observed in the pragmatic field, it is already fully possible to attribute to a contract the possibility of inserting an arbitration clause to submit the disputes that may arise from the contract to arbitration.

Moreover, if the contracts must be governed by principles, the smart contracts cannot deviate from the direction given by the social function of the contract, and must prioritize the public interest, because even beyond the cases provided for in the Civil Code, the process of contractual dirigisme operates in accordance with the Introduction Act to Brazilian Law Rules (Decree Law No. 4.657/42), namely: "Art. 4º. Quando a lei for omissa, o juiz decidirá o caso de acordo com a analogia, os costumes e os princípios gerais de direito"[123].

Therefore, if the smart contracts suffer this lack of connection through the delineation of their contours, they are null and void and cannot compel either party to fulfil its obligations.

It is therefore clear that a code can formalize and structure a good contract, take care of its inviolability, execution, and also keep an accessible history.

Also, in a pragmatic perspective, the smart contract is deterministic in nature as a contract but, without legal equipment, the code cannot generate the effects of a valid contract.

In the next topic, we will then analyze smart contracts from the perspective of legal business plans.

3.2 The Legal Business Plans applied to Smart Contracts

Following the doctrinal proposal to divide the legal business through the ponteana ladder theory, the analysis of the plans of the legal business applied to smart contracts is moved forward.

3.2.1 Plan of Existence

Smart contracts must comply with the elements of existence of any other legal business. In this sense, the core elements are (i) the declaration of will, (ii) the object, (iii) the subject[124] and (iv) the form.

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[122] It's called the Side-chain networks parallel to Blockchain.

[123] Art 4. When legislation is silent, the judge shall decide the case in accordance with analogy, customs and general principles of law. (Literal translation).

[124] Due to the great discussion about Internet access, it becomes relevant the question of the validity of the conclusion of electronic contract by an incapable person. We believe that it is very useful, in this sense, the admissibility of

In addition to these general elements listed above, in order for the business to be valid, as regards the category elements proper to each type of business, smart contracts must obey them, since they do not result from the will of the parties, but from the legal system (law, doctrine and case law).

Therefore, the operator of the right must observe the essential (indeterminable) categorical elements - which help us to categorize the legal transaction, such as the consensus on the thing and the price in the purchase and sale contracts.

On the contrary, by not observing these elements, the contract may be substantially converted into another business. In addition, the parties may exclude (of their own free will) the natural (derogable) category elements, such as the clause that excludes liability for eviction (article 448 of the Civil Code).

In addition, particular elements (voluntary by nature), must be taken into account in relation to smart contracts the condition, term, charge and penal clause.

3.2.2 Plan of Validity

Once the analysis that makes up the elements of the existence of smart contracts has been overcome, we pass the analysis of the validity plan, which briefly deals with qualifying the elements of the existence plan, through requirements.

Therefore, in relation to the declaration of will - which is expressed here through cryptography - it is necessary that it be free, conscious and voluntary so as not to contradict the legal system in relation to the cogent norm, good customs, good faith[125] and social function.

We must remember that the declaration of will continues to be fundamental to private law, since although it is subject to the limits of private autonomy, like the socioeconomic function, it still immediately privileges the private interest of the holder.

Therefore, the interpretation of smart contracts, taking into account the dynamism of the relationships established in electronic contracts, should have as a parameter beyond the declared will (object of interpretation), the uses and customs, as advocated by Karl Larenz (2006, pp. 55-64).

It is reasonable, in this sense, to recognize that specific rules in relation to electronic contracts are bound to be outdated by the advancement of new technologies.

In addition, we must consider that, as stated in Statement 409 of the Fifth Journey of Civil Law "Os negócios jurídicos devem ser interpretados não só conforme a boa-fé e os usos do lugar

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electronic signature to ensure the safety of contractors in situations where it is necessary to prove the truth of the facts in court, such as the identity of the contractor.

[125] Knowing that smart contracts are bilateral or plurilateral legal transactions, we must consider, with more reason, the objective good faith. Therefore, it is important to emphasize the clarification of relevant information, the clarity and scope of the content of the contract in the pursuit of the economic purposes for which it is intended.

de sua celebração, mas também de acordo com as práticas habitualmente adotadas entre as partes"[126], an understanding that should be taken from the combination of articles 113 and 422 of the Civil Code of 2002.

Therefore, for the formation of the smart contracts, it is necessary in the case that *in concretu* there is the manifestation of will of the parties, as an element of validity of the contract.

And in the same way that we cannot ignore the gestures in relation to the declaration of will, we cannot ignore the algorithmic codes.

Still in relation to the declaration of will as a requirement for the validity of the contract, we highlight that by the functionality of smart contracts it is perceived that, from formation to execution, the contract has a great binding force that aims to satisfy the legal business in an efficient manner.

If taken to the field of Economic Law Analysis, we will see that the smart contract seeks the application of Nash's Equilibrium, because Blockchain itself induces the balance of the platform, by which no point of the network has to gain by changing its strategy in a way Unilateral.

In this sense, it is correct to say that both users and miners are not controlled by a centralized authority, and that in such a way seek to maximize their own results, taking into account what other participants declare.

In this way, Blockchain highlights the relationships established by the conjugation of the theory of declaration (objective) with the theory of trust (subjective).

Therefore, in an eventual dispute, the judge must consider the proposer's statement, since the receiver must not be affected by the declarant's subjectivism, as stated by Rodrigo Fernandes Rebouças:

> Portanto, toda as formas de expressar uma declaração de vontade, seja expressa ou tácita, [...], devem ser consideradas para a validade da formação do contrato eletrônico, já que o sujeito que declara uma vontade (expressa ou tácita) passa a ter uma responsabilidade sobre a sua declaração frente a sociedade e ao terceiro. Não se admite mais situações individualistas e em prejuízo aos valores da função social do contrato, da boa-fé objetiva e da teoria da confiança. (REBOUÇAS, 2018, p. 122)[127].

Therefore, the objective good faith and its attached duties should guide the smart contracts, and the bidder can not excuse himself from his acts and statements before society - which is protected in relation to the social function of the contract - on the pretext that the will must prevail over the declaration; nor does it seem fair who freely exercised the choice to hire and refuses to comply with the contract to be released.

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[126] Legal transactions shall be interpreted not only in accordance with good faith and the use of the place where they are entered into, but also in accordance with the practices usually adopted by the parties. (Literal translation).

[127] Therefore, all forms of expressing a statement of will, whether express or tacit, [...], must be considered for the validity of the formation of the electronic contract, since the subject who declares a will (express or tacit) has a responsibility for his statement before the society and the third party. No more individualistic situations are admitted and to the detriment of the values of the social function of the contract, the objective good faith and the theory of trust. (Literal translation).

In relation to the object, it is necessary that it is lawful, possible, determined or determinable; as for the subject, the law provides that he must be a person capable of exercising the rights and practice acts of civil life (except for situations of emancipation and also of representation and assistance that exceptionally authorize the power of disposal and acquisition).

However, the capacity should not be confused with legitimacy, given that the former refers to the possibility of appearing as a legally active or passive part of the business, as well as the conditions of the agent, while legitimacy refers to the condition of validity or effectiveness of the business, to act in contracts provided for by law.

Although the concepts are close, they are not to be confused, since the party may be able, but may not have legitimacy to act in the concrete case, as in the case of the need for a uxoria grant provided for in item I of article 1,647 of the Civil Code of 2002.

It is important to make a counterpoint in relation to smart contracts: as seen, such contracts are endowed with pseudoanonymity, i.e., as a rule - in public Blockchain[128] – the only information visible to the public is the "digital address" of the user.

Its capacity, in this sense, will only be visible in the case of sharing this data.

Furthermore, as to the legality of the object, it is assumed that the Blockchain's mining structure allows the users of the network to identify illicit objects.

With respect to the form, it must be prescribed or not defended by law (according to articles 107 and 212 of the Civil Code of 2002). Therefore, electronic contracts are classified doctrinally as atypical and free form contracts - *ad substantiam* -, in spite of their content may be disciplined by law.

Also in terms of validity, in relation to the general category elements, it is important to observe the useful time for the specific legal business, as well as that the agent is legitimized for the business.

In relation to the inderogable categorical elements, there are no general rules for all businesses, and therefore it is necessary to observe what is available about each type of business.

In relation to the derogable categorical elements, there is no requirement of validity.

Particular elements, finally, can lead to nullity of the condition or the entire legal business, depending on the specific case – such as unlawful conditions and/or contrary to good customs, and the condition relating to the physically impossible thing.

3.2.3 Plan of Effectiveness

The effectiveness of smart contracts is, therefore, the effectiveness of the effects expressed and desired. In fact, in this plan the effectiveness factors are extrinsic to the business, but they influence the achievement of the desired results manifested by the contracting parties.

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[128] In the public Blockchain, anyone can participate from anywhere in the world.

According to the tripartite theory, based on the lessons of Antonio Junqueira de Azevedo, these factors are divided into (i) general effectiveness attribution factors, (ii) directly targeted effectiveness attribution factors and (iii) more extensive effectiveness attribution factors.

For Azevedo:

> [...] a) os *fatores de atribuição da eficácia geral*, são aqueles sem os quais o ato praticamente nenhum efeito produz; é o que ocorre no primeiro exemplo citado (ato sob condição suspensiva), em que, durante a ineficácia, poderá haver a possibilidade de medidas cautelares, mas, quanto aos efeitos do negócio, nem se produzem os efeitos diretamente visado, nem outros, substitutivos deles; b) os *fatores de atribuição da eficácia diretamente visada*, que são aqueles indispensáveis para que um negócio, que já é de algum modo eficaz entre as partes, venha a produzir exatamente os efeitos por ele visados; quer dizer, antes do advento do fator de atribuição da eficácia diretamente visada, o negócio produz efeitos, mas não os efeitos normais; os efeitos, até a ocorrência do fator de eficácia, são antes efeitos substitutivos dos efeitos próprios do ato; é o que ocorre no segundo exemplo citado, em que o negócio, realizado entre o mandatário sem poderes e o terceiro, produz, entre eles, seus efeitos, que, porém, não são os efeitos diretamente visados; c) os *fatores de atribuição de eficácia mais extensa*, que são aqueles indispensáveis para que um negócio, já com plena eficácia, inclusive produzindo exatamente os efeitos visados, dilate seu campo de atuação, tornando-se oponível a terceiros, ou, até mesmo, *erga omnes*. (AZEVEDO, 2002, p. 57).[129]

In this same sense, Rodrigo Fernandes Rebouças (2018, p.88), lists that in relation to the factors of attribution of general effectiveness, there are contracts linked to a suspensive condition, or even the legal transaction typically received. It also exemplifies that in relation to situations of suspensive conditions of linkage to the payment "[...] a compra e venda existe e é válida, porém depende de confirmação do pagamento ou da liberação de determinado crédito"[130].

In relation to the factors that attribute the effectiveness directly aimed at, the author explains that these occur in situations of insufficient representation - where the legal act goes beyond the powers conferred by mandate -, despite the fact that the 2002 Civil Code allows for the possibility of ratification of acts committed with abuse of power, as provided in art. 662 of Constitution of the Federative Republic of Brazil.

It is also limited, in terms of efficacy, that the factors of attribution of the most extensive efficacy are the legal acts of publicity in general - such as the acts related to rights in rem or those

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[129] [...] a) the attribution factors of general efficacy are those without which the act has practically no effect; this is what occurs in the first example cited (act under suspensive condition), in which, during the ineffectiveness, there may be the possibility of precautionary measures, but, as for the effects of the business, neither the directly aimed effects nor others are produced, replacing them; b) the attribution factors of the directly aimed efficacy, which are those indispensable for a business, which is already in some way effective between the parties, to produce exactly the effects it is aimed at; that is to say, before the advent of the attribution factor of the effectiveness directly aimed, the business produces effects, but not the normal effects; the effects, until the occurrence of the effectiveness factor, are rather substitutive effects of the effects proper to the act; it is what occurs in the second example mentioned, in which the business, carried out between the agent without powers and the third party, produces, among them, its effects, which, however, are not the effects directly aimed; c) the factors of attribution of more extensive efficacy, which are those indispensable for a business, already with full efficacy, including producing exactly the intended effects, to expand its field of action, becoming enforceable against third parties, or even erga omnes. (Literal translation).
[130] [...] the purchase and sale exists and is valid, but depends on confirmation of payment or the release of a certain receivable. (Literal translation).

in which registration is required to have effect -, which will generate effects only in relation to third parties.

Rodrigo Fernandes Rebouças (2018, p. 94) also remembers that situations of ineffectiveness may occur in the electronic contracts, and as such the smart contracts, as it is verified in the contracts with resolution clause.

Another issue directly linked to effectiveness, in our view, is related to the place and time of hiring and the *lex loci celebracionis*.

It is known that compliance with the rule of art. 9 of Introduction Act to Brazilian Law Rules establishes as a rule the application of the law of the country in which the legal relationship was established. On the other hand, this rule applies to contracts between presentees (physically or with simultaneous communication, even if the parties are miles away).

Due to the fact that many electronic contracts are practiced among absentees, extending this possibility to smart contracts, it seems to us essential that during the formation of the contract the place of the contract be established, a necessary element, for example, to define the competent forum (*lex fori*) to settle a possible dispute and, also, for there to be the interpretation of the contract in relation to uses and customs, since the legislative process does not accompany the development of the so-called new technologies.

As seen, there is no guarantee that the contracting in smart contracts occurs simultaneously and, therefore, the criterion of definition as to the actual place where the bidder is located at the time of contracting should be applied.

Still, in relation to time, it is essential that the smart contracts have the element of time stamp (timestamping) so that it is possible to analyze the formation of the legal business and also to define who figured as bidder.

Rodrigo Fernandes Rebouças (2018, p. 75), in this sense, adds that both the place element and the time element - which, in our view, compete for the effectiveness of smart contracts -, are necessary to the analysis of numerous implications, such as those relating to the deadlines and guarantees, as well as other issues, such as those involving the prescription and decay.

And, by virtue of the elements place and time, conditions eminently linked to the plan of effectiveness of smart contracts, it is concluded that the smart contracts must be classified as impure because they contain accidental elements.

3.3   Formation and Proof of Smart Contracts

In relation to the formation of Smart Contracts, it can be said that, due to Blockchain technology, the proof of the effective binding and the existence of the contract is always present and effective.

This is due to the block registers, which are - as a rule - unalterable. In this sense, every smart contract leaves a kind of "track", which can be used as proof of existence or of the conditions of the contract (*ad probationem* form).

Under the perspective of the form of legal business (element studied in the validity plan), we must remember that in the case of electronic contract the form is free, since it only has form those businesses with a prescribed form, according to the principle of freedom of form and consensualism embodied in art. 107 of the Civil Code.

However, the assertion does not mean that the smart contracts do not have a form because, if it were so, they would not even exist.

Therefore, taking into consideration the "factors of attribution of the most extensive effectiveness" studied previously, it is necessary that the smart contract takes an *ad probationem* form so that it can be effective and valid before third parties - including for judicial demonstration -, because if there is any doubt, the parties may demonstrate the content of the contract by sending or displaying it, even if in printed form (*ad substantiam* form).

Therefore, in some situations - depending on the fixing of a specific form - it will be necessary, for example, to "take" the smart contract to public registration in cases where the law determines or, also in cases that shape the provision of Article 109 of the Civil Code, while this is not possible virtually.

The Code of Civil Procedure of 2015 (in Section VIII) lists three articles in relation to electronic documents, namely, art. 439 *usque* 441 below transcribed:

> Art. 439. A utilização de documentos eletrônicos no processo convencional dependerá de sua conversão à forma impressa e da verificação de sua autenticidade, na forma da lei.
> Art. 440. O juiz apreciará o valor probante do documento eletrônico não convertido, assegurado às partes o acesso ao seu teor.
> Art. 441. Serão admitidos documentos eletrônicos produzidos e conservados com a observância da legislação específica. (BRASIL. Lei n. 13.105, de 16 de março de 2015).[131]

With due regard, it is necessary to interpret the text of the legislator. A "conventional process" is to be understood as one relating to processes that take place in a physical environment.

This time - according to article 439 of the *codex* - the electronic documents may be used in the conventional process, however they depend on conversion to the printed form and verification of their authenticity. The exception to the rule comes soon after, where the legislator wanted to allow the appreciation of the electronic document by the judge, which in this case can be presented either by conventional process or by means of digital support.

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[131] Art. 439. The usage of electronic doc-uments in conventional procedure shalldepend on their conversion to a printedformat and the verification of their au-thenticity, under the law.
Art. 440. The judge shall assess the pro-bative value of the unconverted electronicdocument, the parties being assured accessto its contents.
Art. 441. Electronic documents producedand kept in accordance with the specificlegislation shall be admissible.

There is also provision for the admissibility of electronic documents, which must be kept in compliance with the specific legislation, in this case Provisional Measure 2,200-2, which allows the use of a digital certificate - including those not issued by ICP - Brazil, provided that it is accepted by the parties as valid or accepted by the person to whom the document is opposed (pursuant to article 10, paragraph 2 of the Provisional Measure).

What the Provisional Measure provides, in this sense, is only the presumption of authorship/veracity in relation to its signatories - in relation to evidence - and not as a requirement of validity of the legal transaction.

Furthermore, such electronic documents may be used as evidence, pursuant to article 212 of the Civil Code. More. The legislator, in article 369 of the Code of Civil Procedure, allows the use of electronic evidence to prove the truth of the facts, even if not specified, and the judge may freely examine the evidence, considering the facts and circumstances, in a motivated manner, as provided for in article 131 of the same *codex*.

In order for there to be no doubt about the possibility of using smart contracts as evidence, we must return to the provisions of article 225 of the Civil Code, transcribed below:

> Art. 225. As reproduções fotográficas, cinematográficas, os registros fonográficos e, em geral, quaisquer outras reproduções mecânicas ou eletrônicas de fatos ou de coisas fazem prova plena destes, se a parte, contra quem forem exibidos, não lhes impugnar a exatidão. (BRASIL. Lei nº 10.406 de janeiro de 2002).[132]

However, in relation to the conservation or conversion of a physical document into an electronic medium, even before a specific legislation for such, we cannot ignore the existence of Law 12.682 of 2012, as stated by Rodrigo Fernandes Rebouças:

> Não ignoramos a existência da Lei 12.682 de 2012, porém a referida lei teve grande parte de seus artigos vetados por não respeitarem a segurança jurídica ou as normas de arquivamento já existentes, de forma que os seus poucos artigos vigentes não são capazes de trazer e definir qualquer regulamentação específica para a produção, conversão ou conservação de documentos eletrônicos, apenas fazendo referência a própria Medida Provisória 2.200-2 [...]. (REBOUÇAS, 2018, p. 98).[133]

In the meantime, having overcome the question of the existence of the smart contract by virtue of its free form - as a rule - we must pass the substantial analysis of the *ad substantiam* form, i.e. in relation to the formalities.

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[132] Art. 225. The photographic reproductions, cinematographic works, sound recordings and, in General, any other mechanical or electronic reproductions of facts or things make full proof of these, if the party against whom they are displayed, they impugn the accuracy.

[133] We do not ignore the existence of Law 12.682 of 2012, however, the referred law had most of its articles vetoed for not respecting the legal certainty or filing rules already existing, so that its few articles in force are not able to bring and define any specific regulations for the production, conversion or conservation of electronic documents, only making reference to Provisional Measure 2.200-2 [...]. (Literal translation).

In order to guarantee legal certainty, the legal system requires certain contracts to comply with these formalities. This helps, for example, the knowledge of the contract by third parties unrelated to the legal relationship, including the Judiciary, which according to the author "[...] em última análise, é o destinatário de todo o clausulado de um contrato, já que em caso de litígio, seja ele o maior interessado em saber o que foi pactuado [...][134]".

Therefore, nothing prevents the smart contract is taken to the appreciation of the Judge, because it has a means of access to data and information contained therein and that is guaranteed by electronic signature of the parties, as seen in relation to interpersonal, interactive or intersystemic contracts.

It remains to be considered, however, that the analysis of smart contracts by the Judge may be hampered by the possible difficulty of understanding the contract, given that its preparation occurs in algorithmic language.

Therefore, it should be observed with respect to smart contracts the enforceability of form in cases in which it is required, as well as requirements regulated by Title V, Book III of the General Part of the Civil Code.

For the above reasons, there is no reason to refuse the validity of smart contracts.

3.3.1 Pre-Contractual Considerations

Having overcome the notion that the electronic contract must always observe the freedom of forms and objective good faith, provided for in article 422 of the Civil Code, we will now analyze the pre-contractual phase.

As in the case of contracts entered into in a traditional environment, the pre-contractual phase also has great importance in relation to smart contracts, mainly due to the alignment of the parties' conduct to the standard of objective good faith, loyalty, transparency, information, cooperation, etc.

In the specific case of electronic contracts, the duty of information is very important, since it is essential to determine the success or failure of an operation. This is largely due to the risks inherent in electronic contracting itself and also to the feeling of mistrust among the contracting parties themselves.

For this reason, in order to make a smart contract possible, the proposal must be clear, precise and fulfil its duty of information regarding the right of withdrawal. According to Rodrigo Fernandes Rebouças (2018, p. 108) "[135]o mesmo se dá com a aceitação, pois, se esta for realizada

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[134] [...] in the final analysis, he is the addressee of the entire clause of a contract, since in the event of a dispute, he is the one most interested in knowing what has been agreed. (Literal translation).
[135] [...] the same happens with the acceptance, because if this is done improperly or in dissonance with the real will, the acceptor should perform the immediate withdrawal. (Literal translation).

de forma indevida ou em dissonância com a real vontade, deverá o aceitante realizar a imediata retratação [...]".

Furthermore, since smart contracts have the characteristic of being contracts performed, *a priori*, between absentees - by the time interval between the issuance of the proposal and the acceptance -, we must consider that the first phase for the formation of the contract is of an interpersonal type.

Therefore, the main characteristic in relation to the proposal and the acceptance is that there is the need for an active manifestation of the parties, both to issue the proposal and the acceptance. Therefore, if the acceptance is issued after the deadline or if sufficient time elapses in the proposals without a deadline, the proposal ceases to be binding on the proponent under the terms of clauses II and III of article 428 of the Civil Code.

As to the concept of "sufficient time", the author affirms that:

> O conceito indeterminado [...] aplicado pelo legislador deve ser complementado pelo operador do direito para cada caso concreto e de acordo com os usos e costumes (art. 113, Código Civil), no entanto, acreditamos que tal questão é motivo para infindáveis debates jurídicos no Poder Judiciário, justamente pela ausência de um padrão de comportamento, sendo altamente recomendável que todas as propostas (eletrônicas ou não) contenham uma cláusula expressa do seu prazo de validade. (REBOUÇAS, 2018, p. 109).[136]

Furthermore, it is necessary to assert that in relation to acceptance, the hypothesis of untimeliness provided for in article 430 of the Civil Code may manifest itself frequently, because Blockchain transactions have a relatively long average confirmation time due to the effects of network latency on the safety performance of the ecosystem.

The effect of latency can also be harmful in relation to the provisions of article 432 of the Civil Code, given that in some cases, the refusal may not arrive in time and the contract is considered concluded, a situation in which it could result in loss and damage by the rupture of negotiations (and by the fair expectation of the bidder).

As for the possible amendment to the original proposal, we know that it results in recognition of the counterproposal as a new proposal, as provided for in article 431 of the Civil Code.

The issue gains relevance in relation to smart contracts in view of the definition of the place of hiring, since the Internet is only a means, and not a place itself.

In this sense, article 435 of the Civil Code establishes that in the absence of choice of competent forum to decide a dispute involving the contract, the place of conclusion of the contract is considered as the place of issuance of the proposal.

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[136] The indeterminate concept [...] applied by the legislator must be complemented by the operator of the law for each concrete case and in accordance with the uses and customs (art. 113, Civil Code), however, we believe that this issue is reason for endless legal debates in the Judiciary, precisely because of the absence of a standard of behavior, and it is highly recommended that all proposals (electronic or not) contain an express clause of their validity period. (Literal translation).

Therefore, when a counter-proposal is issued, it is also necessary to know the place from which it was emanated. In fact, in the case of an electronic contract, it may come from several places in the world, in which case the aforementioned Introduction Act to Brazilian Law Rules (Decree-Law No. 4.657/42) will apply.

3.3.2 Preliminary Contract

In relation to the preliminary contract - an autonomous contract in relation to the definitive contract -, Rodrigo Fernandes Rebouças (2018, p. 113) states that its use is intended to ensure the formation of a future legal transaction due to the current unavailability of capital or requirements required by law or, also, it may be used as a technique to develop commercial agility in order to establish the main issues of a contract at first and, subsequently, agree the other conditions and obligations.

The author also warns of the doctrinal discussion that sustains that electronic contracts excel in agility and instantaneous formation, and that this position is not of good technique, since these contracts may be contracts of duration or of deferred performance. In this sense, Rodrigo Fernandes Rebouças maintains:

> Acreditamos que os contratos preliminares podem ser perfeitamente formados e aplicados ao meio eletrônico. Identificamos tais atos jurídicos, tanto de forma isolada, ou seja, ocorrerá apenas a formalização eletrônica do contrato preliminar sendo o contrato definitivo firmado de forma tradicional como por exemplo em uma operação societária de incorporação, quanto a possibilidade de ambos os negócios (preliminar e definitivo) serem formados pelo meio eletrônico, *v.g.* em uma operação comercial de compra e venda de um software de gestão empresarial. (REBOUÇAS, 2018, p. 114).[137]

Therefore, if there are sufficient elements for the formation of a definitive contract (punctuation of rights and obligations, consequences, etc.), the rule of article 463 of the Civil Code will apply to smart contracts, unless it provides for a right to repentance.

In this sense, the smart contract may be enforceable by means of judicial protection, at the request of the interested party, according to article 464 of the Civil Code by the instruments provided for in articles 497, 814 and 821 of the Code of Civil Procedure.

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[137] We believe that preliminary contracts can be perfectly formed and applied to electronic media. We have identified such legal acts, both in an isolated manner, i.e., there will only be the electronic formalization of the preliminary contract and the definitive contract will be executed in a traditional manner, such as in a corporate merger transaction, as well as the possibility of both businesses (preliminary and definitive) being formed by electronic means, e.g. in a commercial transaction for the purchase and sale of a business management software. (Literal translation).

3.4 Public Offering in Smart Contracts

Knowing that smart contract is classified as a hybrid in relation to intersystemic and interpersonal media, it is not necessary to talk about offering to the Public Offering, which is present in interactive electronic contracts.

Thus, in the absence of an electronic system that reaches a specific audience, as occurs in Blockchain, *a priori*, the offer is non-existent in smart contracts.

On the other hand, if it is possible to integrate a Blockchain smart contract into a "web" environment through the so-called "DApps" (Decentralized Application) as occurs in the Ethereum platform, according to Parmy Olson (2018) and Darryn Pollock (2019), the rule of article 427 of the Civil Code applies to them.

In these cases, the offer to the public is equivalent to a proposal when it contains all the essential elements of the proposed business, obliging the bidder to comply with it, if the contrary is not the result of its terms, the nature of the business, or the circumstances of the case.

3.5 General Clauses in Smart Contracts

Due to the need for agility in the treatment of the relations, pre-established clauses - and stipulated unilaterally, as a rule by the bidder in several types of contract - must observe the same content and form of the contract by adhesion, and may be altered by the contracting parties during the negotiation treatment.

These general clauses can be registered directly in the block chain of the Blockchain, in order to avoid undue changes by one or other contracting party.

In addition, the operator of the right must observe the provisions of the Civil Code in relation to the protection of the adherent from such contractual forms, according to art. 423, *caput* and sole paragraph and art. 424.

Thus, as stated by Rodrigo Fernandes Rebouças:

> Por se tratar de forma de contratação por adesão e sendo cláusulas pré-dispostas unilateralmente, cabe ao operador do direito, responsável pelo desenvolvimento de tal modelo contratual, cuidados especiais com a clareza do texto, a elaboração de condições, direitos e obrigações de forma equilibrada e o mais equânime quanto possível, bem como, os requisitos atrelados a boa-fé objetiva e a função social do contrato. (REBOUÇAS, 2018, p. 143).[138]

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[138] As this is a form of contracting by adhesion and being clauses pre-disposed unilaterally, it is up to the operator of the law, responsible for the development of such contractual model, special care with the clarity of the text, the preparation of conditions, rights and obligations in a balanced manner and as fair as possible, as well as, the requirements linked to objective good faith and the social function of the contract. (Literal translation).

Also in this regard - and within the limits of the autonomy of the will, *a priori*, the parties may stipulate the *solve et repete* claus[139], which is clearly a waiver of the exception to the unfulfilled contract, as provided in articles 476 and 477 of the Civil Code of 2002.

However, such clause will not be valid in view of some contracts, such as adhesion contracts as per article 424 of the Civil Code, and also in view of the contracts protected by Law 8.078/90 by virtue of the express provision in article 51, in which cases it is possible to review for excessive onerosity.

Therefore, it can be seen that within the plan of the autonomy of the will, it is necessary to be careful in relation to provisions that result in abusive clauses and in mismatches with its determinations, under penalty of being ruled out by the Judiciary Power in an eventual litigation.

This is because, although smart contracts are eternal[140] and immutable, it is possible to programme them so that they are not used.

3.6   Digital Payment

According to Rodrigo Fernandes Rebouças (2018, p. 135), the digital payment [...] assume a figura de um fato jurídico como requisito de validade e eficácia do contrato eletrônico em função das circunstâncias negociais"[141].

Applied to smart contracts, such understanding leads to the reasoning that digital payment is a form of consent to an electronic contract, under the bias of objective good faith and the very analysis of business circumstances.

3.7   Silence on Smart Contracts

As seen, silence is admitted as a form of expression of will for the formation of a contract, as established in the Civil Code of 2002, as per art. 111 of the Civil Code.

However, in the case of smart contract, the issue remains prejudiced, since in view of its formation, the silence is not able to produce practical effects.

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[139] The *solve et repete* clause, which is common in administrative contracts, shall apply to the waiver of the opposition to the exception of the contract not fulfilled. In short, it can be understood as "pay, then claim". In other words, the clause obliges the contracting party to fulfil his obligation under the contract, even if the other party fails to fulfil his obligation. However, after performance of the obligation, the ontractor who has performed his part of the obligation may invest against the defaulting party, forcing him to perform the contract (where possible) or terminate the contract, with losses and damages.

[140] Although this issue is originally linked to data protection in centralized systems, it is a very important issue that should be analyzed from the perspective of the General Law for the Protection of Personal Data (LGPD or LGPDP), Law No. 13.709/2018, mainly in relation to the right to anonymization, blocking or elimination of data, which may run into and harm Fundamental Rights established and protected by the Citizen Constitution (CRFB). More. It is necessary to raise the level of discussion by separating the types of Blockchain and the types of data processed (personal or non-personal), as seen in this paper.

[141] [...] takes the form of a legal fact as a requirement for the validity and effectiveness of the electronic contract depending on the business circumstances. (Literal translation).

In other words, due to its hybrid composition - of interpersonal and intersystemic means - there is no possibility of the contract being completed, nor of forcing it, without the expression of the acceptance of one of the parties.

Here, before the concrete case, silence cannot be recognized as a manifestation of will since, considering its practical use, it is not apt to create the conviction that there was consent.

3.8 Electronic Signature (ICP-Brasil)

Smart contracts are characterised, in short, by a construct involving a data programming phase, followed by the verification and electronic execution phase of the contract.

The data programming phase occurs through programming language (algorithmic), which brings as benefits higher degree of probability of inviolability. This process involves cryptography and proof of work, as seen the operation of the Blockchain.

In the programming phase, the parties outline the contractual instrument, listing rights and obligations. In the words of Rodrigo Fernandes Rebouças:

> [...] estas obrigações serão eletronicamente verificadas, tal como, o pagamento e/ou a entrega de todas as demais obrigações contratuais, tais como a liberação de garantias, pagamento do preço, remessa do produto ao comprador, etc. (REBOUÇAS, 2018, p. 129).[142]

For this reason, in relation to the classification of smart contracts as an electronic contract, it can be said that the medium used is hybrid, and is shaped in relation to the interpersonal contracting medium at first and then the intersystemic contracting medium.

Given that one of the characteristics of smart contracts is the coding (or programming) of the data relating to the contract, the interpersonal phase is configured at first.

Consequently, the second phase is succeeded by the intersystemic phase, responsible for the execution of the contract itself, in an "automatic" manner, since there is no direct interference by the legal subject at this stage.

It is important to highlight that, in relation to the proof of the declaration of will, as well as its respective validity, due to the ecosystem to which the smart contract belongs - Blockchain - the proof of the contracting elements (including the declaration of will) becomes crystal clear, since they are recorded in a decentralized chain of blocks, unalterable, and with time stamp (timestamping), which makes the smart contract endowed with a high degree of legal certainty.

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[142] [...] these obligations shall be electronically verified, such as the payment and/or delivery of all other contractual obligations, such as the release of guarantees, payment of the price, delivery of the product to the purchaser, etc. (Literal translation).

In addition, in relation to the declaration of will, to ensure certainty with the issuer and other issues relating to the data and information in the contract, smart contracts use the electronic signature.

As seen in the previous topics, the electronic signature is a way to guarantee the integrity of the electronic document, as well as the recognition of its issuer through asymmetric cryptographic methods[143] and the use of keys[144] (public and private), which, although different from each other, allow the reading of the content only by those who have a corresponding key[145].

However, as warned by Rodrigo Fernandes Rebouças (2018, p. 132), electronic signatures alone cannot guarantee that absolute fraud is avoided. In this sense, he recalls that "[...] a solução para esta questão está na utilização de certificado digital"[146].

Fabiano Menke adds on the subject:

> O certificado digital é uma estrutura de dados sob a forma eletrônica, assinada digitalmente por uma terceira parte confiável que associa o nome e atributos de uma pessoa a uma chave pública. O fornecimento de um certificado digital é um serviço semelhante ao de identificação para a expedição de carteiras de identidade, só que um certificado é emitido com prazo de validade determinado. (MENKE, 2005, p. 49).[147]

Also, as seen in previous analyses in this work, Provisional Measure 2,200-2 - which instituted the Brazilian Public Key Infrastructure - expressly provides for the possibility of digital certification not issued by ICP-Brazil, provided that it is accepted by the parties as valid or accepted by the person (natural or legal) to whom the document is opposed. Such signature is not a requirement of validity of electronic contracts, and consequently, of smart contracts.

Thus, the smart contracts have the characteristic of presumption of authenticity and identification of the contracting parties, and as mentioned by Rodrigo Fernandes Rebouças (2018, p. 133), it is also "[...] instrumento hábil para dar ensejo a ação de execução de títulos extrajudiciais"[148].

As the electronic signature is intended for the unequivocal identification of the signatory, in the event of disagreement between the person appearing on the signature of the contract and the

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[143] According to MARCACINI (2002, p. 27): "Asymmetric cryptography has this name because of the asymmetry between its key pairs. This key pair is generated by a computer program from the use of complex mathematical calculations, so that "two numbers can be found that are so related to each other that they serve one as a public key and the other as a private key".

[144] Such keys are fixed-size combinations of letters and numbers that are automatically generated by a software after a mathematical calculation process.

[145] In practice, the public key is used to encrypt the document; the encrypted version sent by the network can only be deciphered by using the private key. In other words, it is necessary to share the public key. Likewise, it is possible to encrypt using a private key, which can only be deciphered by using a public key. If there is no misuse of the private key, the document really has the origin it appears.

[146] [...] the solution to this issue lies in the use of digital certificates. (Literal translation).

[147] A digital certificate is a data structure in electronic form, digitally signed by a trusted third party that associates a person's name and attributes with a public key. The provision of a digital certificate is a similar service to that of identification for the issuance of identity cards, except that a certificate is issued with a specified expiration date. (Literal translation).

[148] A skillful instrument to give rise to the action for enforcement of extrajudicial titles. (Literal translation).

person appearing on the certificate, we are faced with a situation where the validity of a document is questionable. However, as stated by Rodrigo Fernandes Rebouças (2018, p. 134), the conduct of the parties may supply such divergence, in which case there is no need to question the validity or otherwise of the contract because "[...] tal alegação resultaria na indevida atuação contrária aos seus próprios atos – *venire contra factum proprium*"[149].

It is therefore clear that the way in which wishes are expressed through the use of electronic signatures is fully valid for the formation of the smart contract, and is also a way of ensuring greater legal certainty.

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[149] Such claim would result in undue action contrary to their own acts - *venire contra factum proprium.* (Literal translation).

4. FINAL CONSIDERATIONS

It cannot be denied that the current technological wave experienced in several countries of the world is evidently much faster than others that preceded us in history.

In the current historical moment, we experience that scientific dynamism is necessary for the law to accompany the development of contractual relations.

In this sense, new technologies should be the subject of research by legal operators, since many of them have a certain degree of connection with the science of law[150], as is the case of Blockchain, through smart contracts.

When we think about them, we must above all understand how existing concepts and structures can be transported to this new technology.

On the preceding pages, the reader found a description of the Blockchain and an outline of the Blockchain in the field of law with regard to smart contracts.

Depending on the problem presented, the proposals made regarding the formation, formalization and execution of smart contracts are innovative and capable of changing the current conception of contracts created through traditional means/instruments, although they also serve as a means of implementing a will agreement between the contracting parties.

In them, through the technique of cryptographic protocols, it is guaranteed that the information contained in the contract is not altered, but that it is available for public consultation, despite the fact that the data can only be read by those who have the respective key to access them.

Furthermore, through an in-depth analysis, we understand that even in the absence of rules expressly applicable to smart contracts, they must be subject to the doctrinal scrutiny, the legal standards in force and also the general principles of law.

Thus, from the Brazilian Theory of Contracts and the Theory of Legal Business, we see that smart contracts do not constitute a new type of contract, since they can be checked and classified as electronic contracts, given the use of electronic means for their formation.

Within the private law model, smart contracts are likely to face strong crises of confidence in contracts, where they tend to be seen as an opportunity to expand the capacity to conduct legal business, maximizing results[151] such as reduced costs and increased transaction speed.

In this perspective, it can be said that smart contract has the ability to improve in relation to electronic contracts, especially with regard to the search for quality, efficiency, security and reliability, inherent to the Blockchain.

Therefore, even though they are not a new type of contract, smart contracts represent a "new" way of contracting, which is capable of producing legal effects in a valid manner, a matter

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[150] Law as a science has as reference the thought of Hans Kelsen, in the beginning of the twentieth century, when the publication of "Pure Theory of Law" in the year 1934.
[151] It is assumed that the best outcome of the contract is its optimum point or, in other words, the one that keeps the closest relation to the agreement smoothness.

that is not confused with the verification of the validity of the legal transaction of the case in concrete and with the resulting consequence provided for by art. 169 of the Civil Code of 2002.

However, like any other electronic contract, they have characteristics common to contracts of this type, which are, the scarce legislation, the flexibility of the concepts of time and space, as well as the dispensability of physical means/instruments (such as paper).

Passing through the doctrinal frameworks, we conclude that smart contracts are true agreements of wills, which formalize the legal business through a Blockchain network.

These agreements - in addition to binding the parties - are potentially self-executable and allow, for example, that the automatic payment occurs from the fulfillment of a certain condition, foreseen in the code of the contract, which in this case is written in programming language.

Its main peculiarity is that this new way of contracting establishes a hybrid form between intersystemic and interpersonal electronic contract, since it is developed in two phases[152].

Its qualities are reflected by the qualities of the Blockchain technology, which are: possible cost reduction, possible increase in degree in relation to legal security and immutability, the latter being debatable due to possible programming errors or the incorporation of poorly elaborated provisions, which could generate civil liability.

After analyzing the requirements of existence, validity and effectiveness, it is stated that general rules of contract law will apply to smart contracts, as well as specific principles of electronic contracts, such as functional equivalence.

Furthermore, it is possible to question the fact that its implementation - resulting from computational language - may bring possible difficulties of interpretation by the parties and, also, by the Judiciary Power in case of contratual dirigisme, since although Law No. 13.874/2019 adds the sole paragraph to art. 421 of the Civil Code of 2002, it is still possible contractual review and intervention in contracts, even if in a minimal way in private contractual relations.

Perhaps one of the greatest challenges does not necessarily have to do with legal issues, but rather with the eventual conflicts between the functioning of the contract code and, by the way, the way people contract.

In this sense, it is prudent to encourage that despite being prominent, smart contracts do not tend to eliminate the default of contracts, despite the fact that they can potentially reduce them, even because the Blockchain is unable to control, for example, the effects of real life, such as defects in the thing and the delay in the harvest.

From a practical point of view, due to the need for knowledge of very specific techniques, it can be seen that, also for this reason, their adoption may be hindered.

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[152] Since one of the characteristics of smart contracts is the coding (or programming) of the contract data, the interpersonal phase is set up at first. Therefore, the second phase is succeeded by the intersystemic phase, responsible for the execution of the contract itself, in an "automatic" way, since there is no direct interference of the legal subject at this stage.

In addition, several issues may emerge from this study with the purpose of adjusting the development of technology, such as issues of international law, applicable rules and lawfulness of objects.

We must remember that, In any operation of gathering, storage, custody and treatment of records, personal data or communications by connection and internet application providers in which at least one of these acts occurs in national territory, the Brazilian law and the rights to privacy, protection of personal data and the confidentiality of private communications and records must be mandatorily respected, as established in article 11 and other provisions of Law No. 12,965 of 2014 (Brazilian Civil Rights Framework for the Internet).

The adoption of Blockchain smart contracts is a great challenge, because they are capable of transforming the social structure in which we live, mainly because they change hierarchy and the coordination of processes through decentralization.

The issue becomes even more relevant when the absence of a "central authority" to resolve these conflicts and propose a return to the *status quo ante* is pointed oct. Any attempt to resolve conflict based on the declaration expressed in the contract by the parties (literality), will be configured as incongruous, since art. 112 of the Civil Code establishes the prevalence of the intention of the parties over the literal meaning of language.

In this sense, we must also stick to the inclusions made to article 113 of the Civil Code, brought by Law no. 13.874/2019, which states in paragraph 1 that the interpretation of the legal transaction must attribute to it the meaning that the interpretation of the legal transaction must attribute to it the meaning that is confirmed by the behavior of the parties after the execution of the transaction; correspond to the uses, customs and practices of the market related to the type of transaction; correspond to good faith; is more beneficial to the party that did not write the provision, if identifiable; and correspond to what would be the reasonable negotiation of the parties on the matter discussed, inferred from the other provisions of the transaction and the economic rationality of the parties, considering the information available at the time of its execution, considering the information available at the time of its execution.

Furthermore, despite enabling the parties to compromise as in a parity contract, smart contracts may also use the contractual technique of adhesion when using pre-drafted clauses in their templates, in cases in which there is a trace of standardization, at which time they should also be analyzed from the perspective of Law 8884/1990, especially with support in art. 54, *caput*, and paragraph 3.

As can be seen, the interest in smart contracts is significant among legal scholars, because it is worthy of encouraging important questions and also of providing public discussion.

Therefore, it cannot be denied that the Blockchain has been speculated as a solution applicable to a multitude of challenges, including in relation to contracts.

Given the importance of the various issues explored here, with special attention to the challenges of provisioning, codification and implications, it is essential to take smart contracts to the scrutiny of stakeholders.

Innovations should not be a cause for immediate alarm, but should encourage scholars to observe with caution the changing phenomena and, if necessary, be able to propose changes to the measure.

Certainly, the change of records and record-keeping processes made in a traditional way - on paper - to the digital environment still depend on a lot of work and, especially, on human approval, which is why they will continue to exist for a long time to come.

Even in the best-case scenario, we should not overestimate technology in the short term, nor underestimate it in the long term.

Let's take Blockchain smart contracts seriously!

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