# Blockchain Constitutionalism

*Morshed Mannan, Primavera de Filippi, Wessel Reijers*

# I.   Introduction

The Nomic game was introduced by the philosopher Peter Suber. In the game, players vote to create a system of rules, including rules about the making and amending of rules. The game illustrates one of the fundamental challenges of legal systems: the *paradox of self-amendment*. Suber asks about the amendment clause of a constitution: "[m]ay a rule that permits the change of other rules also permit its own change, especially its irrevocable change into a form inconsistent with its original form?" (Suber 1990: 11). The self-contradictory and illogical character of irrevocable constitutional amendment clauses derives from the fact that they provide an opening to modify and replace the amendment clause *itself*, thereby creating the possibility of abolishing their own basis of existence. Yet, if an amendment rule cannot be used to amend itself, it will prevent any future legislative or executive power to revise the constitution, leading to potentially undemocratic outcomes. The paradox of constitutional amendability is also closely related to sovereign power. If a sovereign is truly omnipotent in the Schmittean sense, then it should be able to change everything in a legal order – including an irrevocable amendment rule (Suber 1990: 73). In other words, constitutional unamendatibily is inherently at odds with the existence of an omnipotent sovereign.

According to Suber, the legal order cannot fully defeat this paradox, but can nonetheless domesticate it. In line with Hart (Suber 1990: 26), he argues that, empirically, legal rules often logically contradict each other, yet this does not lead to the collapse of the legal order, nor does this threaten its legitimacy. The validity of the law is not derived from its internal logical consistency or abstract correctness, but rather "is a matter of power and social practice" which implies acceptance by legislators, judges and the public at large (Suber 1990: 278). This means that even the highest-order rules, like those established in a national constitution, are only *contingently immutable*, and not *categorically immutable*. Even unamendable provisions (also referred to as 'eternity clauses'), which prohibit amending certain constitutional provisions, can be modified by future generations through a replacement of the constitution via peaceful or revolutionary means. Suber, therefore, asserts that there is only a difference in degree between regular repeal procedures and outright revolutions, for all rules—regardless of their level of entrenchment—can eventually be repealed.

Suber's 'Nomic' game simulates a legal system that allows for self-amendment. Yet, the validity of its rules, according to Suber, is contingent on the agreement of the humans participating in the system. Nomic influenced the design of the Tezos blockchain, a billion-dollar market cap blockchain network which constitutes one of the most ambitious attempts at achieving full 'on-chain' governance (Goodman 2014). Tezos aims at creating a system where the rules governing the behaviors of participants in the blockchain network are fully determined by the logic of the blockchain protocol (De Filippi and McMullen 2018). By defining immutable 'rules to change the rules' (i.e., *secondary rules*), Tezos necessarily has to grapple with the paradox of self-amendment. Yet, while laws written in natural language can more easily cope with ambiguities and internal inconsistencies, the rules of a blockchain protocol - written in the strict, inflexible language of code - must remain internally logical and consistent, not only as a matter of convenience, but also as a matter of practicality.

But even the most fundamental rules sometimes need to change. In principle, Tezos, like Nomic, allows for this evolution to happen, as participants in the network can propose and vote upon protocol upgrades. However, in contrast to the law, human acceptance is not enough to guarantee the validity of the system. The Tezos protocol (like any other software system) also needs to be logically consistent in order to be operational. As a consequence, blockchain protocols are subject to the

self-amendment paradox posed by Suber, as a lower-order 'rule' (i.e. smart contract code) will not be able to function if a higher-order 'rule' (i.e. the blockchain protocol) is irrevocably irrevocably amended in a way that would break this consistency. While such contradictions can be tolerated—or 'domesticated' in Suber's terms—within traditional legal orders, they cannot be easily accommodated within the technological legal order of blockchain technology, which we refer to as the *rule of code* (De Filippi, Mannan, and Reijers 2022).

The *rule of code* enacted by blockchain technology stands in sharp contrast to the *rule by code* that prevailed in an era of large online platforms. In the early days of the Internet, Lessig (2000) coined the term '*code is law*' to explain how rules embedded in software code can shape and influence behavior in a similar way to the law (Grimmelmann 2005). Yet, the code deployed by centralized online platforms is subject to the whims of external authorities—both the platform operators and governments where these operators are domiciled. Hence, in systems subject to *rule by code,* a sovereign can instrumentalise code in order to serve its own interests. For instance, the Facebook platform has a 'functional sovereign', Mark Zuckerberg, who through his 'agents' (e.g., content moderators) may arbitrarily remove any content or user from the platform (Klonick 2018; Pasquale 2017; Chander 2012), provided that this is done in accordance with the laws of the jurisdictions in which Facebook operates. Similarly, AgoraNomic has a webmaster who in principle has the power to shut the website down.

The *rule of code*, in contrast, describes how a technological system can be designed in a way to eliminate, or substantially reduce, the arbitrary power of any single sovereign authority. Open, permissionless blockchains simultaneously enacts and limits the sovereign power that acts through them. In this context, code is used to fulfill one of the fundamental goals of the *rule of law,* where a government is ruled in accordance with the law, and itself ruled by the law. Hence, instead of code being instrumentalized to implement the will of an external sovereign as per the rule by code, in the *rule of code*, the code is - at least in theory - the ultimate sovereign authority (De Filippi, Mannan and Reijers 2022). For this reason, some authors have likened the on-chain governance rules of many blockchain-based systems to constitutional orders, insofar as they enshrine secondary rules that establish (technical) limits on the use of sovereign power (Alston 2020). More recently, blockchain governance is experiencing a new wave of *constitutionalization* whereby on-chain governance is paired with off-chain governance by means of external covenants and codes of ethics drafted in natural language (Tan et al. 2023).

Blockchain technologies has thus been described by a few authors as a new form of constitutional ordering (Alston 2020, Alston et al. 2022; Berg et al. 2020; Rajagopalan 2018). But what is the normative stance adopted by blockchain communities seeking to create these new *constitutional* orders? This chapter seeks to address this question by engaging with the evolving literature on '*societal constitutionalism*' and '*digital constitutionalism*'. Societal constitutionalism (Golia and Teubner 2021; Teubner 2012) argues that constitutional orders are not only produced 'top down' from political actors, but also 'bottom up' from societal actors (e.g., private enterprises, NGOs, multilateral agencies). Digital constitutionalism (de Gregorio 2022, 2021; Celeste 2019; Suzor 2018) also fits within this framework, but focuses in particular on the constitutional questions raised by the concentration of private power in the hands of large transnational online platforms (e.g., Google, Facebook, Amazon) and how rights and principles from liberal state constitutions (e.g., due process, rule of law) can be enshrined into these platforms. As discussed in the subsequent section, we distinguish between *exogenous* digital constitutionalism and *endogenous* digital constitutionalism in describing the pressures that act upon these online platforms.

The next section provides a concise overview of the functional purposes of a (state) constitution, the distinction between formal constitutions and material constitutions, and how constitutionalism has been embraced and (re-)articulated by scholars of societal and digital constitutionalism. The following section applies insights from constitutional theory to blockchain technology, aiming to conceptualize what constitutes the constitution of a blockchain-based system, with reference to both on-chain and off-chain governance rules. It focuses on the case of TheDAO attack in order to highlight the potential contradiction between the formal and material constitution of a blockchain system, and how - even in a blockchain system - the material constitution always exercises pressure on the formal constitution. The paper thus argues that, in order to ensure the legitimacy of blockchain governance, it is important to formalize and codify the off-chain constitution of blockchain-based systems, by means of formal constitutions written in natural language that can more accurately reflect the principles and social norms of blockchain communities.

# II.    Constitutionalism

While providing a precise definition of what constitutes a constitution might be a challenging task, because of the multiple ways in which the term is used, from a functional perspective, it is possible to identify a general commonality: a constitution establishes governance institutions and defines their corresponding affordances and constraints, and includes entrenched rules whose modification is more difficult than the amendment of regular governance processes (Hardin 2013: 64; Ginsburg and Melton 2015: 688).

Constitutions are typically used for the creation and design of organizations, ranging from states and transnational networks to small clubs and business organizations. A constitution sets out 'primary rules' that oblige the organization (specifically its organs and functionaries) to perform certain duties and functions (i.e., substantive rules of conduct), and 'secondary rules' that determine how primary rules are to be ascertained, enacted, amended, or repealed. Secondary rules (such as Suber's amendment clauses) confer validity to primary rules by establishing how these rules are constituted, while remaining agnostic about their content (Besson 2012: 385). Together, primary and secondary rules enable collective action and decision-making, while establishing affordances and constraints to the organs to whom decision-making powers have been delegated.[1]

In most constitutions, rules are accompanied by a set of principles that represent an organization's core values. These principles are generally not enforceable in the same way as rules are, because they lack specificity.[2] Rules are more clear-cut and easy to codify, while principles are more vague and require interpretation to be applied, yet they serve an important guidance function for the judiciary and other governance institutions. The rule that lays down the parliamentary quorum for enacting a constitutional amendment is thereby distinct from the constitutional principle for the protection of free speech. Sometimes, the dividing line between rules and principles is not easy to draw. Consider, for instance, the doctrine of proportionality which lays down a set of rules for validating or invalidating legislation or actions that constrain the exercise of constitutionally-protected human rights, while also denoting substantive standards or principles for determining whether these constraints are necessary or sufficient (Bendor & Sala 2015; Barak 2012).

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[1] We thank Eric Alston for underscoring the importance of this aspect of constitutions.
[2] According to Raz, "rules prescribe relatively specific acts; principles prescribe highly unspecific actions" (Raz 1972: 838).

While most states *have* constitutions, the question of traditional *constitutionalism* relates to whether states *ought to* have constitutions in order to be perceived as legitimate, and what is the scope of these constitutions. A minimalist approach to constitutionalism suggests that rules should be put in place to limit the power of the sovereign (i.e., the holders of political offices) (Arato 2017: 6)—these include both primary rules establishing fundamental rights and secondary rules establishing, amongst other, separation of powers and independent judicial review. A maximalist approach to constitutionalism might add a variety of other protections, such as e.g., the protection of minority rights. The following sections draw upon existing scholarship on constitutionalism and constitutional theory in order to explore the function and scope of constitutions in existing institutional frameworks.

## 1. Material and Formal Constitutions

According to interwar constitutional theorists like Hans Kelsen, Herman Heller, and Constantino Mortati, constitutions can be subdivided into two core parts—a *formal constitution* and a *material constitution*—both coexisting in a legal order with different degrees of alignment to one another. This distinction is important to appreciate for better understanding the nature and logic of constitutional development. The formal constitution consists of the rules which have been 'codified' into a particular medium; set out in a single solemn written document (as in France), or across several sources (as in the United Kingdom) (Kelsen 1945). The formal constitution specifies secondary rules (*i.e.*, rules to change the rules), distinguishing between constitutional amendments and ordinary legislative changes (Arato 2017: 4). The material constitution has a more contested definition. For Kelsen, the material constitution is connected to the 'basic norm' that underpins the logical functioning of the whole legal order (Kelsen 1945: 124; Colon-Rios 2020: 199-202); its core function is to confer and constrain the powers of the apex organs of the state (e.g., the three branches of government) (Vinx 2021: 473). All legal orders have material constitutions and sometimes, material constitutions are codified into a formal text in order to be made more explicit (Vinx 2021: 473-474). The authority of the formal constitution ultimately rests on its alignment with the material constitution (Colon-Rios 2020: 214). However, because of the inherent limitation of codification and the specificities of natural language, the formal constitution can be both under-inclusive and, in some cases, over-inclusive with regard to the material constitution it was intended to codify.

Kelsen's definition of material constitution has been criticized for being incomplete as, according to Kelsen position, social and political forces are not in themselves relevant for understanding constitutions. Kelsen's definition doesn't adequately account for constitutional conventions and practices that are often omitted in written constitutions, or the breakdown of political authority that constitutions are often subject to (Goldoni and Wilkinson 2022: 19; Arato 2017: 6). In contrast, Marxist theoreticians have argued that the material constitution encompasses all the "actual relations of forces" pressing against the formal constitution and governance system (e.g., working class struggles) (Lasalle 1862 [1942]). An important distinction between these two views is that Kelsen's positivist 'legal' interpretation does not account for *constituent power*, i.e. the power of the people to create new legal-political orders, including constitutions, with the source of this power being outside of the purview of the law and thus incapable of legal regulation (Colon-Rios 2020: 4). Some philosophers have deemed the exercise of constituent power to be so exceptional and revolutionary that it defies definition:

> "[c]onstituent power cannot be defined by the legislator or formalised by the philosopher. It breaks the framework of constitutions and cannot be confined within a book. When it appears,

it is like lightning sundering the bosom of a cloud. It inflames the atmosphere, finds its victim and then disappears" (Cortes 1970 in Cristi 2000).

In contrast, Marxist and other 'sociological' interpretations consider constituent power to have a more persistent presence, even beyond the founding moment of a legal-political order. Constituent power protects material constitutions from arbitrary acts by organs of government, including those that can amend the formal constitution (Colon-Rios 2020: 187). At the same time, it is constituent power that can *replace* a constitution altogether, irrespective of whether a formal constitution contains unamendable clauses, and produce a new constitution with new content (Colon-Rios 2020: 191, 193). Sociological interpretations have in turn been been critiqued as being too "reductionist", for reducing the law to a mere ideological tool for power-holders, and for being vague as it potentially encompasses all of society within its definition (Goldoni 2019: 73).

Both the legal and sociological interpretations of material constitution have value for understanding democratic constitutions (Vinx 2021: 471). In light of that, the material constitution has recently been defined in a manner that accounts for both interpretations, as a:

> "set of concrete ordering forces, namely political unity, bearing institutions, social relations and fundamental political objectives, which make up the constitutional order. In other words, it is the material that constitutes, and is constituted by, the formal process of constitutional law and the relation between them." (Goldoni and Wilkinson 2022: 1)

In general terms, while the formal constitution constantly strives to reflect the material constitution, it often fails to do so (Arato 2012). Indeed, given its dynamic and ever-evolving nature, there are always aspects of the material constitution that are not properly articulated in a formal constitution. As a consequence, the constituent power animating the material constitution can seek closer alignment with the formal constitution and exert direct or indirect pressure onto the formal constitution. Conversely, material constitutions could also be jeopardized by actions of government actors—such as through breaches of fundamental rights—and the function of 'emergency' clauses in formal constitutions is intended to protect the material constitution (Schmitt 2008: 80-81). These clauses can be triggered by a sovereign to suspend disruptive actions and restore the material constitution, thereby absorbing the exception into normal social order (Goldoni 2019: 77).[3] In other words, the formal constitution can also support the material constitution.

Certain provisions of the formal constitution may be deeply entrenched (Roznai 2013), stymying efforts at democratic reform through legislative means. These provisions may be *indefinitely* entrenched (i.e. when no mechanisms are provided in a constitution to amend them) or only partially entrenched, if additional voting thresholds (e.g., supermajority) and procedures are available to amend these provisions (Albert 2010: 670-672). Were the formal constitution not to appropriately reflect the material constitution, entrenched clauses might potentially lead to attempts at replacing the constitution in its entirety (Elkins, Ginsburg and Melton 2012, p. 82), provided that most parties believe they will be better off under a new constitutional arrangement (Elkins, Ginsburg and Melton 2012, p. 7). This can most vividly be seen in the context of dramatic socio-political changes, like the fall of a dictatorship, where the impulse towards democratization comes into conflict with the constitution of the old regime. For philosophers like Carl Schmitt, there were differences in how the material constitutions could be changed compared to formal constitutions. Unlike amendments to the formal constitution, which could be made through ordinary legal processes subject to any existing unamendable clauses, the material constitution could only be changed by constituent power through

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[3] Of course, there are many instances in which emergency powers are used to repress the 'will of the people'.

any means they see fit (Colon-Rios 2020: 205). Others, like Mortati, considered there to be hard limits to changes in the material constitution even by the constituent power, as the "fall" of the material constitution amounted to a "fall of the state itself" (Colon-Rios 2022: 221-222).

## 2. Digital & Societal Constitutionalism

While the concept of constitutionalism has traditionally been bound up in Weber's idea of sovereignty vested in the state in light of its monopoly over violence, multinational corporations and other private actors have also become relevant for constitutional theory. The concentration of power in the hands of multinational corporations, particularly in the digital economy, brought new "constitutional questions for the principle of rule of law and democracy" (De Gregorio 2022: 298-299). These multinational corporations are challenging some of the key constitutional principles in liberal democracies, such as freedom of expression, leading to heated debates about the role of private actors in upholding constitutional rights. Yet, as the vast majority of these companies, such as Google, Facebook or Twitter, have their primary registration in the United States, they benefit from an expansive reading of the First Amendment (i.e., protection of freedom of speech) by both the US Supreme Court and the executive branch. Besides, the fact that constitutional rules do not create obligations on private actors further curtails the power of the state to intervene in how these online platforms are governed (de Gregorio 2022, 310, 313).

Let's consider content moderation on a platform like Facebook more closely. For a large part, this happens automatically, by means of machine learning algorithms that sift through flagged material. Human content moderators still play an important part, but this is likely to be reduced in the future (cf Gillespie 2020). On top of that, Facebook has established an 'Oversight Board' to deal with the most problematic cases, which also sets precedent and is therefore argued to be part of the *Lex Facebook* (Golia 2021). When Facebook intervenes in platform governance, it leverages the performative nature of code, for instance to suspend or delete a user account. It does not need to send in the police or use physical force, it can simply act by virtue of its coded legal system; an extension of earlier practices like Digital Rights Management. Yet, by doing so, it also potentially affects constitutional principles that protect the rights of its users, who are also citizens of certain territorial jurisdictions. One of these principles that is potentially violated is that of free speech: when Facebook acts to shut down a user account in line with its *Lex Facebook*, it might also violate the user's right to free speech under the protection of a state constitution. While a US court may consider Facebook not to be subject to constitutional rules upholding freedom of speech, despite it being used by public officials and being an important forum for public discourse, courts in other jurisdictions may horizontally extend the protection of fundamental rights and freedoms to include private actors.

The challenge posed to constitutional theory by the proliferation of powerful actors in the digital economy has been taken up under the heading of 'digital constitutionalism' (Celeste 2019). One interpretation of digital constitutionalism is as a concept that captures the suite of regulatory efforts underway to ensure that private actors, such as social media platforms, conform to certain core values like human dignity (de Gregorio 2022; 2021). We describe this as *exogenous digital constitutionalism* as it is a concept informed by how external constitutional actors, such as states or supra-nanational entities like the EU, perceive the constitutional impact of online platforms.

Another reading of digital constitutionalism draws on 'societal constitutionalism' (Golia & Teubner 2021) and we describe this as *endogenous digital constitutionalism*. The proposition of societal constitutionalism has been to look at the empirical reality of sociological phenomena at the

transnational level and identify trends of constitutionalisation beyond the nation-state. Societal constitutionalism is thereby offered as a new approach to construct and answer the constitutional problem in the context of globalization (Teubner 2012). Societal constitutionalism as a legal theory considers that two distinct types of constitutions emerge "outside the limits of the nation-state", the first emerging from *"institutions of international politics"* and the second in the previously cited "private" sectors of global society (Golia and Teubner 2021: 359). In such a framework, we can quickly identify large social media platforms like Facebook. Taking a systems theory perspective, societal constitutionalism argues that globalisation has generated interdependencies that have taken away agency from states and distributed it amongst societal actors, like Facebook. These societal actors possess agency within the global order and act transnationally across multiple jurisdictions (Mannan & Schneider 2021), the effects of which cannot simply be undone through state violence.

The reading of digital constitutionalism[4] informed by societal constitutionalism is both descriptive, in arguing that entities operating digital ecosystems like Facebook *have* their own constitutional order, and normative, in arguing that this order *ought* to be constitutional in nature by drawing on best practices from existing states. As such, this interpretation of digital constitutionalism is sometimes regarded as an "ideology that adapts the values of contemporary constitutionalism to the digital society" (Celeste 2019: 76). The installation of an oversight board to 'adjudicate' over controversial content can, for instance, be seen as an effort to instill constitutional procedures and constitutional principles like the separation of powers (Klonick 2020). Hence, not only nation states but also institutions like Facebook generate their own constitutional law and constitutional orders.

Authors differ on what the constitutional values of these orders ought to be, but the literature on digital constitutionalism takes a pragmatic stance by investigating the application of values that are generally (though not categorically) accepted as 'constitutional' in liberal democracies, such as due process and meaningful consent (Suzor 2018: 5-7). Respecting these principles and incorporating these rules from traditional constitutions ought, according to this view, not be at the discretion of an elite individual (like Mark Zuckerberg or Elon Musk) but rather of a 'rule of law' legal framework that limits the sovereign power of entities (and their executives) operating in the digital realm - most notably large online platforms. To shape constitutionalism in the digital realm, some authors have proposed a constitutional framework that supports (1) norms that recognize digital technology as an enabler of fundamental rights (e.g., a right to Internet access), (2) norms that limit fundamental rights violations (e.g., data protection regulations), and (3) norms that establish a balance of power (e.g., giving co-decision rights over platform regulation to citizens) (cf. Suzor, van Geelen, & West 2018).

These three approaches to bolster digital constitutionalism make a lot of sense in the 'Web 2.0' paradigm, characterized by the predominance of large online platforms. Yet, the focus of exogenous digital constitutionalism on intervention from the outside makes less sense when considering the decentralised 'Web 3.0' paradigm, in which blockchain technology and technological decentralisation plays a major role. The reason is that sovereignty in open, permissionless blockchain systems is distributed and a policy maker cannot simply pick up the phone and talk with the CEO of Ethereum to negotiate a new policy for user co-decision making. Rather, sovereignty is distributed between the technology and human participants acting through it. The 'matter' that blockchains are made of—namely software code—is increasingly important as a co-determinant of human

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[4] There are many critics of constitutionalism beyond the state. Their core contention is based on the alleged incapacity for constitutional processes beyond the state of relying on a "social substratum" to which the nation-state claims legitimacy through citizen's general acceptance of the constitutional order (Cotterrell, 2016). In this vision, a global constitutional theory can only be a set of normative hierarchies that would regulate transnational phenomena beyond the State, unless a global and unique constitution were to be adopted.

organizations. It is different from written laws or rules because it is both descriptive and performative: it needs no human utterer or reader to constitute a 'speech act', it can do so autonomously. In other words, code has the capability to make the word and the act coincide (i.e., what it says, it can simultaneously do) (Diver 2021). Code is therefore a technology that allows humans to delegate certain legal operations, pretty much like the mechanism of a vending machine allows for a delegation of a sales contract (Szabo 1996). As a consequence of this delegation, and the technical properties of blockchain systems outlined in the subsequent section, it is difficult to directly impose legal obligations on a blockchain protocol (as opposed to individual network participants) (De Filippi, Mannan and Reijers 2022b).

In other words, even though external constitutional constraints can be aimed at the 'constitutionalisation' of blockchain systems, self-imposed internal constitutional constraints are arguably the most important levers for changing (the effects of) blockchain systems. Unlike actors within the Web 2.0 paradigm that are concerned with legality and being perceived as legitimately governed by external entities (i.e., exogenously legitimate), actors within the Web 3.0 paradigm are primarily concerned with being perceived as legitimately governed by network participants (i.e., endogenously legitimate) and may introduce constitutional constraints to secure this perception. For this reason, 'blockchain constitutionalism' constitutes a unique species and cannot be subsumed under the current heading of 'digital constitutionalism.'

# III.   Blockchain Constitutionalism

Let us first turn to the question of what sets blockchains (and their constitutional orders) apart from applications living on centralized Internet servers. A blockchain is a distributed digital ledger containing an ordered list of transactions  that are cryptographically signed and disseminated through a peer-to-peer network. Some nodes in this network, usually referred to as 'miner' or 'validator' nodes (depending on the chosen consensus mechanism) are responsible for the creation of new 'blocks' of time-stamped transactions—which must be cryptographically valid and mathematically compatible with  all previous transactions in the chain. In Bitcoin's proof of work algorithm (Nakamoto 2008), the creation of a new block of transactions requires an increasing amount of computational power,  which increases as the number of contributors in the network grows. Albeit relatively costly in terms of energy, this contributes to ensuring the security of the blockchain network, as anyone eager to tamper with the data recorded on the blockchain would have to have access to huge amounts of computational power to overrule the majority of the network (the so-called 51% attack) (De Filippi, Mannan, & Reijers 2020). Since Bitcoin, different versions of blockchain architectures have emerged—such as Ethereum, which has recently moved from 'proof of work' to 'proof of stake' (where participation in the operations of the network is not based on the amount of computational power but on the amount of tokens staked by each validator node) (Ethereum 2022).

Regardless of the chosen consensus algorithm, all open permissionless blockchains have at least the following characteristics in common: (1) they are *distributed*, at the technical level; (2) they operate *transnationally*, across borders; (3) they are *tamper-resistant*; (4) they operate with *pseudonymous* identities, and (5) they *preclude the possibility of unilateral manipulation* or control (De Filippi, Mannan, & Reijers 2022). The first and still dominant use case of blockchain technology is digital cash, which translates into a great variety of cryptocurrencies. Yet, more use cases have emerged, in particular with the advent of Ethereum, a general-purpose blockchain protocol which allows for the creation of decentralized applications (DApps), decentralized autonomous organizations

(DAOs), as well as secure and distributed name registers. Many blockchains today enable the creation of 'smart contracts', i.e. self-executing conditions written in software code. Because of the versatile nature of these applications, blockchains hold out the promise of eventually competing for dominance with traditional Internet applications like the ones run by large platform companies.

Most blockchain applications today serve mostly a commercial function, for instance as investment vehicles or gambling platforms — for which it might make little sense to consider political constitutional constraints (e.g., establishing a separation of powers) and existing forms of corporate governance may be more suitable for the governance of these platforms (Davidson and Potts 2022). Yet, as organizations like Facebook illustrate, constitutionalism and politics might be relevant for specific applications that have public functions which are not easy to exit from, and might therefore need to be held accountable for a greater degree of legitimacy (Schneider 2022). While still in their embryonic stage, already a substantial number of blockchain-based systems touch upon public functions—be they related to monetary sovereignty (e.g. cryptocurrencies), infrastructural provision (e.g. funding networked infrastructures and resources), political activities (e.g. elections or other decision-making systems), or related to the functioning of civil society (e.g. public discourse). These particular types of applications are what motivates our research of considering blockchain technologies from a perspective of constitutionalism.

# 1. On-chain and Off-chain Constitutions

Zargham et al. (2023), have investigated the nature and properties of a constitution from a functional standpoint. They argue that a constitution is that which defines and structures the nature and operations of the organization it refers to. In other words, "the function of a constitution is to delineate the boundaries of a particular organization or entity, entrenching elements of its composition relative to that organization's regular processes of decision-making, as well as against the broader array of legal, social, economic, and environmental forces that make up its context(s)" (Zargham et al., 2023). This is the *constitutive function* of a constitution, which, they argue, applies not only to governments and organizations, but also to technological artifacts and living organisms. A different perspective of blockchain constitutions is provided by Berg, Davidson, & Potts (2018) who take a political economy standpoint to describe blockchains as constitutional orders to the extent that they are "rule-systems in which individuals (or firms, or algorithms) can make economic and political exchanges" (Berg, Davidson, & Potts 2018: 384). In this section, we draw on previous scholarship on constitutionalism in order to inform our insights on the role that constitutionalism plays in the blockchain space.

The distinction between formal and material constitution (described in the previous section) is particularly relevant in the case of blockchain applications. The formal constitution of a blockchain is not implemented in writing through legal documents or bylaws, but rather codified on-chain directly into the technological fabric of the blockchain network. The protocol of a blockchain sets out certain rules that stipulates how the system works and how different actors can interact with it (cf. Rajagopalan 2018: 365). These on-chain rules are defining the very essence of the blockchain. They cannot be unilaterally changed and they do not require the intervention of any third-party enforcement authority in order to ensure their application, as they are automatically executed by the underlying network infrastructure (Alston 2020: 149).

In the context of blockchains, for instance, we can make a distinction between on-chain rules that qualify as 'constitutional rules' and those that qualify as 'ordinary legal rules'. The former are

protocol rules that cannot be modified at all cost, unless by engaging into a fork of the network. An example of such constitutional *on-chain rules* is the consensus mechanism used by the Bitcoin network, which instructs the miners on the conditions that must be fulfilled in order for a transaction to be included into a block, and for a block to be included into the Bitcoin blockchain (Berg, Berg & Novak 2020: 195; Rajagopalan 2018: 366). Similarly,  the 'block reward' that is granted to miners for their contribution to adding a new block to the network is an entrenched rule that can only be modified through a hard-fork. The latter typology of rules are those that can be changed more readily through a standardized procedure. For instance, in the case of Ethereum, the administrative decision to establish and modify the gas price is a constitutional rule, which results in the establishment or the modification of  an ordinary legal rule, i.e., the price that users must ultimately pay to execute transactions on the network. Although not officially recognized as such, most blockchain systems thus already have a formal constitution, which is reflected through their technological design and code-based rules.[5]

In addition to their formal on-chain constitution, blockchain systems also have a material constitution, which transpires from the various practices and social norms that blockchain communities have implemented in order to deal with the need to change the protocol of a blockchain or the rules of a smart contract, beyond what is already provided for by the formal constitution of the system. The material constitution of a blockchain subsists exclusively off-chain: it relates to all these rules and principles that govern a particular blockchain community—comprising developers, miners, validators, users, etc.—in addition to the on-chain rules enshrined in the protocol. These rules are not automatically enforced by the protocol, but are nonetheless recognized (and socially enforced) by the blockchain community. A particularly illustrative example of a material constitution are the various improvement proposals procedures that have been adopted in the context of many blockchain networks (e.g. BIP for Bitcoin, EIP for Ethereum), which provide clear and standardized procedures to implement changes in the code-base of a particular blockchain system, along with roles and responsibilities for the different actors involved in the process. Another example is the principle of *blockchain neutrality*, according to which block producers should not discriminate amongst transactions if not on the ground of their economic profitability (De Filippi and Mannan, 2022). While doing so would not qualify as a violation of the blockchain protocol per se (*i.e.* the formal constitution), such practices might nonetheless be regarded as illegitimate by some community members (e.g. as in the case of Maximum Extractable Value or MEV) (De Filippi, Deffins, & Poux 2023), and, in some cases, may even be reprimanded by the community. In short, there is a misalignment between the formal constitution and the material constitution.

A prominent example that clearly illustrates the distinction, and gradual misalignment, between the formal constitution and the material constitution of a blockchain system is TheDAO attack in 2016 (Dupont 2018). While several years have elapsed since this attack, it continues to be an exceptional example of forking—or constitutional change—compared to ordinary changes that do not violate the fundamental rule-sets of the blockchain protocol (Berg, Berg & Novak 2020: 195-196; Berg, Davidson, & Potts 2018: 389).  TheDAO was a decentralized investment fund implemented on the Ethereum blockchain, and operated via on-chain governance. However, one of the rules (inadvertently) enshrined in its architecture allowed for an attacker to siphon a large portion of TheDAO's treasury, in a way that was not recognized as legitimate by a large part of the Ethereum

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[5] The Bitcoin ecosystem has even experienced its own version of the 'originalist' vs. 'living' constitution debate. Supporters of Bitcoin Cash have argued that by processing transactions faster the original intention of Nakamoto to establish a peer-to-peer version of electronic cash would be realised. Defenders of Bitcoin have instead contended that as a technically distributed payment system, deference shouldn't be given to any founding text or institution (Berg, Berg, & Novak 2020: 198)

community. In Suber's terms, the rule was valid from a viewpoint of causal inference (*i.e.* from a strictly formal perspective), but not from the viewpoint of acceptance and comportment with legal conceptions of theft (i.e. it was incompatible with some of the principles enshrined in the material constitution of the Ethereum blockchain). This presented a significant challenge to the Ethereum community, eager to resolve this crisis while preserving the fundamental rules of the system (i.e., the Ethereum protocol). As opposed to Tezos, which comes with a built-in (*i.e.,* on-chain) system for amending the protocol, Ethereum has more stringent expectations of immutability. Indeed, the underlying tacit rule that characterizes the Ethereum blockchain is that immutability should be preserved at all costs, except if a protocol change is necessary to avoid technical failures, or to facilitate crucial software upgrades. Any amendment to the Ethereum protocol must go through an EIP process, an off-chain method that stipulates the rules for community participants to propose new features, provide technical specifications, and build consensus around a particular protocol change (Alston 2022: 713-714). This is a process that generally involves significant deliberation and a roadmap for implementation. Yet, the proposal to undertake an unscheduled hard fork to rescue the funds siphoned from TheDAO was not justified by a technical need, but rather by a combination of economic and political motives. The accident brought into light an internal contradiction within the material constitution of the Ethereum community, which purports to abide by the principle of immutability, while simultaneously calling for the network to be governed by the principle of justice or equity—which might require a violation of immutability (Alston 2022: 713).

The proposed intervention was to schedule a hard-fork which would effectively violate the formal constitution of the Ethereum blockchain (i.e. the protocol), in order to support *certain* principles of its material constitution. This demonstrates how the material constitution exerts pressure on the formal constitution, but also reveals a *gap* in Ethereum's formal constitution: the equivalent of an emergency clause that can be triggered to support the material constitution. Eventually, even in the absence of a formal amendment option, the hard fork was implemented by a majority of network nodes, who indicated their 'acceptance' by upgrading their clients. As explained above, constituent power (including, but not limited to, network nodes) can act to protect a material constitution by any means, even if an amendment clause is entrenched or even absent.[6] Also, legal validity is driven by acceptance rather than logical coherence. Thus, TheDAO attack has shown how Suber's self-amendment paradox can be domesticated also in the context of blockchain systems, because off-chain governance decisions like choosing to fork are not bound to be logically coherent like code-based on-chain rules. Prominent blockchain proponents, like Ethereum founder Vitalik Buterin, have since effectively echoed Suber's idea, arguing that blockchain governance cannot function without the recognition and acceptance of higher-order principles, which he considers are a source of legitimacy (Buterin 2021).

Many higher-order principles, although strongly enshrined within a particular blockchain community, have not been codified by Bitcoin and Ethereum ecosystems and are therefore not easily identifiable, let alone discussable. Exceptional events like TheDAO attack have an important role in revealing shared values within a particular blockchain ecosystem and galvanizing their community into a constituent power capable of changing the formal on-chain constitution. Various crises, and growing experience with governance, has also created demand for new type of formal off-chain constitutions for blockchain system, which are aimed not at constituting the technical infrastructure, through protocols and code, but rather at formalizing the principles and social norms of the material

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[6] Nevertheless, the high level of consensus required for a successful hard fork acts as an entrenchment clause in blockchain's formal constitution, as it prevents such an option being used lightly.

constitution that govern a particular blockchain community into a more codified document, written in natural language.

The role of such a codified document can be merely to describe or explain the way in which a particular blockchain-based system works or is intended to work. Indeed, while the formal constitution of most blockchains is encoded into the network protocol or smart contract code, it can be complex and inaccessible to individuals without technical expertise (Alston et al. 2022: 714). By creating a separate codified document in natural language, the principles and social norms of the material constitution become more understandable and accessible to a wider audience, including non-technical community members.

Such a document could also provide a framework for community members to consent to, and participate in, shaping the rules, values, and principles that govern a particular blockchain system, by establishing clear governance structures, decision-making processes, and dispute resolution mechanisms. This can serve in the context of both elaborating the rules that will subsequently be enshrined on-chain (*i.e.,* rules for ex-ante deliberation and decision-making) and stipulating the procedures by which rules which have already been encoded into the code-based constitution of a blockchain system can be changed or amended, beyond what is already provided by the system (ex-post modification or amendments). While on-chain upgradability has become a more popular and accepted practice in the blockchain space (Rajagopalan 2018: 378), blockchain technology is constantly evolving, and new challenges and scenarios may arise that require adjustments beyond what had been foreseen by the initial drafters of the blockchain protocol or smart contract code. A formal off-chain constitution allows for a more clear, transparent, and therefore legitimate process of modification and adaptation of existing rules, in order to best accommodate the evolving needs and aspirations of the protocol's constituent power: its community.

## 2. Blockchain Constitutionalism in relation to Digital & Societal Constitutionalism

Blockchain constitutionalism can be understood as a particular type of societal constitutionalism, which shares some similarities with, but also distinguishes itself from, the more traditional framework of digital constitutionalism. It is aligned with the principles of endogenous digital constitutionalism in terms of self-regulation, as both recognize the importance of establishing rules, principles, and norms within digital environments to govern behaviour and interactions. In the case of blockchain systems, the formal code-based constitutions provide a framework for self-regulation, where the rules are encoded into the technological fabric of the network, whereas the material constitution prescribes the way in which these rules shall be elaborated from within the community, and eventually codified into the network itself.

However, when analyzing blockchain constitutionalism through the lens of digital constitutionalism, it's important to recognize the difference that subsists between blockchain-based applications and traditional online platforms. As mentioned above, digital constitutionalism focuses on states and centralized operators with the ability to arbitrarily influence the on-going operations of their online platforms (*rule by code*). Blockchain systems purport to run independently from any third-party authority, operating according to their own legal order (the *rule of code*), whose rules can be enforced by the network itself. Hence, while digital constitutionalism provides valuable insights into the governance and regulation of centralized platforms, it may not fully capture the unique characteristics and challenges of blockchain systems. To fully grasp the intricacies of blockchain

constitutionalism, we need to rely on additional perspectives and frameworks, which are to some extent provided by the broader literature on societal constitutionalism.

Societal constitutionalism focuses on areas where multiple societal actors come together to create and uphold a constitutional order outside the traditional state framework, with its written laws and official institutions. In societal constitutionalism, the constitutional order emerges from the collective actions and agreements of these various societal actors. Blockchain constitutionalism also recognizes that various network actors—from network validators to users to core developers—construct a transnational, self-governing constitutional order through an interplay of the formal on-chain constitution of blockchain-based system and their material off-chain constitution (whether codified or not). Drawing from societal constitutionalism theory, we can anticipate that the material constitution of these blockchain-based systems will dynamically interact with the material constitution of other state and non-state systems (Teuber 2022).

The case of global, public and permissionless blockchain networks is thus an interesting example of a new model of constitutionalisation that builds upon, yet extends beyond the two predominant trends of *digital constitutionalism* and *societal constitutionalism*.

# IV. Conclusion

In this paper, we have argued that the question of constitutionalism is not only relevant to states, but also to a variety of other actors that operate in the societal sphere, including digital platforms. We have shown that blockchain-based networks or applications are constituted through technological means—as opposed to by legal means, as per the large majority of institutions—with their technological protocols and code-based rules serving at the formal constitution of these systems. Yet, the fact that all blockchain systems already possess a code-based constitution does not exclude the possibility—and, in fact, the desirability—of blockchain communities engaging with new processes of constitutionalisation, in order to tackle these points that a code-based constitution cannot properly address. In fact, we believe that it is important for blockchain communities to formalize their principles in a way that extends beyond the limitations of on-chain codification, while still being mindful of the limits of what an off-chain constitution can achieve.

While Suber's paradox of self-amendment can be domesticated within the traditional legal order—insofar as the legal framework can cope with logical contradictions in legal rules—the same is not true for code-based systems, which are administered through the strict logic of code. Thus, while on-chain constitutions can provide a foundational framework for the operations of a blockchain network, they are constrained by the inherent logic and internal coherence of code. Even in the case of blockchains like Tezos, which come with their own on-chain mechanisms for self-amendment, attempting to modify these on-chain constitutions solely through code will inherently restrict the ability of these networks to evolve in a way that is contrary to their own logical parameters.

To effect meaningful change, there is a need for constitutions that can be amended beyond the confines of their own logic. Indeed, as technology evolves and as the limitations (or flaws) of current technological frameworks become more apparent, blockchain communities must acquire the ability to modify the governing principles of these blockchain-based systems in order to address emerging challenges and aspirations. While on-chain governance and code-based rules remain essential for maintaining the integrity and functionality of these systems, the acknowledgement of additional constitutional rules and principles is required to complement and enhance their governance

framework. By creating formalized constitutions expressed in human-readable language, blockchain communities can transcend the limitations imposed by the strict language of code, enshrining the general principles and social norms of their material constitution into a formal off-chain constitution, thereby opening up new avenues for the modification and adaptation of their on-chain constitution. These off-chain constitutions formalize and codify the underlying principles, social norms, and shared values of the relevant blockchain communities, enabling the evolution and adaptation of the on-chain infrastructure in a way that better aligns with collective aspirations and goals. The process of constitutionnalisation, if properly put into practice, also provides a medium through which broader consensus can be reached by enabling diverse stakeholders to participate in the constituent process and contribute to the governance of the wider blockchain ecosystem. It is, however, necessary to be mindful of possible issues arising from an improper implementation of a formal off-chain constitution, as was shown by a few previous attempts in drafting such constitutions (e.g., with the EOS protocol).

OLD STUFFFFF

Changes to the consensus mechanism, from (for e.g.,) proof-of-work to proof-of-stake, are not only changes that are negotiated off-chain but amounts to a major "amendment to the amendment process itself" (Alston 2020: 160; Berg, Berg & Novak 2020: 195).

This means, first and foremost, that digital constitutionalism aims to put *external* constitutional constraints on the unrestrained sovereignty of large Internet Platforms, effectively tempering their *rule by code*. This paper both responds to and departs from this literature. It explores blockchain constitutionalism, not only from the viewpoint of attempting to place external constitutional constraints on blockchain-based systems but also the creation of *internal* constitutional constraints because - as we have seen - blockchain technologies, unlike large Internet platforms, are unique software architectures thatby constituteing constitutional orders in their own right. Focusing on internal constitutional constraints becomes especially important as the properties of blockchain-based networks make the imposition of external constitutional constraints difficult.

As a consequence of this, blockchain technologies can be said to also experience 'constitutional moments' in ways that no other software architectures have. A prominent example of such a constitutional moment is TheDAO attack (Dupont 2018). TheDAO was an early 'decentralized autonomous organization', implemented on the Ethereum blockchain, operated via on-chain governance. However, one of the rules (mistakenly) enshrined in its architecture allowed for an act (unilaterally siphoningdrawing a large portion of the systems' cryptocurrency) that was not recognized as legitimate by a large part of the Ethereum community. In Suber's terms, the rule was valid from a viewpoint of causal inference (i.e. from a strictly formal perspective), but not from the viewpoint of acceptance. This presented a significant challenge to the Ethereum community, eager to resolve this crisis while preserving the fundamental rules ofinference model (i.e., the Ethereum protocol.) implemented through on-chain governance. As opposed to Tezos which comes with a built-in (*i.e.* on-chain) system for amending the protocol, Ethereum comes along with more stringent expectations of immutability. Indeed, the underlying (tacit) rule that characterizes the Ethereum blockchain is that immutability should be preserved at all costs, except if a protocol change is necessary to avoid technical failures, or to facilitate crucial software upgrades. Any amendment to the Ethereum protocol must go through the The preparation of an Ethereum Improvement Proposal (EIP) process, an off-chainwhich is the established mechanismmethod that stipulates the rules for peoplecommunity participants to propose new features, provide technical specifications, and build consensus around a particular protocol change. —; a process that generally involves significant deliberation and a roadmap for implementation, if the proposal is passed. Yet, the proposal to undertake an unscheduled hard fork to rescue the funds siphoned from TheDAO was not justified by a technical need, but rather by a combination of economic and political motives. It was, as such, logically inconsistent with the underlying principles of the Ethereum community. Despite this inconsistency,

Undertaking an unscheduled hard fork to rescue the funds siphoned from a supposedly immutable protocol (i.e., the proposed 'amendment') would, in fact, extinguish the claim that the blockchain protocol is immutable (i.e., the irrevocable limitation on amendment power). In short, the proposal to amend the Ethereum protocol for a *political* reason, is logically inconsistent with the higher-order (tacit) rule of preserving immutability at all costs, except if necessary to avoid technical failures. While a the hard fork was successfullyeventually implemented with a majority sufficient

number of network nodes indicating their 'acceptance' by upgrading their clients., Aas Suber explains, this legal validity is not the same as logical coherence. The ad-hoc decision to fork also raises broader questions of how the self-amendment paradox can be tamed in the context of on-chain governance and the role of acceptance in doing so. Prominent blockchain proponents, like Ethereum founder Vitalik Buterin, have since effectively echoed Suber's idea, arguing that blockchain governance cannot function without higher-order acceptance, which he coins as 'legitimacy' (Buterin 2021) - although, as we shall see, it can better be called legality.

This distinction follows from the hallmark divide between substantive and procedural due process in United States constitutional jurisprudence, yet just as faithfully-followed legal process can still result in injustice, it is unlikely that constraints created by the "rule of code" will prove sufficient to govern the complex blend of equities that these distributed network organizations will necessarily confront in adjusting to changing circumstances. Every significant blockchain network will be presented with its own equivalent of the DAO hack, where agreement as to how to proceed given unanticipated circumstances is lacking. In order to achieve legitimacy in an ongoing representative sense, then, these networks' constitutional values will prove essential in constituting the community's response to unforeseen shocks.

Now that we have provided a preliminary characterization ofwe know what a constitution is, we can ask the question: why do constitutions exist? This is where the concepts of legality, legitimacy and sovereignty become important. First, a constitution authorizes the legal acts of a sovereign power. A sovereign power can be understood as a focal point of decision making, which Carl Schmitt defined as the agency in a political community that can decide on the exception (Schmitt 2005). Yet, a constitutional order is never entirely 'complete' (i.e. there are always unforeseen exceptions to entrenched rules and principles), which means that, in specific cases, the sovereign needs to declare a 'state of exception' (Schmitt 2005) acting to either subsume the exception within the constitutional order or transform the constitutional order itself. A constitutional order is one in which this sovereign power is, by necessity, limited. Hence, an absolute dictatorship can never be constitutional, which does not preclude the paradoxical possibility of a 'constitutional dictatorship' (Rossiter 1948). Constitutions limit sovereignty by means of legal principles and rules, and to the extent they successfully do so they confer 'validity' on new rules and principles that the sovereign enacts. For instance, when a parliamentary decision is made, its adherence to constitutional constraints of transparency and parliamentary quora makes the decision a valid and 'legal' one. Hence, constitutions exist because they bestow 'legality' on the decisions enacted by a sovereign power.

Yet, at the heart of legal philosophy lies a normative conflict between legality and legitimacy. A constitutional order can confer legality but nonetheless be illegitimate; that is, unjust. Consider, for instance, a society in which slavery is condoned by a majority of the population and legalized in the constitution. In such a society, sovereign decisions that establish the ownership and sale of slaves as chattel are strictly speaking legal, but on many counts are illegitimate, amongst other things because they violate basic human rights. This striving for legitimacy is the reason why countries like India and South Africa began to incorporate fundamental principles in their constitutions, so as to provide a normative framework for interpreting the constitution as well as the laws and state actions (e.g., the decision to expropriate or nationalize private property) that derive their authority from the constitution. Laws and state actions that are interpreted as being in keeping with fundamental principles are more likely to be perceived as being legitimate. Legitimacy, therefore, is a more stringent requirement than mere legality and is consequently, more difficult to achieve and maintain.

Nevertheless, there are widely diverging views on the relation between legality and legitimacy. Max Weber, famously, drew legality and legitimacy closely together by arguing that whether an act by the sovereign enjoys validity is a matter of the extent to which it is backed up by the 'appropriate attitudes' (Arato 2017: 13). In other words, the law enjoys legitimacy if citizens generally accept to be under an obligation to obey it, and this obligation is most significantly tied to the state's monopoly of violence. Note that Weber's view is very close to Suber's, insofar as legitimacy is a matter of acceptance. Yet, this move makes legality and legitimacy almost synonyms, robbing the concept of legitimacy of its normative significance. Most authors have, therefore, taken a more normative stance. As Arato (2017: 30) argues:

> Democratic legitimacy is best seen in terms of a plurality of principles. Aside from legal representation, other principles such as the existence and participation of a viable public sphere of communication, fundamental and enforceable political rights, associational freedom, and the widest possible social and political inclusion are also important.

This paper doesn't intend to take a particular theoretical stand on the abovementioned controversies. Thus far, the main purpose of the discussion has been to give an idea of what a constitution is and why it exists.

Potential Example to Work On: Take, for example, the recent constitutional reform process in Chile. The relatively rigid Pinochet-era constitution has been deliberated upon for an extended period of time by many stakeholders in Chilean society who were unrepresented during the drafting of the constitution under the dictatorship and who felt left behind by the country's neoliberal economic model (Couso 2020; Tsebelis 2018). Significant parts of the constitution concerning Chile's economic model, such as the privatized administration and provision of social services, could not be easily changed through constitutional amendment. Around 80% of Chileans voted in favour of a constitutional reform process taking place, indicating that mere amendments to the existing 1980 constitution was not sufficient. Yet, when a more progressive constitution was proposed in place of the previous one, it was ultimately rejected by Chilean voters in a national plebiscite. This can be interpreted as an affirmation of the fact that Chile's formal, rigid constitution ultimately reflects its material constitution, at least minimally. Alternatively, it can be interpreted that the formal constitution is still in tension with the material constitution, given that over 80% of Chileans considered the existing constitution to be unsatisfactory in some way, but the proposed new constitution did not adequately reflect the material constitution either (Carrasco 2022; Prieto & Verdugo 2021). The new constitutional bargain was not worth the costs entailed in replacing the constitution.

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Notes 2022.08.22

- Proposal for funding
- It can be challenged => through the dispute resolution process
- Proposal for infrastructure modification
- Narrative is there is entrenchment, entrenchment is good but it can be bad when its too formal and strict. We're trying to see how the blockchain is offering other ways of building

Notes - call 2022.08.10

Framework of constitutional design:

Difference between Big C constitution and small c constitutions.

Procedural aspects: distinct from the rules of choosing president, designing a legislature, etc. because they are constituting different powers.

Statement of principles => the substantive matter

Distinct elements emerging from the small c constitution of the community.

Where is the 'political' aspect: every time we are looking at procedures to rule over decision-making.

Representativity (=> extent to which formal (saying which rule should be enforced) or material (what is being enforced) is representative of the people) / immutability / Overlapping

Questions : (i) to which extent are things correspondent (material/formal) e.g. 1hive trying to increase correspondence by making formal constitution match material one. (ii) Entrenchment

## 1Hive

i think for the empirical part it would be nice to list different 'constitutional archetypes' of different blockchain-system, and provide a short example for each.

Look at patterns present through many blockchains / DAOs, and assess the extent to which they can be compared to constitutional guarantees.

PoH

Discuss constitutional order of blockchain that are more or less

- **Entrenched vs Completeness as a trade-off**
    - **Though Gardens (or others) are trying to eliminate that trade-off by linking on-chain and off-chain with a properly structured hybrid model.**
- **Formal vs informal**
- **On-chain vs off-chain**

(This is just a mind-map idea to try and figure out whether this is our grid to identify the different tendencies in blockchain constitutions).
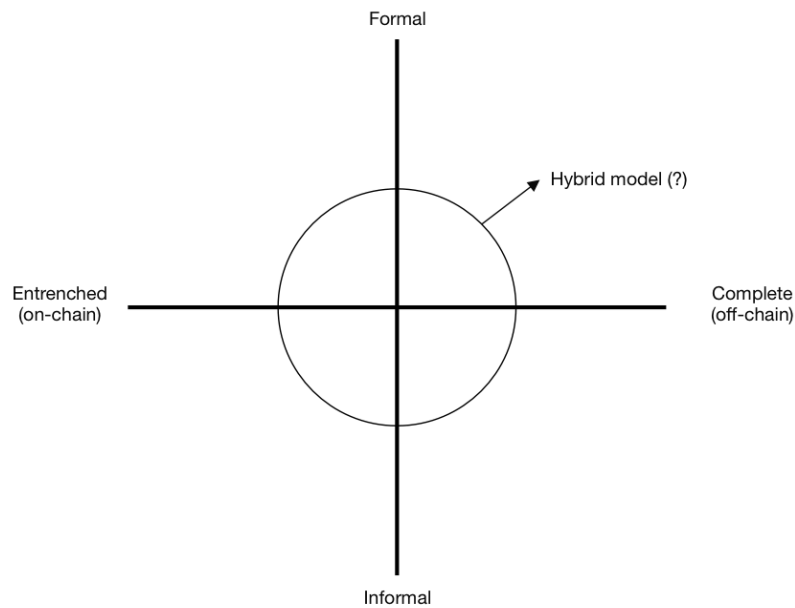
E.g. onchain constitution of 1hive is very **entrenched** (on-chain) but incomplete because of natural language

Legal language is less entrenched, because not part of the software, but more complete because better specified.

Material vs formal

=> formalizing the off-chain governance.

Legality and legitimacy –


All blockchain / daos have material constitutions made up of on-chain and off-chain, but they usually formally recognize only the on-chain one. Hence, weak entrenchment (agaisnt standard belief)

In order to improve the entrenchement, need to recognize the off-chain material constitution as well, and ideally formalize too

—> e.g. 1Hive;  Gardens template : token engineering commons, giveth, use the Gardens template.

(Luke Duncan – founder of 1Hive)

→ EIP/ BIP : formalization of off-chain governance

= must compare formal process (on-chain and off-chain)

- Computational / formal / on-chain   (Tezos, on-chain voting, etc.)

- Computational / formal / off-chain   (snapshot)
- Off-chain formal deliberation  (EIP/BIP)
- Off-chain informal deliberation  (everything else that we dont look at)

Optimism ?

**Various archetypes:**

### (1) Off-chain proposals and deliberation processes

Community driven proposals and discussions for forking:

Social institutions to govern the code are inspired from established open source communities, which have a strong constitutional flavor (e.g. python, debian, etc.), with many discussions and public deliberation.

E.g.: BIP / EIP (based on python PEPs: created as a result of strong community involvement and proposals discussed)  → DAOstar's DAOIP

E.g.:

### (2) On-chain constitutionalism

E.g. Tezos

### (3) Hybrid model

(a) Off-chain covenant + On-chain dispute resolution system – e.g. 1Hive

**Kong** : manifesto that NFT holders signed to show that they abide to it, (they can vote on decisions)

→ manufacture microchips

**ENS**

**Non-formal / off-chain: Gitcoin**

**(1) (1500w)**

*Applying Insights from Constitutional Theories to Blockchain Governance*

- Use societal and digital constitutionalism analogies, as well as analogy between state constitutions and blockchain constitutions: what are the differences and similarities? [Help cement our claim that public and permissionless blockchains do have the properties of a constitutional order]

- Comparative critique; blockchain constitutionalism is not encompassed by lit on platforms and constitutions + not only about external regulation, more about internal governance

- Protocol is the big-C constitution/formal constitution; little-c constitution/unwritten-material constitution  (big-C constitution and little-c constitution are both transversal across on-chain and off-chain governance)

    - Can use EIP/BIP as examples

**Constitutional constraints in blockchain communities**

- On-chain and off-chain governance; on-chain merely about legality, not legitimacy

- Discussing the DAO attack

- Other example? 1Hive! Filecoin? Metagov?

- Which conventions exist in blockchain communities?

- How are proposals made?

- How are proposals discussed/deliberated?

- How are proposals executed?

- Constitutional problems and need to rethink constitutional design

**Towards a blockchain constitution**

- Examples in Internet governance

- Constraints that protect the constitution, e.g., against emergency powers (link to Rossiter's constitutional dictatorship)

- Constraints that enhance the constitution, e.g., transparency, separation of powers, rule of law

- Endogenous legitimacy vs. Exogenous legitimacy

- Elaboration of what this could practically look like; focus on a community (e.g., Ethereum)

**Conclusion**

To include:

https://www.ojp.gov/ncjrs/virtual-library/abstracts/amending-constitutions-legality-and-legitimacy-constitutional

https://www.jstor.org/stable/1123704

**Little thought experiment:**

**Let's define the material constitution as "the set of rules that govern rule making in a particular society, which *can* but need not be written down"**

**Let's define the formal constitution as "the material constitution insofar as it is written down in a solemn document (written for the sake of the material)"**

**Now, you could have different situations in reality, given, say, the following thought-experiments:**

1. **The material constitution is not written down.** In this case, the material constitution is highly unstable. It's a bit like an Occupy Wall street protest. People don't have to abide to explicit rules, but this also makes that nobody is really sure about the rules and deliberation takes forever (even though there might be a strong material basis of agreement).
2. **There is a formal constitution, but it does not support its material basis.** In this case, there could be a constitution with rules that are extremely hard to amend, but that people fully neglect. It might state that government has to be elected through equal and fair elections, but in effect the country's population has been taken by theocratic ideas, giving de facto authority to some cult leader.
3. **There is a formal constitution that supports its material basis.** In this case, the material basis offers effective limits to the authority of the government that acts through the constitution, but at the same time it is translated into

**Extended Abstract:**

The origins of blockchain technology are such that this technology has long been discussed in political terms. It has been characterized as a digital Leviathan with a particular type of social contract implementing a 'rule of code' that could potentially challenge the rule of law. Blockchain technology is of interest to constitutional theorists for at least two main reasons. Firstly, because blockchain networks can shape the behavior of network participants through their technical architecture, while remaining resistant (though not immune) to state intervention. This raises important regulatory challenges that are reminiscent of earlier discussions concerning Internet governance, and as such are of interest to scholars of global constitutionalism and non-state constitutions. Secondly, because blockchain networks operate through tamper-resistant, hard-coded rules that no central authority can unilaterally change. In other words, they implement a codified 'constitution'—which, in Buchanian terms, provides the 'rules for rule making' and constrains what network participants can do (Rajagopalan 2018, p. 365).

Liberal democratic states have written or unwritten constitutions in order to legitimize and/or constrain the power of political sovereigns, giving them not only the ability but also the normative right to deploy their power. Although constitutionalism is not the only source of legitimacy, it is the defining source of democratic legitimacy. As Arato (2017) argues, 'it is almost universally accepted that legal and constitutionalist rules should provide for a democratic system capable of periodically refurbishing democratic legitimacy.' In this sense, constitutionalism is about rule of lawdemocratic constraints on governance, such as the separation of powers, the guarantee of due process, and transparency of decision-making. This paper asks the question: to what extent can constitutionalism answer to the need for legitimacy of blockchain systems?

The paper responds to two trends in academic literature. First, it responds to the emerging debate on 'societal constitutionalism' (Golia and Teubner 2021), which argues that constitutional structures can be found beyond the constitutions of democratic states; including in transnational organizations and systems of private ordering. Hence, despite being non-state entities, blockchain systems can be said to have constitutions. Second, it responds to the recent literature on 'digital constitutionalism' (Celeste 2019), which focuses on the increasing power of large Internet platforms over public functions, like the facilitation of democratic discourse, and their ability to shape the behavior of platform users. Digital constitutionalism frames itself as an 'ideology', for it aligns itself a-priori with the liberal democratic understanding of constitutionalism, arguing that the power of Internet platforms should be checked from the outside by subjecting it to constitutional constraints. Responding to these two bodies of literature, this paper innovates on two points. First, it expands the discussion on societal and digital constitutionalism to the political and legal studies of blockchain technologies. Second, and more importantly, it goes beyond digital constitutionalism by arguing that blockchain technology does not only present the challenge of thinking about external constraints (e.g., limitations on content moderation established by state law), but also about internal constraints. The reason for this is that, unlike large Internet platforms that can operate like digital fiefdoms, open blockchain networks have constitutional constraints de-facto built into their very design. This unique feature of blockchain systems opens up a new type of discourse on 'blockchain constitutionalism.'

The paper consists of three sections. The first section is *conceptual*, addressing the question of what is a blockchain constitution? It starts by considering a constitution as a set of rules for rule-making (i.e., secondary rules). In line with Kelsen and Buchanan, constitutions have a formal (i.e., textual) and material (i.e., effective) component, which may or may not overlap (called entrenchment). On the one hand, the technical components of blockchain constitutions (so-called

'on-chain governance') is fully entrenched, since code is both written and performative. On the other hand, the social components of blockchain constitutions (so-called 'off-chain governance) comprises a set of social conventions or institutional rules that regulate governance processes. This includes written and unwritten rules and procedures that govern how proposals for network upgrades are made, debated, voted upon, and implemented. The focus of this paper is specifically on the 'off-chain governance' level, because it allows for a much larger variety of constitution-making than on-chain governance. The paper is agnostic regarding the type of constitution that is most desirable for a given blockchain system: some systems might be served by implementing a more authoritarian or oligarchic constitution, others more by implementing a democratic constitution. Yet, in the development of the normative point, the paper focuses on liberal democratic constitution making, which is particularly relevant for blockchain ecosystems that claim to be democratic or that, like the large Internet platforms, threaten to infringe upon vital public functions.

The second section is *empirical*, addressing the question of how do blockchain constitutions function in practice? It starts by discussing the The DAO attack, to underline the importance of thinking beyond the on-chain and fully entrenched parts of the blockchain constitution. This attack reveals two of the main challenges central to constitutionalism: (1) the states of exception that challenge a constitutional order, and (2) the emergence of a (popular) sovereign in response to a state of exception. We argue, therefore, that blockchain constitutions need to be able to respond to a state of exception without destroying their decentralized nature, thereby legitimizing the post-sovereign power that is exercised by network participants. The paper presents ethnographic findings on common practices in different blockchain communities that legitimize the off-chain governance process (e.g.how proposals for network upgrades are made, how they are deliberated, how they are subjected to voting or other procedures of decision-making).. It outlines what types of constitutional constraints can be already found in the written and unwritten rules, or conventions, that shape the off-chain governance of these communities.

The third section is *normative*, addressing the question of what constraints could be implemented to legitimize blockchain constitutions from a liberal democratic point of view? As indicated before, these constraints will not be desirable for all blockchain systems; merely to those that do or should appeal to democratic legitimacy. To contextualize this point, different constitutions of Internet governance bodies (like ICANN) are presented. This section starts with a high-level overview, arguing how off-chain governance processes could be formalized in accordance with constitutional rules that would ensure amendability, representation, a viable public sphere, enforceable political rights, and the widest possible social and political inclusion. Then, it focuses on two corner-stones of democratic legitimacy that are the most relevant to blockchain constitutions: (1) a constitutional protection against sovereign powers in the case of a state of exception and (2) the guarantee of due process in the exercise of constitution-making. Concerning the first, the paper draws from the work of Rossiter on constitutional dictatorships, arguing how the constraints presented in his work could inform constraints on blockchain governance. Concerning the second, the paper draws from (??) on the guarantee of due process as a condition for legitimate governance, showing how such a guarantee could be implemented in blockchain constitutions.