Democracy Through The Blocks:
Towards the Era of Law Engineering⋆

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Abstract. As we enter the age of decentralization, technological and political tensions stress the fabric of modern Democracies. Understanding the theoretical and practical challenges that we will be forced to face is the focus of this project. From the technological choices and their implementations, passing through their political and philosophical consequences, a new path needs to be drawn in order to understand whether DLTs will fundamentally change the very concepts of eDemocracy and governance, or improve existing models.

Keywords: DLT · blockchain · eDemocracy · eGovernment · transparency · automation · Law Engineering · Rules as Code.

1 Problem overview

It goes without saying that Democracy, in order to be effective, needs to ensure the transparency and auditability of its institutions and their respective ramifications' actions and decision process [10]. The obvious reason for this need is that, as long as the *sovereignty belongs to the people and is exercised by the people in the forms and within the limits of each given Constitution* [35], the people must be aware of how the power that they have delegated to the institutions is being used in order to hold them accountable.

Fortunately, technology nowadays is progressing at an impressive pace and can be used to empower democratic institutions — and the Public Administrations as their ramification — by making them more accountable to the people by the means of an increased level of transparency. Public Administrations' websites for transparency purposes are a good example of that; but still, even though documents do get published at some point, most of the times the process that lead to decisions happen behind closed doors. Most importantly, it is not rare

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that the administrations disregard the applicable transparency laws and omit to publish their documents on their respective websites. As long as the administrations remain in *material* control of the processes, the ultimate — factual — decision of when and what to publish is theirs, thus facilitating corruption events. There are, of course, remedies, but they are in most cases subsequent to the violations and can be costly.

Distributed Ledger Technologies (DLTs) such as the Blockchain [29] and Distributed Web Technologies such as IPFS [4] can offer a way of ensuring the transparency of democratic institutions, representing the texture of an e-Governance [26] infrastructure on top of which e-Government [23] services can be built through the automation of processes by the means of *Smart Contracts* [11] and/or *Decentralized Autonomous Organizations* (DAOs) [41][15]. Moreover, DLTs can represent a tool that citizens could use to hold institutions and Public Administrations accountable in a more direct and prompter fashion, narrowing the margins of corruption events.

However, the adoption of these technologies to such an extent and at a such high institutional level poses a series of questions that need to be answered — and this is the purpose of this work: to push further the Digital Single Market [19] and investigate whether and how it would be possible to build a European legal and technological framework to empower transparency and combat corruption via public process automation, reducing the need for bureaucracy, enabling secure and law-abiding automated interactions between citizens and Public Administration [18].

As of now, being still in the preliminary stage of the work, three main questions arise.

2   Main questions

2.1   The technological choice

What technology should be adopted by a state for eGovernance, with particular regard to its kernel protocol: a permissioned, state-run DLT *vs* a permissionless, community-run DLT.

This question is — without a doubt — the fundamental one. Not only because it will affect the practical ways of implementation (see last question), but most most importantly because it could determine a new configuration of *checks and balances*, as will be briefly discussed in the next question.

It cannot be ignored that the very reason why the Blockchain was born in 2009 was to give the people the power to operate in a trustless manner through disintermediation, without the need for institutions [29]. Hence, the adoption of DLTs at a State level, *prima facie*, would seem to betray the crypto-anarchist philosophy that inspired Satoshi Nakamoto [1].

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[1] It should be sufficient to note that in the Bitcoin whitepaper [29] the first reference is to http://www.weidai.com/bmoney.txt [13] and that the first paragraph reads: "I

Nonetheless, in a Democratic society, the *Social Contract* that binds its citizens requires compromises and — by definition — a sacrifice of part of the people's individual freedom. In a scenario where the *Social Contract* is to be transposed into a DLT protocol, will have to be taken into consideration the fact that a state-run, permissioned DLT, while being certainly an innovative mean of governance, would just (maybe) increase transparency and efficiency, without, however, giving back to the people a part of the power originally delegated. On the other hand, an open, permissionless DLT wouldn't have the need of a State (as originally envisioned by Nakamoto), but would therefore leave its participants without the ability to enforce off-chain laws in relation to off-chain events (e.g. judiciary power, damages and seizing of assets for compensation) and, most importantly, to be subject to the developers that maintain the DLT without the legal means to hold them accountable [39][3]; a circumstance that would pose a serious threat to the effective decentralization of power.

As a matter of fact, more often than not, open source project of this magnitude are hosted on GitHub or similar platforms and rely on a group of developers that either **a)** give their free time for the community or **b)** are actually paid by an organization (e.g. *The Ethereum Foundation*). These developers/maintainers are the *de facto* fiduciaries of a nominally authority-free, decentralized blockchain, and as such hold a significant amount of decision-making power. The *hard fork* that occurred in 2016 in response to the DAO hack is a perfect example of that: the Community was split by a decision driven by core developers and maintainers. As a result, the Ethereum Classic blockchain was born [16]. Needless to say that such an event, had it occurred in an institutionally adopted, state-wide blockchain, would have had catastrophic consequences both socially and economically.

Another problem that will arise is the one of the consensus algorithm. It cannot be ignored that in some cases the *hashrate* (or *mining power*) tends to be concentrated in just a few *mining pools*, making it easier to pursue attacks on the chain. Hence arises the necessity of a consensus algorithm that could meet the yet to be found needs of a structured, decentralized Democracy. Moreover, the architecture of the protocol should make *hard forks* particularly disadvantageous for the reasons that will be discussed in the next section.

These considerations bring us to the inevitable — yet obvious — conclusion that in a Democratic society a balance needs to be struck. The ever-arising need for disintermediation and decentralization of power must come to terms with the *Social Contract* and vice versa. So, it will be of upmost importance to identify the characteristics and features that a truly Democratic DLT should have.

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am fascinated by Tim May's crypto-anarchy. Unlike the communities traditionally associated with the word 'anarchy', in a crypto-anarchy the government is not temporarily destroyed but permanently forbidden and permanently unnecessary. It's a community where the threat of violence is impotent because violence is impossible, and violence is impossible because its participants cannot be linked to their true names or physical locations.".

2.2   Political, philosophical and legal implications

What would the political and philosophical consequences be, given the adoption of a certain technology. In particular, whether and how the separation of the Three Powers of a state could be affected or how new *checks and balances* could be added to the *constitutional equation.*

The adoption of a DLT for the transposition of (part of) the *Social Contract* may have significant political and philosophical implications. In fact, it could be argued that the very birth of the Blockchain stands true to the latin phrase *"ubi societas, ibi ius"* [2], where the internet users are the *societas* and the Blockchain protocol is the *ius.* Of course, rules to govern the internet were already into existence, but those rules were (are) given by existing institutions, while the Blockchain could be considered a spontaneous event, a formalization of *social contract* by technological means in a borderless, institution-less society.

The formalization of an existing *social contract* into a DLTs, would pose significant questions. Once the rules are formalized, the underlying philosophical and political motivation of said contract would become automatically effective and — literally — self executing. Therefore, understanding the philosophical nuances of the protocol becomes an upmost important matter. Whether we'll be governed by a Techno-Leviathan [37], or whether the adopted protocol will reflect Rousseau's, Rawls's [34] or Schmitt's ideas is a question to be investigated.

Moreover, the consequences of such adoption could range from simply a more efficient and transparent institutional ecosystem, to a drastic shift in the three-powers balance. It needs to be taken into account the fact that Distributed Ledger Technology will not be the only one that could potentially reshape Democracy. Artificial Intelligence (AI) will play a fundamental role in our future, too, especially with regards to automation in key aspects of Democracy. Ranging from automation in the Public Sector, to legal drafting and automatic judicial decision making, AIs will need to be put in check with a constitutional-level tool. DLTs can represent this tool, acting as a safety valve, allowing for a direct control of the automated processes and the flow of data to be fed to the AI, thus ensuring that the sovereignty will still belong to the people.

Such a scenario would probably entail another important political and philosophical consequence. A technologically empowered Democracy would mean a lower latency between political decisions and their implementation. If citizens are to be given back part of their originally delegated power, the consequences of their choices would be more swift. Facing the almost immediate consequences of their choices (or lack of them) would probably mean to hold the e-Democracy stakeholders more accountable to themselves, thus pushing them to take a more active role in society.

In addition, if DLTs could enable new means of direct democracy, new forms of delegation of power could be imagined. As an example, it might be argued,

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[2] For the purpose of this work, we adhere to the theories proposed by Italian Jurist Santi Romano as expressed in his famous book "L'ordinamento giuridico" in 1918 [36], re-edited in 1947 with footnotes acknowledging critiques to his view.

the protocol could, in theory, give the citizens a kill-switch to cut the power off their representatives that are mishandling it, when certain conditions are met. This would allow for a safer delegation of constitutional powers, that might open the gates to new, yet to be imagined forms of government.

However, some serious (potential) drawbacks cannot be ignored. As briefly mentioned in the previous section, the state-wide protocol will probably have to face with the issue of the so called *hard forks* — events where the protocol is split in two, as a portion of its users decide to follow their own different rules. Since *hard forks* are relatively easy to achieve (basically, a software upgrade), this could seriously endanger the unity of a nation. A group of people of a specific region, with strong political beliefs, could perform a schism from the mainland with relative ease, with catastrophic consequences under every aspect.

On a more practical note, the adoption of DLTs in the public sector would cross path and overlap with other issues related to the right to Internet access and the open market [21], the protection and enjoyment of human rights on the Internet [31] and, of course, its entanglement with data protection [20].

2.3   The implementation challenges

How the technology adopted will have to find ways to not give up the underlying philosophical choices, by embroidering them into its core with the *checks and balances* of each different constitutional power in both institutional and every-day applications.

Once the DLTs protocol infrastructure will be chosen, adopted or developed, e-government and e-democracy *services* will have to be built upon it. In some countries, such as Estonia, this is already a reality. However, in order to truly reshape Democracy, implementation cannot stop at (relatively) simple, isolated *services*: mirroring the separation of powers into the code, whilst ensuring transparency, auditability and disintermediation requires something more. If the DLT's protocol can be compared to a constitution, the applications built upon it (*smart contracts* or *dApp*) could be compared to the law [14]; however, this approach has been fiercely criticized [32]. Hence arises the necessity of a complex technological ecosystem. In particular, the crucial aspect of this ecosystem would be to require, in order to function, besides human-readability [24], the least possible amount of *Oracles*. It could be argued, in fact, that one of the key aspects of a technological democracy should be the empowerment of citizens through disintermediation. Heavily relying on state-run *Oracles* would betray this ideal and ultimately the core philosophy of Distributed Ledger Technologies.

In order to achieve this, each and every DLT-powered public service, DAO, b2b, b2c or c2c smart contract will need to be *justiciable.* For justiciablity is the true gatekeeper of each Democracy, courts will have to be empowered to enforce their rulings over services, registries and smart contracts. However, the Judiciary power should not be given a simple backdoor to the system, for this would mean, again, the betrayal of the philosohpy of DLTs. Courts of justice should rather be themselves dwellers of the Distributed Democracy, where their

processes and trials — automated or not — will be ever more transparent and auditable.

Taking as an example a Land Registry, if it is to be handled by a central authority that would serve as an *Oracle*, while some benefits are surely given, the control of it would remain centralized. On the other hand, however, some off-chain, material and natural events need to be registered, such as the seizing of assets due to civil liability. A solution that could be explored is the large-scale adoption of interconnected, decentralized *services* in each of the Three Powers of the State. In the aforementioned example, a Land Registry would be able to register the seizing of a citizen's tokenized asset if — and only if — a judicial proceeding *that took place in the very same DLT* had as its parties the very same stakeholder and as subject the seizing of that specific tokenized asset.

The complexity of the proposed ecosystem would probably mean that a state-wide DLT ecosystem will be comprised of several, interconnected protocols, since, for instance, some aspects of Democracy require different levels of transparency (e.g. in e-voting, voters identity and vote cast must not be traceable). This means that a major issue will have to be solved: *atomic swap* [25]. If atomic swap won't be solved, cross-protocol services will have to rely on off-chain *Oracles* — again, betraying the core philosophy.

3   State of the art

The implications of the adoption of DLTs for governance has been studied by many different authors [33]. Some authors display a fair degree of skepticism, claiming that governing through the blockchain will only ever be at best efficiency exercises [12]. Other authors explored the philosophical nuances of different blockchain technologies, by analyzing the social contract theories that better describe different technological and architectural choices [34]. Others have investigated whether a decentralized governance model could put the necessity of the State into question, concluding that blockchain-based governance can be seen more as an *organizational theory* rather than a stand alone *political theory* [2]. On the opposite side, other authors see DLTs as an institutional technology that possesses constitutional properties [5][6][14]. Going further, other authors explore the concept of decentralization as a political ideology, but at the same time underline the gap between "the forms and extent of decentralization as prescribed by the ideology, and the practical forms in which it manifests in various blockchain networks" [8]. As a matter of fact, some Authors have questioned the actual level of decentralization of DLTs, casting light over issues that tend to be overlooked, such as the shift of trust from institutions to the coders and the nodes that develop and run the network [39], and showed how there are quite often occasions of re-centralization of power when it comes to taking core decisions in software upgrades (such as the Bitcoin's inflation bug of 2018) [40]. The investigation on the issue has been pushed forward in 2019 thanks to a quantitative study of the decentralization of the governance structures of Bitcoin and Ethereum, by scraping the open-source repositories associated with

their respective codebases and improvement proposals to find the number of people contributing to the code itself and to the overall discussion [3]. Finally, other authors put through critical examination the concepts of *code of law* vs *code as law* to identify whether, and to what extent, regulation by blockchain will successfully avoid governance by conventional law, identifying three possible way of these forces to interact with one another: (a) hostile evasion; (b) efficient alignment; (c) alleviating transactional friction; [42].

Under a more practical point of view, the use of blockchain technology in the public sector has been analyzed in a a thematic report prepared by the EU Blockchain Observatory and Forum [27], and deeply assessed by a JRC report [1]. The EU studies show how the technology is still in its early stages of state-level adoption, and serves more as an IT infrastructure rather than a groundbreaking political innovation tool. Other EU projects are currently exploring new usages of DLTs, such as a pilot project named European Financial Transparency Gateway, based on blockhain technology (at the time of writing, just a demo) [17]. Also, in 2018 the European Blockchain Partnership was born, aiming at the cooperation between member states for the "establishment of a European Blockchain Services Infrastructure (EBSI) that will support the delivery of cross-border digital public services, with the highest standards of security and privacy" [18]. However, again, these project seem to lean more on the aspect of IT infrastructure rather than a political game changer. Nonetheless, a 2017 study commissioned by the EU Parliament Research Service (EPRS), has underlined the potential of DLTs to be the groundbreaking technology it claims to be, for example, automating the implementation of policies through a smart contract ecosystem [9]. In general, "Rule as Code" is a concept that is gaining traction around the world [30].

Even though some holistic approach have been pursued [22], none seem to properly address the problem of how to mirror the separation of powers in DLT-powered eGovernment services. The problem has just been briefly mentioned by two prominent authors [38][7], and a promising new DLT [28] seems to be aiming in the correct direction. However, this aspect seems to be quite overlooked and for this reason it is worthy of deeper analysis.

4   Methodology

The first step of this research project would be the technological assesment, in order to weigh technological, legal, political and philosophical pros and cons of public *vs* private DLTs, as above mentioned. In particular, the most wide spread DLTs, such as Ethereum, IOTA, EOS, Tezos and, of course, the Hyperledger, but also emerging new technologies such as STORE. An in-depth analysis of their governance model will be of essence to single out the features that fit best a truly decentralized Democracy.

The political and philosophical investigation would follow, in order to properly understand the drivers and the consequences of such a choice. This would entail a preliminary study and comparison of different implementations of democratic values and ideals in existing and ideal political systems. The just men-

tioned analysis is needed in order to establish a method of evaluation and assessment of existing, work in progress and future projects that combine the use of DLT in public governance (such as the European Blockchain Partnership and Service Infrastructure and how it could push forward the Digital Single Market, and if such evolution of the Public Sector would require disruptive changes under a legislative point of view).

Also, surveys on the public perception of the issue by the tech and law communities, together with the one of non-experts in the field, could prove to be useful.

Finally, implementation challenges would be explored, having particular regard of countries were DLTs are already used in some e-government services. In particular, since justiciability plays a key role in democracies, a study of emerging DLTs that try to address the issue is due; moreover, experiments in building justiciable services, having regard of existing civil and administrative procedural laws could prove to be of essence for keeping the research grounded to reality.

5   Conclusions

This work had the goal to lay down a possible path for future research, singling out the main questions that might be overlooked by current state of the art on the open issues. The final and ambitious aim is to push the research forward in order to build the foundations of a new way of thinking, that concurrently tackles technological, juridical and political challenges. This new way of thinking could be called *Law Engineering*, as it would serve as a tool to carefully balance, in a precise and scientific way, the different needs that arise from the modern and ever-evolving society.

6   Acknowledgment

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