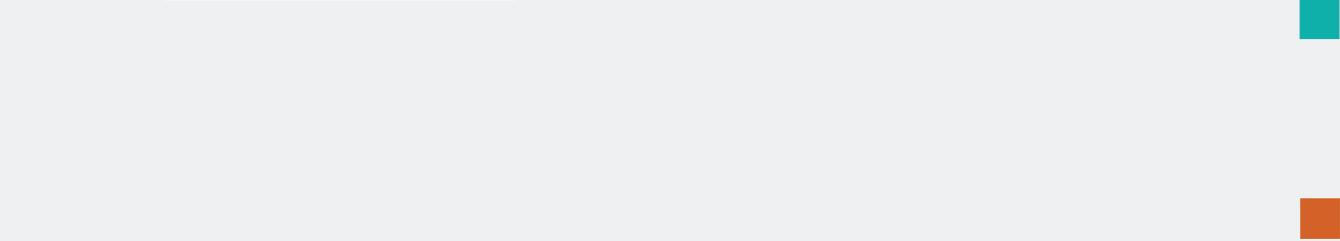
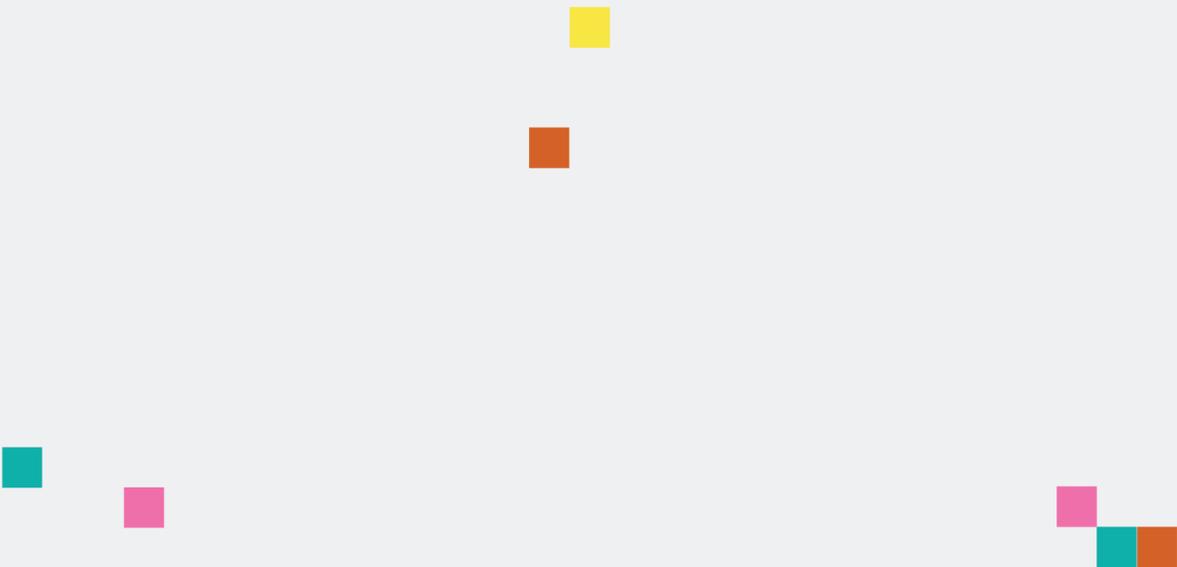




decode



**Framework for democratic
governance of distributed
architectures**



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 732546



Project no. 732546

DECODE

DEcentralised Citizens Owned Data Ecosystem

D 2.3 Framework for the democratic governance of distributed ledger technologies

Version Number: V1.0

Lead beneficiary: UOC

Due Date: December 2017

Author(s): Antonio Calleja-López (IN3/UOC), Arnau Monterde (IN3/UOC), Xabier Barandiaran (Decidim BCN/IMI)

Editors and reviewers: Tom Symons (Nesta)

Dissemination level:		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Approved by: Francesca Bria, Chief Technology and Digital Innovation Officer, Barcelona City Council (IMI)

Date: 31/12/2017

This report is currently awaiting approval from the EC and cannot be not considered to be a final version.

Table of Contents

Table of Contents	2
1. Executive summary	4
2. Introduction	6
3. Decoding governance	11
3.1. Unpacking governance	11
3.1.1. Historical thread: the rise of governance, neoliberalism, and the network society	12
3.1.2. Conceptual thread: government, governance, governmentality	14
3.1.3. Methodological thread: three key approaches to governance	16
3.1.4. Conclusion	18
3.2. Governance and distributed ledger technologies	19
3.2.1. Blockchains unchained	19
3.2.2. Blockchains and governance	21
3.2.2.1. Crisis of trust: from the crisis of the welfare state to the crisis of neoliberalism	22
3.2.2.2. A technological approach to governance	23
3.2.2.3. The technopolitical loop and beyond	25
3.2.2.4. Governance of blockchains	26
Varieties of blockchains	26
Levels in the governance of blockchains	26
4 cases of governance of platforms	28
Bitcoin governance: code is law and proof of work	28
Ethereum governance: code is law and proof of stake	31
Tezos governance: vote is law and code.	33
Dfinity governance: AI is law	34
A note on the blockchain governance paradox	34
Exits, forks, and governance	35
Mechanisms of infrastructural and technopolitical governance	36
Paradigms of meta-governance	37
Governance challenges	37
Challenges at the level of platforms	37
Challenges at the level of applications	38
Challenges at the level of ecosystems	38

Actors in blockchain ecosystems	39
Global Solution Networks for the the governance of blockchains	40
On the evolution of blockchains	41
3.2.2.5. Governance by blockchains	42
Organizations: the DAO (Distributed Autonomous Organizations)	42
Corporations: the DAC (Distributed Autonomous Corporation)	43
Governments: from open governments to bitnations	43
3.3. Decoding democratic governance	44
3.3.1. A preliminary approach to the relation between democratic governance and distributed ledger technologies	44
3.3.1.1. Sketching democratic governance	44
3.3.2. The technopolitical loop of networked democracy: digital infrastructures for democratic governance & democratic governance of digital infrastructures	45
4. Democratic governance of open source software and communities	47
4.1. Models of governance of open source software communities, resources and technologies	47
4.1.1. Elements of governance in peer-production communities: the open source software paradigm	47
Community boundaries: Identifying what and who is within the community	49
Incentives, functions and duties within the community or ecosystem	50
Incentives in open source software projects	50
Roles and motivations	50
Open Source Community Sustainability and financing	51
Collective-choice arrangements	52
OSC Governance models	52
Monitoring: from open source to open development	54
Sanctions: Free software licenses and beyond	55
Conflict resolution	56
Barriers for formalizing a governance model	56
When communities split (forking)	57
The project is too young or too small	57
Recommendations for addressing governance issues	57
4.1.2. Case study: democratic governance of Decidim	58
Decidim.org	58
Metadecidim, a democratic technopolitical community	60
Decidim Social contract	62
The governance model of Decidim	64

4.2. Preliminary schema for the democratic governance of DECODE ecosystems	69
4.2.1. Specific dimensions (of Decode) to consider	69
4.2.2. Issues to be considered for DECODE in practice	71
5. The DECODE pilot: distributed ledger technologies for a democratic governance of society	74
5.1. Mapping networked democracy	74
5.1.1. The rise of the network society and informational capitalism	74
5.1.2. Democracy and the rise of data and surveillance capitalism	76
5.1.3. Decidim and metadecidim: third generation networks for radical democracy	76
5.2. DECODE technology for networked democracy	80
5.2.1. Decode pilot: i.digital and citizen i.initiatives	81
DECODE wallet and i.digital	81
DECODE i.initiative ledger	81
DECODE data dashboard	81
Democratic transformations	82
Recrafting visibility: transparency, anonymity, and data autonomy.	82
Boosting collective action and intelligence	82
6. Conclusions	84
7. Bibliography	85

1. Executive summary

The DECODE (DEcentralized Citizen Owned Data Ecosystems) project turns around three key realities at the core of the current data economy: technological infrastructures (software and hardware), data, and social actors. It proposes a model of data ecosystems where, in opposition to the current data economy, citizens (both individually and collectively) own, govern, and make the most of their data¹.

In this deliverable we carry on two main tasks. Firstly and more importantly, we outline a preliminary framework for the democratic governance of distributed ledger technologies (or blockchains) such as DECODE. Otherwise, we focus upon the connection between social actors and DECODE technology, attending primarily to software. We leave the systematic consideration of the democratic governance of data for a later work (D2.5). Secondly, we look at some of the impacts that DECODE technology (specifically, in connection with the Decidim digital platform for participatory democracy) may have upon democratic governance in the network society.

In order to accomplish the first task, we explore the various definitions, models and realities of governance as present in various literatures. We do so from a historical, conceptual and methodological viewpoints. We believe it is necessary to properly understand the genealogy and potentialities of this concept (and its linkages with the notions of government and governmentality) in order to explore politics today. Although we distinguish different strands of literature and policy making based on the notion of governance, probably the most relevant one for our exploration is the one tied to New Public Management and neoliberal policies since the 1980s. We also point towards alternative visions, which have called for a democratic governance of society that questions the centrality of representative democracy, corporations and the bureaucratic State: a tradition going from the New Left's Port Huron Statement to the alter-globalization movement of the 2000s, up to offshoots of the more recent Occupy and 15M movements.

We then look at the relations between distributed digital technologies such as blockchains and the notion of governance. Currently, most blockchain narratives and models neatly fit under the neoliberal governance paradigm: positions of mistrust towards the State go hand in hand with calls for markets (idealized as decentralized social systems) and business logics to be introduced in public management and services. Narratives around blockchain technologies such as bitcoin and ethereum echo and take advantage of the crisis of trust on institutions brewing since the 2008

¹ As explained in this article by DECODE coordinator Francesca Bria:

economic crisis at the very least, calling for the circumvention of any external “third party” mediating relations between any two actors in society. Blockchains, “trustless digital ledgers”, come to supply a key piece missing from the neoliberal governance landscape: a technological infrastructure that promises to “disrupt” institutions such as central and private banks, financial corporations, bureaucracies, and the like. We look at some of the existing governance structures of blockchains, and their limits.

We present DECODE as an alternative vision of distributed ledger technologies, and their relations to democracy. This vision can be more closely linked to radically democratic traditions of the last 40 years, and beyond. We show how the DECODE technology, specifically in connection with democratic digital infrastructures such as Decidim², holds potential for advancing towards a democratic governance of both distributed ledger technologies and the network society more broadly. We suggest this in a double movement or technopolitical loop: a) we first outline a preliminary framework for the democratic governance of DECODE technology (for this we build upon D1.8); b) then we briefly look at how a project such as DECODE may affect democracy and the democratic governance of the network society in a broader sense (on this we build upon D1.7).

In order to explore a potential model for the democratic governance for DECODE technology, we analyze some models of open source software, and map some of their problems. We then move into a detailed analysis of the emerging “decidim model” of democratic governance of digital infrastructures (from the viewpoint of the code, the cothe legal framework, and the community), which we are currently helping to define along with actors in the Decidim ecosystem. Then we make some proposals for DECODE.

Finally, we look at some of the impacts that DECODE technology may have for democracy and the democratic governance of social processes, especially in connection to Decidim. We first make a brief recount of the rise of the so called networked society and networked democracy, and how the latter is confronted to day with so called data and surveillance capitalism. We then suggest that a third generation of digital networks (such as Decidim) may help to advance to a more radical democracy. Afterwards, we explore some of the possibilities of DECODE may hold for democracy in the economic, social and political planes, focusing in this last one and its potential relations with Decidim.

² Decidim is a free software, digital platform for participatory democracy, first sponsored by the Barcelona City Council. It results from historical processes tied to the 15M movement.

2. Introduction

Life, datafied: searches and findings, musical and biological rhythms, series and films, friendships and love relationships, goods and services, politics and cities... All these human realities are today increasingly shaped by the algorithms of companies such as Alphabet, Spotify, Fitbit, Netflix, Facebook, Tinder, Amazon, Twitter, Airbnb. As people in developed countries spend ever more time on devices connected to the Internet, a new digital layer or environment (Echeverria, 1999) surrounds their personal and collective lives, or, more precisely, permeates and reshapes them.

In the digital spaces built by corporations such as those just mentioned, actions leave (or are made to leave) data traces that are continuously aggregated, mined and used in the expectation of shaping individual and collective actions. That is the core of the new data economy, which has situated Google or Facebook among the richest companies in the world (Bria, F. et al 2015).

A new social and economic reality results from the struggles of millions of actors deploying or using technological networks, developing new data mining methods, ideating innovative economic schemes, transforming their perception of the world... This new economy, its pervasive influence on everyday life and its datafication (Lohr, 2015), and the concentration of wealth and power within it outlines an ambiguous landscape for democracy and society more broadly... Some questions become urgent: what is data and what types are there? Who creates, who owns and who controls it? Why and for what purpose? How? Who benefits?

The DECODE (Decentralize Citizen Owned Data Ecosystems) project grows out of an increasingly widespread, critical diagnosis of the current forms of data economy, as well as its conditions and impacts³. It is also oriented to transform it. The project aims to do so by articulating a vision and, specifically, “practical tools to give people control over how their data is used, and the ability to share it on their terms” (D1.7)

The DECODE project will build technologies and ecosystems in which people have ownership over their data, and are able to decide where it is stored, who can access it, and for what it is used. Furthermore, third parties will be able to build applications on top of the DECODE infrastructure without having to harvest and keep personal data.

³ This analysis is summarised in this report from the D-CENT project: https://dcentproject.eu/wp-content/uploads/2015/06/D3.3-Annex-Internet-Identity-Seminar_annex.pdf

People getting personal and collective control over their data will shift the balance of power in the current model of data economy. Today, big corporations such as Facebook or Google have wide control over the data generated by their users. They have become monopolies of a growing economic field. More importantly, they have become key shapers of the everyday.

If States traditionally stood for the centralized control of information and action of their subjects (Scott, 1998), today it is corporations that are gaining pre-eminence. After all, no country has access to so many granular details of the daily life of 2 billion people as Facebook does. Regulation is only slowly emerging (as discussed in D1.8), with a new General Data Protection Regulation becoming enforceable in the European Union from May 2018. But it is built over a field where power asymmetries and lack of transparency are widespread. Surely, neither corporations nor the emerging data economy are democratic in nature, and the growing concern is whether they are detrimental to democracy itself. They seem to be fostering multiple forms of what has been defined as “data extractivism”, in which users’ information is hoarded and exploited by corporations whose management and use of data is unaccountable (D1.7). Those who generate the data have no control over it, those who put the means for generating it get it, the result is that people’s lives become transparent to companies that are not. People’s lives become increasingly shapeable on a granular level, but the new shapes may actually build upon and feed back into negative personal and collective traits (as suggested by earlier relevant figures of companies such as Facebook⁴).

This has generated multiple negative outcomes (as resumed in D1.7): practices of exclusion and discrimination based on data, ranging from insurance denial to association with crime; it has undermined privacy and security online, with ever more data being extracted under terms and conditions that frequently are either difficult to understand to non-negotiable; economic disempowerment of non associated users or new economic actors against huge corporations. People become undemocratically governed, surveilled, disempowered.

New regulation (such as the mentioned GDPR), raising public concern (for reasons that go from Edward Snowden’s revelations about massive surveillance by the US government to discourses around political networks between countries), and new technologies (such as DECODE) may help to recraft the balance of power in the digital data economy. As an alternative to the status quo, “DECODE will create a new digital

⁴ As suggested in different interviews, such as

<https://www.theverge.com/2017/12/11/16761016/former-facebook-exec-ripping-apart-society> and <https://www.theguardian.com/technology/2017/nov/09/facebook-sean-parker-vulnerability-brain-psychology>.

economy ecosystem, enabling in particular the rise of more localised, democratic models for pooling and sharing data” (D1.7).

To adapt the famous characterization of democracy by Abraham Lincoln as a government of, by, and for the people, we could say that a key element of DECODE’s vision is to construct ecosystems of “data of the people, by the people, for the people” (rather than “from” the people, as in the current model), otherwise, where they have personal and collective control over it (over its ownership, storage, access, use, etc.).

At the centre of this debate is the question of governance and, more concretely, democratic governance. Much of this has to do with who makes decisions, and how decides about data and the digital infrastructures are made. Once we pose the question of the who and how of decision making, questions around governing are not far. “Governance”, the term of preference for speaking of the process of governing beyond the State, is both a complex phenomenon and an ambiguous term (Björk et Johansson 2001; Hufty, 2011a). We devote section 3.1 to articulating and defining our approach to it.

Furthermore, governance is not necessarily aligned with democracy. However, some forms of governance can, indeed, be democratic: it is to this type that we devote attention here. We do so not in general terms but rather in relation to digital infrastructures, their management and potential impacts. This helps to both narrow down the issue of democratic governance while complexifying it, since research on these infrastructures, like the phenomenon digitization and datafication of everyday life, is a still emerging research field.

It does so in a double (and recursive) sense: in terms of how the DECODE technologies can contribute to a democratic governance in the network society and, reversely, in terms of how infrastructures such as DECODE can be democratically governed. It tries to alter the current model in which key infrastructures of the information society are controlled by corporations that in turn influence democratic processes (Bode et al., 2018)

This deliverable does not aim to give a full model of democratic governance for distributed ledger technologies nor a full map of the potential impacts of DECODE technologies for various aspects of democratic governance and democracy more broadly. Rather, it tries to provide a useful preliminary framework for the exploration of these issues. In practice, this exploration will unfold along with the DECODE project itself and, more concretely, with the Decidim pilot (assessed in D2.6). This approach derives not only from the complexity or novelty of the matters at stake, or even of DECODE as technology, but also with the very nature of our understanding of democracy as an open ended process of collective (decision) making. Democratic governance of

distributed ledger technologies (from DLTs) must be explored and constructed democratically rather than defined a priori.

3. Decoding governance

3.1. Unpacking governance

The term “governance” comes from the ancient Greek “kubernân”, used to refer to the steering of ships. Early on, Plato used it to refer to the steering of the polis and human beings. It passed from Latin into numerous Modern languages. For most of modernity it has been used as a synonym with government and governing. Only in the last four decades it progressively become a distinguishable term and concept, in many cases opposed to “government”.



Statistics of use of the term “governance” in publications in English language, according to Google n-grams⁵

Its rise in popularity went hand in hand with the raise of discourses and policies frequently grouped under the label of “neoliberalism”. Governance came to challenge the modern primacy of government as a key social and political form, both in the conceptual and the practical planes. Its clear rise has not meant clarity. Governance has been used as a discursive dispositive in processes of governance description and promotion, in academic research and political action, with a variety of meanings. As noted by Hufty (2011a), this fuzziness may actually be a welcome aspect or “productive misunderstanding” (Bohannon, 1958), an anchoring point for the action of actors with a variety of interests (Sahlins, 1985). For this reason, in the following sections we try to clarify “governance” from a historical, conceptual, and methodological viewpoint.

⁵ We use this as an illustration, aware of the various limits of the google n-gram corpus.

3.1.1. Historical thread: the rise of governance, neoliberalism, and the network society

Governance has become a key concept in public policy, as well as in politics and economics more broadly, in the last four decades. Hufty (2011b) has distinguished four strands of literature that have contributed to this. The first is that of *organizational theory*, focused on corporate governance; a second one is that of *global governance*, dealing with the proliferation of supranational (and frequently sub-national) institutions and agreements redefining the power of the nation-state; a third, devoted to *good governance*, has been mostly a prescriptive literature applied to development policies; a fourth, interested in *public management*, that has sometimes promoted and sometimes analyzed the weakening of the role of the State in social life in favor of markets and policy networks. In this section we focus on this last thread. We do so because we believe these traditions anticipate the historical-political climate heralding the advent of mainstream discourses linking governance and blockchain.

The “governance turn” in policy discourse and practice is associated to “changes in the nature and role of the state following the public-sector reforms of the 1980s and 1990s. Typically, these reforms are said to have led to a shift from a hierarchical bureaucracy toward a greater use of markets, quasi-markets, and networks, especially in the delivery of public services” (Bevir, 2007: 364).

Neoliberal advocates of these reforms departed from a critique of the Keynesian Welfare State as unmanageable, unsustainable and ultimately contrary to economic development (In continuity with the early neoliberal critiques to socialist planification-- Hayek 1945). A core tenet was that “the state is inherently inefficient when compared with markets”, so that it should “concentrate on making policy decisions rather than on delivering them” (ibidem, 365). Differently, the model of an “entrepreneurial government”, reliant upon competition and markets, should call for government to “steer” rather than “row”, it should make policy to be implemented by markets (or institutions following similar logics): these are basic ideas of the so called New Public Management and its model of governance.

A first key to neoliberal New Public Management (NPM hereafter) has been marketization: processes of outsourcing, consumer choice and privatization of public services and bodies. Especially in countries such as the US or the UK, this advanced a process of “hollowing out the State” (Rhodes, 1995) and made it reliant upon a variety of private actors for the implementation and success of public policies. A second strategy is that of “corporate management”, which implied the introduction of incentives and metrics coming from private management into public administration: focus upon and evaluation of results, higher quantification of performance, customer attention, or resource optimization tied to budget reduction.

According to authors such as Bevir (2007, 2013), in the late 90s and 2000s, a second wave of State reform came under what has been sometimes defined as a “new governance” approach. It emerged as a discourse oriented to address a different array of problems, from terrorism and global warming to the effects of the NPM policies themselves: concerns about equity, receding quality and quantity of public services, fragmentation and decrease in accountability of the State under the NPM model of governance gained track. This resulted in the emergence of policy networks, public-private partnerships and the centrality of voluntary organizations, an attempt to involve the organized citizenry in different aspects of policy making. The “Big Society” advocated by Cameron is an example of this model, as well as of its drawbacks: citizen involvement was frequently limited and usually relied on voluntary work, going hand in hand with the basic neoliberal principle of state and budget reduction (Kisby, 2010).

The growing global power of a variety of international institutions (from the IMF or the European Union to the World Health Organization) and, especially, big corporations, along with the proliferation of free trade agreements, meant that the traditional role of the State and its centralized model of government of social life became reformulated and sometimes fuzzied into a landscape of polycentric political power, where multi-stakeholder governance appeared as a more suitable model for both descriptive and prescriptive purposes (Young, 1999). Suprastate and sub-state powers push the State from a paradigm of government into one of governance .

Beyond both NPM and new governance models, alternative approaches emerged from activist ideas tied to radical participatory democracy and anarchism (Bevir, 2007; Mason, 2016; Graeber, 2013). Movements such as the alter-globalization called for and experimented with forms of radically democratic governance (Della Porta, 2013). Creative practices involving ICTs were crucial for these experiments, making them not only key for its organizational forms, but also of its political ideals and norms (Juris, 2008).

These processes went hand in hand with the rise of what Manuel Castells called “the network society”. The development and introduction of information and communication technologies by diverse social actors in a growing arrange of social settings was associated to an emergent array of practices and social forms. The ideal (more than the reality) of the internet, the world wide web and cyberspace appeared as the image of a distributed and free network for the circulation of information (from speech to capital). For better or worst, empowering social or market influence on governing, the network society implies that governance and democracy comes to embody a networked and distributed model instead of the classical pyramidal (top-down) model of governance.

3.1.2. Conceptual thread: government, governance, governmentality

The historical processes mentioned above have been discursively constructed in terms of a confrontation and transition from traditional bureaucratic government to innovative networked governance. Identified with centralized and hierarchical forms of coordinating action, government has been presented as a relic of modern times in need of deep transformation (Bevir, 2007).

The nature of government itself, both as a concept and as a reality, has been part of this debate. For our purposes, it is possible to distinguish government qua “thing”, as an institution, as government of the State, and government qua “process”, as an action, as the exercise of governing, as government by the State. Although word usage varies from country to country, “government qua thing” is frequently associated with either the body of elected officials that hold office in a given country (the executive power), its representative political bodies (the executive and the legislative, sometimes including the judiciary), or its public administration as a whole (including the aforementioned powers). Otherwise, the term covers meanings that go from the State as a whole to the subset of it charged with politically orienting its action (f.i.: in the form of public policy) and giving it a frame (f.i.: in the form of legislation), as well and to represent it at the highest level (f.i.: in internal and international relations).

“Government qua process” is sometimes considered as an abstract term to label the “method, range, purpose, and degree of control of society by state” (Bevir, 2007: 387).

The transition from the government to the governance paradigm implies changes in both axes. In the institutional axis, it implies that new actors collaborate with it and intervene in the enactment of some of its traditional functions. In the processual axis, it implies that the hierarchical, rigid, top-down, and centralized model of governing gives way to a less centralized, more flexible, bottom-up and sometimes less hierarchical forms of doing so.

Governance has been repeatedly noted as an ambiguous concept (Björk et Johansson 2001; Hufty, 2011a). Probably one of the broadest definitions, Hufty (2011a: 405) suggests governance encompasses: “processes of interaction and decision-making among the actors involved in a collective problem that lead to the creation, reinforcement, or reproduction of social norms and institutions”. A key point is that “it focuses not only on the state and its institutions but also on the creation of rule and order in social practices” (idem). In some cases, government is no more than a concrete institution enacting a concrete type of governance.

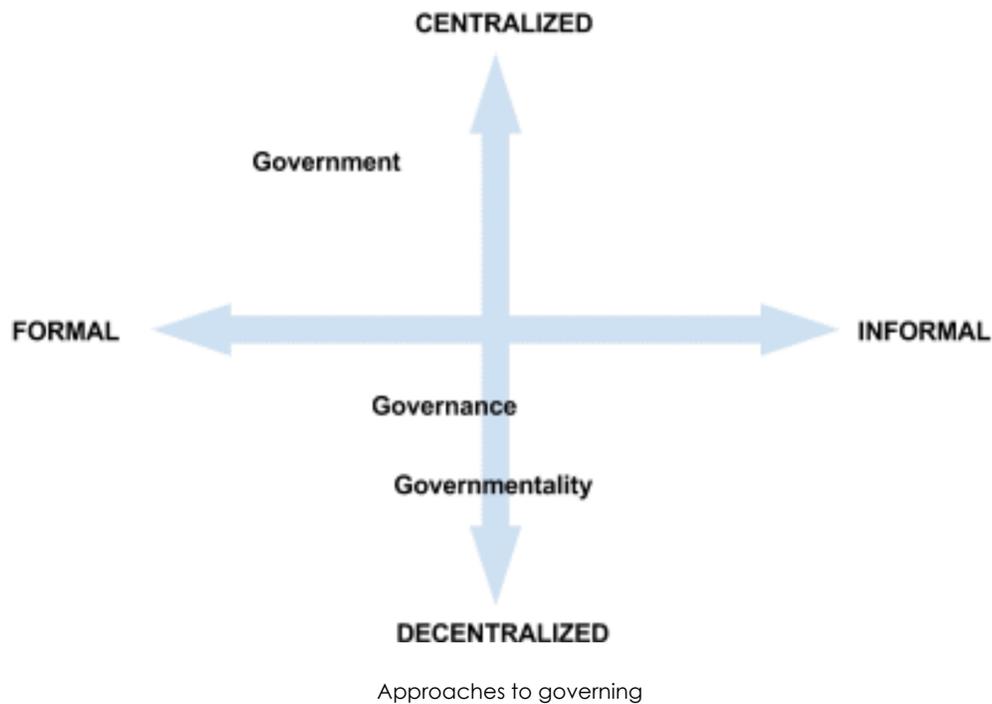
The historical transition in primacy from government to governance in Western societies in the last quarter of XXth century, is partially problematized by a third notion that can

help to clarify some key aspects of the forms of governing: *governmentality*. The notion, first coined by Michel Foucault (2008) tries to look beyond the formal institutions and processes of governing by the State into the concrete practices by which conduct is conducted, otherwise, how dispositions and behaviors are generated, shaped or influenced by certain practices. This approach detaches State and government: it looks also to practices of government in other institutions and even at the level of the individual and its self-conduct. Any form of governmental practices, surely those by the state, generate both complementary self-government practices as well as counter-practices that challenge them.

The concept results from the combination of this practice of governing with the rational form that defines it in modernity. Formal methods of calculation, measurement, registration, definition, taxonomy, etc. developed during modernity both are extracted from, applied to and reinforced by these practices. Modern human and social sciences rely upon these practices in order to generate knowledge. It is not that knowledge is power (to put it with Francis Bacon) or even that power is knowledge, but that this pair has to be thought as a hybrid knowledge/power. Furthermore, Foucault was premonitory in his analyses of technologies and techniques as forms of assembling forms of knowledge/power: his classical image of Jeremy Bentham's Panopticon as a material metaphor of surveillance

These processes of knowledge/power somehow underlie both traditional models of top-down State government as well as decentralized governance practices. Interestingly, they also show their commonalities. Crucially, the concept of governmentality challenges views that see in governance's distributed forms of organization either emancipatory forms by default or tools for its advance. Governmentality points to the omnipresence of power and to the need to map it in detail, and case by case, and more importantly for this project, at the level of protocols, infrastructures, mechanisms and dynamics that emerge from the technological (in the broadest sense) articulation of power.

We can sketch a schema that situates these three positions:



3.1.3. Methodological thread: three key approaches to governance

There are numerous approaches to governance. Ultimately, they are influenced by different theoretical traditions in the human and social sciences (for a recent synthesis, Bevir, 2011): rational choice, institutionalism, and interpretivism.

Rational choice theory (Dowding, 2010) (the basis of much NMP, as noted above), is a micro-level economic analysis that defends a view of social action as resulting from the aggregation of the performances of actors rationally pursuing their individual interests. Otherwise, trying to maximize utility (wealth and/or power). Public interest appears as either a chimera or as a result of such an aggregation of individual actions and interests; politicians and public servants appear as selfish individuals as any other. Consequently, one of the recipes to align the interest of the latter with citizens' interests was to introduce corporate management criteria into State bureaucracies or substitute them with market actors.

Institutionalist currents (Peters, 2011) have focused on how formal organizations, rules or procedures, but also norms, habits, and cultural customs shape collective behavior. Within so called "new institutionalism", there are various positions, from those that try to apply rational choice principles to those that follow historicist lines, thereby attending to the becoming of institutions over time (f.i.: using notions such as path dependency), or sociological ones, which focus on how they shape actors' identities and comprehension (for a synthesis Bevir, 2007).

Interpretivists (Bevir, 2010), on the other hand, emphasize the role of human discourses and practices in the construction of governance: the struggles between different actors and their webs of meaning around governance configure a given constellation. These constellations can be studied synchronically and diachronically.

Probably the more systematic attempt to define a methodological approach to governance has been carried on by Hufty (2011a). His so called Governance Approach Framework (GAF) aims to turn “governance” from a fuzzy concept into a rigorous empirical methodology. The author claims that the approach must be: *descriptive*, avoiding the normative load usually associated with the notion of governance in policy analysis (from the traditional celebration and advocacy for governance by NMP to the ideas around “good governance”); *interdisciplinary*, cutting across disciplinary boundaries to show the polyhedric reality of governance processes (crucially, including the viewpoints of actors themselves, thereby becoming participatory); *reflexive*, enacting self-critical (and, thereby post-positivists, critical realists approaches); *generalisable* (going beyond concrete governance cases and forms); *comparative* (an aspect directly connected to the previous one); and *operational* (able to be applied to empirical cases).

Perhaps more importantly, Hufty proposes five analytical tools to understand governance: problems, social norms, actors, nodal points, and processes. Governance involves actors, norms, and processes that may be either formal or informal.

The first key concept is that of problems or “sets of interrelated issues at stake”. Problems are framed differently by different actors, so they are frequently at stake in the struggle around governance. We could say problems can also be the objects of governance).

The second are actors, individual or collective. According to Hufty, they must be approached in a series of steps. Firstly, an identification and description of actors, be they formal or informal, and a justified decision of how it will be done. Secondly, an assessment of their influence, attending to factors that go from their capital (in Bourdieu’s term) and their intention to use it up to their effectiveness in doing so and their interactions with others. This facilitates a classification of strategic, relevant and secondary actors. Thirdly, a taxonomy of their interactions: negotiation (equal but calculating and self-interested), directive (asymmetric in power), reciprocal (equal and moral-based, in the tradition of Mauss, 1923-4).

Their collective action and interaction generate (and is informed by) a third key element, social norms, “shared beliefs” that “guide, prescribe, and sanction collective and individual behaviour”. Institutions are systems that formally and informally embody and nurture certain norms. Interestingly, on the basis of social theory (Krasner, 1982; Searle, 1995; Finnemore and Sikkink, 1998) authors tend to distinguish between different levels of norms (Hufty, 2011) and, thereby, governance (Kooiman, 2003): first order or

regulatory norms (the level of governance) concern the rules of individual and collective behavior; second order or constitutive norms (the level of institutional governance) concern the rules or principles by which the rules (according to Hufty, 2011a) and the institutions that embody them (according to Kooiman, 2003) are established, cared for and transformed⁶; third order or meta-norms (the level of meta-governance) concern general social principles and values. The relations between the three can be understood as a multi-scalar interplay, they can range from the local to the global, and imply struggles around their generation, transmission and reception (a reception that can go from rejection to adoption).

All of these can be traced at what Hufty (2011a: 413) defines as “nodal points”, key “physical or virtual spaces where various problems, actors, and processes converge, and where decisions are taken, agreements concluded, and social norms created (e.g. a negotiating table or a local community assembly)”. They can be articulated in chains and operate at multiple levels. They may be a good entry point to a study of governance in a concrete case.

The fifth category are “processes”, which serves to look at the interplay between the previous elements in time. They help to look at their entangled becoming.

These five “tools” are deployed in to analyze governance as a phenomenon that is situated in a context (operating as independent variable of sorts) and that affects a problem (which operates as a dependent variable). They help to open up and explore its richness and, in doing so, allows more precise interventions into governance in order to improve the outcomes in the management of the problems or issues at stake.

3.1.4. Conclusion

As we have seen, there are different threads to be considered when approaching governance. The historical thread shows the linkage of mainstream discourse on governance by neoliberal policies in the last decades. At the same time, it shows that there may be more than one pathway in looking at governance, with some of them connecting better with radical democratic traditions. This points to potential alternatives for thinking the relation between governance and blockchains in democratic terms, beyond the current mainstream discourse on the matter.

⁶ Kooiman (2003) distinguishes second order governance (which concerns the governance of institutions of governance) and third order governance, which concerns broader norms and principles that orient governance as a whole. We prefer Hufty’s bipartite formula, and understand that the “meta-” level can have different objects but has the same “reflexive” structure.

The conceptual thread helps to distinguish it from government, and to connect it to issues of governmentality. While the relations between government and governance are frequently framed in terms of conceptual and historical opposition (as a transition from the centrality of bureaucratic government to network based governance), governmentality opens a view into the shared practices that underline the realities pointed by these two concepts. Furthermore, it opens the discussion to the relevance of technologies in the shaping of personal and social life, which is clear when discussing both blockchains and data.

We have also seen different traditions of approaches to governance. We believe different elements can be taken from each of them. Interestingly, Huffy's proposal seems to connect aspects of rational choice, institutionalism, and interpretivism, which makes it useful in the process of exploring governance in practice. In spite of the author's insistence on description over prescription, it can be a relevant reference for a process of outlining a model of democratic governance for DECODE infrastructure.

3.2. Governance and distributed ledger technologies

The array of issues connected to governance partially shifts when we speak of distributed digital infrastructures. By these we understand, very basically, information technology systems that have no structural center. The structural homology with governance is clear: one speaks of decentralized technological structures; the other, of decentralized sociopolitical structures. But exploring their connections requires a further inquiry. We begin it by presenting blockchains and some of their impacts.

3.2.1. Blockchains unchained

Two historically paradigmatic cases of decentralized information technology infrastructure are the Internet itself and the World Wide Web. As noted in Baran (1964)'s classic article, the Internet was thought as a distributed (or, at the very least, decentralized) network connecting and allowing the flow of information between different US research and military centers. By lacking a single center, the network could withstand the eventuality of a nuclear attack: information could be re-routed by unaffected nodes. Similarly, the World Wide Web was conceived as a potentially global network of hyperlinked digital sites and contents (Berners-Lee & Fischetti, 2000).

In 2008, Satoshi Nakamoto (a pseudonym for one or more people) published "Bitcoin: a peer to peer electronic cash system". Its implementation generated a digital currency involving transactions that are evaluated in the thousands of billions of euros per year. This has catapulted the key technology behind bitcoin, distributed ledger technologies (or blockchains), as the new paradigm of a decentralized digital architecture. So much

so that some World Economic Forum reports (Tapscott & Tapscott, 2017) herald blockchains as the first step in the emergence of a second generation internet, “the internet of value”, that will replace “the internet of information” of previous decades. These “World Wide Ledgers” may “record anything of value to humankind”, from citizenship and voting rights to ownership, “anything else that we can express in code” (Tapscott & Tapscott, 2017: 5).

Blockchains can be defined as distributed ledgers (or databases) that record transactions between parties in a way that is verifiable and permanent, and which are maintained and operated by a decentralized peer-to-peer network that shares protocols for adding new elements to the ledger (otherwise, for adding new blocks to the chain). All transactions are registered in the chain and every new transaction (or block of them) is tied to the immediately preceding one. Altering a recorded block requires to alter others, which requires to mobilize a majority of the network and a rapidly increasing quantity of computation. The original idea behind bitcoin is that this cost makes it both difficult and economically unsavvy to attempt such tampering.

Authors (Tapscott & Tapscott, 2017) have aptly summarized numerous characteristics of public ledgers or blockchains:

- they are distributed, meaning that they are supported by networks of computers that have no key center, if they have any at all, which makes it more resistant to attack or censorship.
- they use encryption techniques known as “public-key cryptography”, in which a given user holds a secret private key that grants control to a public key shared with other users, which potentiates both privacy and security of information transfer;
- they are open (at least, to the users in the network) and frequently public (accessible to anyone), which allows traceability and visibility (or transparency) of the operations ran on it;
- they can be (almost) immutable, which safeguards the integrity of the operations that take place in them;
- they are exhaustive because every transaction is recorded and tied to its precedents and subsequents;
- frequently, they are open source, which allows analysis, copying, autonomous modification and sharing of these modifications, allowing certain forms of autonomy---which does not imply others will accept or follow them.

The combination of several of these properties (distributedness, publicity and immutability) brings about a celebrated characteristic of blockchains: they allow to get rid of middlemen, be they corporations or governments, in validating all sorts of transactions between two parties. Today, people have to trust concrete institutions to

keep the accounts of things such as currencies or votes in elections, with blockchains--so the narrative goes--one can just see the ledger and check the math.

These properties have been connected to a series of “design principles” (Tapscott & Tapscott, 2016):

- network integrity or encoded trust, since transactions are mathematically validated;
- distribution of power, since there is no single point enabling control or censorship;
- value as incentive, since contributing to the network provides valuable tokens;
- security and privacy, granted by cryptography;
- rights (especially property ones), since interactions are tightly regulated;
- inclusion, by eliminating middlemen (such as banks) in the access to capital.

The applications are growing and the expectations are numberless (Swan, 2015; Tapscott & Tapscott, 2016): from digital currencies to distributed autonomous organizations, corporations and societies (DAOs, DACs, and DAs), from blockchain government to blockchain science, and from digital art to digital identity verification. Some have suggested that much of the entrepreneurial development on this growing field takes the form of “X, but on the blockchain” (Allen & MacDonald, 2016), in a way that resembles the dot-com boom of the late 1990s, where the formula was “X, but on the internet” (Davidson, De Filippi & Potts, 2016). Part of the current challenge resides in navigating the moving waters between realistic descriptions, plausible expectations, and technophilic and techno utopian hype, frequently tied to business strategies⁷.

3.2.2. Blockchains and governance

The relations between blockchain and governance are at the very core of the blockchain discourse. Distributed ledger technologies are heralded as a form eliminating the need of third parties. And, connecting with the traditional liberal discourse (as well as some traditions in marxism and anarchism), government is the paradigm of a “third party” getting in between any two actors trying to interact in society. The idea of “governing without governments” (as noted by De Filippi & Loveluck, 2016: 3) is a desirable goal of mainstream narratives around both blockchain and governance. Blockchains can be easily frame as a perfect dispositive of governance. On the other hand, as we will see as we analyse the history of blockchains, they have proven to be technologies themselves urgently in need of governance.

⁷ As suggested in reports on the topic <https://www.ft.com/content/b5b1a5f2-5030-11e7-bfb8-997009366969>

3.2.2.1. Crisis of trust: from the crisis of the welfare state to the crisis of neoliberalism

Nakamoto's paper was published in 2008, a key year within the last big financial crisis, whose impacts are still being felt today. For various authors this was the beginning of a "crisis of neoliberalism" (Duménil & Lévy, 2011) and the kickstart of a "Great Regression" (Geiselberger, 2017) one of whose characteristics seems to be a crisis of trust in institutions ranging from governments to corporations. If the economic crisis of the 1970s and its interpretations paved the way for the success of neoliberal reforms and the rise of the governance concept from the 1980s onwards, the current context may well be contributing to the success of narratives around blockchains as new technologies for governing social relationships. These emphasize the revolutionary value of the idea of "trust-by-computation", otherwise a "a shift from trusting people to trusting math" (Antonopoulos, 2014). But why is trust so important and what do blockchains bring to bear to this problem?

One of their key innovations lies in their response to the so-called "problem of cooperation". This is a particularly relevant game-theory problem in some social interactions such as commercial ones. Basically, people (especially those interacting at a distance) may not trust each other. In one-to-one interactions, some may fault in their promises (f.i.: not sending money after a product has been sent to them). In many-to-many interactions, some may forge transactions or the currency itself. But if fear of situations such as these prevents trust building, commerce may never happen. The usual solution is the emergence of third parties such as banks and States that both give assurances to the different parties and, more importantly, ensure to enforce promises and punish rule breakers. But these third parties gain a position of power that they can use in their own favor. This has generated a variety of criticisms coming from right and left political positions.

In the wider context of governance this is one of the most celebrated characteristics of blockchains: while traditional bureaucratic and commercial relations implied third parties such as banks and States and ambiguous legal codes for governing the interactions between two parties, one of the alleged virtues of blockchains is that they eliminate the need of third parties by recurring to public and univocal mathematical ledgers. Anyone can see the rules and the transactions, and can be sure that they will be enforced because they are written in self-operating code. Since such a code is run by a distributed network of peers, actors can trust the outcome of a transaction, without the fearing the abusive power of a third party.

In historical terms, we hypothesize that, if a crisis paved the way for governance in the 1980s, the one since 2008 is paving the way for a new form of it. The technocratic and capitalist dynamics that pushed the concept and practice of *governance* back then

may be finding new forms today, among them, that of blockchains. So far they seem to herald a form of what we may define as a “technocapitalist” or “technoliberal” governance⁸. After all, the first blockchains served to build a currency. If, under the neoliberal paradigm, the constitution of global markets required the work of setting and operating transnational institutions such as the IMF or the World Bank, or trade agreements ranging from NAFTA to the so far unclosed TTIP, bitcoin or ethereum seem to be able to open markets primarily (although surely not exclusively) with the support of software and the internet. Much discourse on bitcoin and ethereum hopes for a time of global markets (when not Bitnations) based on digital ledger technologies, untouched by any concrete national or international jurisdiction: an extension of their current situation of legal limbo, a new stage of capitalism after neoliberalism, defined by a technoliberal governance.

3.2.2.2. A technological approach to governance⁹

In terms of approaches to governance, the rise of blockchains seem to call for a new type, an approach to governance focused on its infrastructural deployment, technological encoding and pre-conditions. This brings it closer to the literature on governmentality. In section 3.1.3. we followed Bevir in outlining three approaches to governance: rational choice, institutionalism, and interpretivism. The discourses around blockchain and the practices associated to them seem to outline a fourth one: a technological (or technocentric) approach. In this context, a technological approach to governance means several things: first, that a key factor in defining and governing relations between actors is technology, concretely, software code and computing infrastructure; secondly, that the primary form of rationality is engineering, otherwise, other logics and languages are translated and even subordinated to it (this usually implies a technocentric discourse frequently fitting with business logics); thirdly, it is frequent (although not necessary) for key actors making decisions about the code and blockchain rules to be core engineers or technology owners, such as miners (as it is clear in the case of bitcoin and ethereum, Atzori, 2015).

In synthesis, the technological approach implies the promotion (by practitioners and evangelists) or the description (by researchers) of a form of governance (of and with

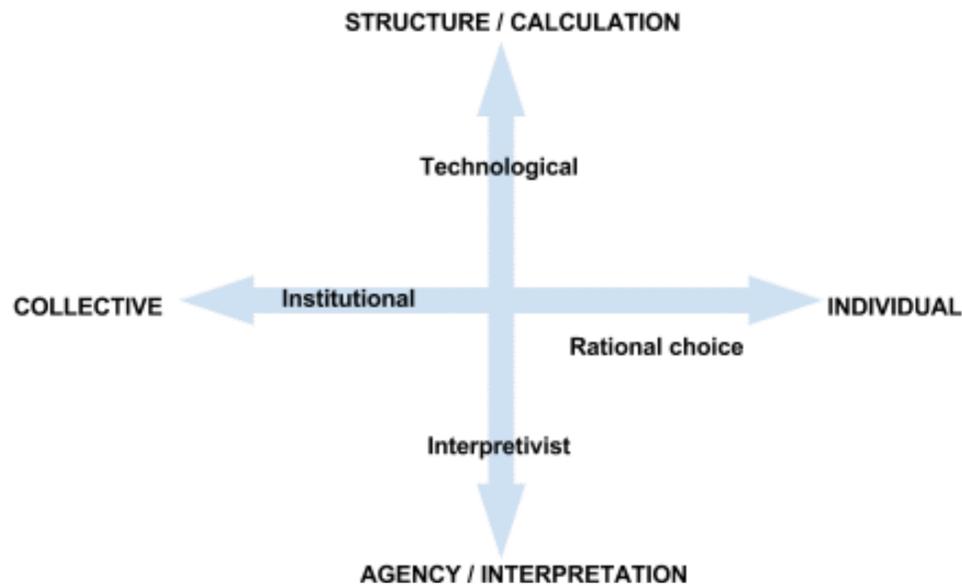
⁸ For the notion of US “technoliberalism” as one of the two great utopias of the XXth century, along with that of Sovietic socialism, see Kumar (1987).

⁹ Our choice of the term “technological” should not obscure the fact that any technological approach in this context, especially those deploying the apparent neutrality of the technological, is technopolitical, otherwise, it presupposes and performs certain political positions and dispositions. We could say a technological approach is a technopolitical one that does not recognize nor systematizes itself as such: it frequently is a technocentric or technocratic position, vs others, such as the democratic.

blockchains) defined by the rule of software, of engineering, and of software engineers. This amounts to a threefold form of technocracy.

This situation is synthesized in Lawrence Lessig's famous sentence according to which, in a given digital setting, the software "code is law": it limits and guides social behavior, makes possible or impossible certain trends of individual and collective action and, in this way, structures social relations. As Langdon Winner (1986) pointed out, a second "technological constitution" of society emerges, not necessarily aligned with its legal constitution. While in many technological settings the political dimension is hidden (such as in Winner's classical example of bridges), the discourse around blockchain technology is explicitly based on this principle. Blockchain advocates usually stress how this technology makes of code and mathematics the center of economic, legal and even social interactions.

If we recapitulate the four approaches detailed above we can elaborate a quadrant that simplifies them using two axes, a vertical one that situates them in relation to the variables structure/agency and calculation/interpretation, and an horizontal one that situates them in an spectrum collective/individual. The first plane or axis points to the fact that, while some approaches to governance give more weight to structures (be it external, such as technologies; or even internal, such as an individual's interests) in the shaping of agents' actions, other approaches stress agents' initiative and freedom. While the former position tend to stress the role of operations of calculation (be they objective, by computers, or subjective, like in rational choice theory), the latter pays attention to the variety of interpretations and conflicts around them as shapers of governance. In the second axis, we can see approaches that emphasize the importance of the macro-level, of the collective (such as institutions) in shaping governing, while others attend more to the micro-level of individuals (sometimes to the point of reductionism) , with others attending at at the meso-level of interactions (be they mediated by technologies or interpretations).



Quadrant of approaches to technopolitical governance

These various lenses can be combined in the study of governance. If above we said that Hufty's (2011a) model allowed to accommodate elements coming from rational choice, institutionalist and interpretivist positions, the same can be said of technological ones. When he speaks of norms and “shared beliefs” that “guide, prescribe, and sanction collective and individual behaviour” we can now say “sociotechnological” norms, which include technologies that orient, shape and sanction behavior in a similar but rather more forceful way than traditional moral or legal norms. This complementarity can be appreciated in the following section.

3.2.2.3. The technopolitical loop and beyond

We need a polyhedric approach because processes and practices of governance in relation to technologies are complex. Institutions frequently help to shape actors' interpretations that are crucial in the shaping of technologies such as blockchains, and these then serve to mediate and stabilize actors' competing interests into a shared and immutable form. The interrelations between these factors (and others) can be many. For the purposes of this work, we distinguish between two directions in our analysis, we attend to:

- governance by blockchains, or how distributed ledger technologies could affect governance structures and processes.

- governance of blockchains, how governance is or may be enacted upon distributed ledger technologies¹⁰.

The two are connected in various ways. In some cases, they define a recursive technopolitical loop between human-driven governance of the technology and the technology-based governance of human interactions. In principle, core engineers can decide a change in the code of a given blockchain. It is usually people (with technologies, such as computers) the ones who change a given technology that, afterwards, other people merely use as a given structure shaping their relations: in the process, both humans and technologies are shapers and shaped. However, in some blockchains (see Dfinity¹¹), the first recursive loop may become technological only: Artificial Intelligence could be the arbiter over changes to be introduced in some blockchains, as we explain below.

3.2.2.4. Governance of blockchains

Varieties of blockchains

Like in the case of governance, there are different models of blockchains. One of the taxonomies of this variety has attended to the kinds of things that are built with them. Recurring to the classical division between web 1.0, 2.0, 3.0, etc. Swan (2015) has distinguished blockchain 1.0, epitomized by bitcoin, used for currencies; blockchain 2.0, whose best embodiment is Ethereum, used for contracts; blockchain 3, with examples such as Namecoin (for distributed domain names) or Foldingcoin (for health issues), defined by applications out of the economic realm.

Levels in the governance of blockchains

There are not only different types of blockchains, but also different aspects to take into account when addressing their governance. A first relevant factor to consider is the objective levels at which governance of blockchains operates, otherwise, the things being governed. A second one concerns the normative levels at which governance is being articulated, otherwise, the types of norms influencing such governing. We touch upon the objects of governance first.

Tapscott & Tapscott (2017) have distinguished three levels to take into account when dealing with the governance of blockchains:

¹⁰ This use of governance by and of blockchains is taken from De Filippi & Loveluck (2016).

¹¹ Dfinity is defined in its website as “an unbounded, performant, self-governing blockchain computer”. More information at <https://dfinity.org/>.

- the level of platforms (such as Bitcoin and Ethereum¹²)
- the level of applications built on them (such as DigixDao or Namecoin)
- the level of ecosystems around them.

Each of these implies different actors and challenges.

On top of these three levels of governance of blockchains qua objects, we can distinguish three levels of governance of norms. Earlier we saw that norms operate in governance at three levels (as seen in 3.1.3.). The three normative levels of governance can be applied to the three objects just mentioned, namely, platforms, applications, or ecosystems. We remind them here:

- the level of governance: here we find first order or regulatory norms that concern the rules of individual and collective behavior;
- the level of institutional governance: here we find constitutive norms that concern the rules or principles by which the rules (according to Huftly, 2011a) and the institutions that embody them (according to Kooiman, 2003) are established, cared for and transformed¹³;
- the level of meta-governance: here we find third order or meta-norms that concern general social principles and values.

The relations between these three levels can be understood as a multi-scalar interplay, they can range from the local to the global, and imply struggles around their generation, transmission and reception (reception that may go from rejection to adoption).

If we apply this threefold schema to the relation of governance and blockchains (be they platforms or applications), we have three types of levels of normative governance of blockchains:

- infrastructural governance. It is determined by the software code and results from its application. This is the level at which the “code is law” rule applies more forcefully.
- technopolitical governance. It results from the politics and decision making around the code, it derives from negotiations and institutions defining its governance, from the legal to the community aspects.

¹² Here Tapscott and Tapscott erase the distinction between Blockchain 1.0 and 2.0 suggested by Swan (2015).

¹³ Kooiman (2003) distinguishes second order governance (which concerns the governance of institutions of governance) and third order governance, which concerns broader norms and principles that orient governance as a whole. I prefer Huftly’s bipartite formula, and understand that the “meta-” level can have different objects but has the same “reflexive” structure.

- technopolitical meta-governance. Here is where the conflict between various general technopolitical paradigms takes place, in our case, the technoliberal and the democratic (as commented in section 3.2.2.1).

4 cases of governance of platforms

In this section we look at two levels of normative governance of blockchains: the infrastructural and the technopolitical. We look at four representative cases¹⁴: bitcoin, ethereum, tezos and dfinity. We have chosen them because they embody different responses to issues at these two levels of governance.

Bitcoin governance: code is law and proof of work

Bitcoin is a digital currency based on a distributed ledger (or database). Its functioning was defined in a paper by Satoshi Nakamoto (a pseudonym) in 2008. As we mentioned earlier, one of its most celebrated advantages lies in its potential for avoiding third parties (corporate or central banks, as well as States) in solving the so called “problem of cooperation”.

Bitcoin is based on a public (anyone can see it), permissionless (anyone can access and use it), cryptographically secure and distributed ledger. A key step in the functioning of a blockchain is the process of adding new blocks. Since there is no central, trusted agent certifying that a given block of transactions is correct, the network must come to a consensus. This requires a process of mathematical validation, which follows a distributed consensus protocol, the so called “proof of work” (POW). Since there may be nodes trying to cheat (f.i.: trying to double spend a given amount of tokens by forging transactions and including them in a block), anyone trying to add blocks has to solve a hard, time-consuming, computational problem. So called “miners” get a reward (coins) for doing so.

As noted by various authors (f.i.: De Filippi & Loveluck, 2016, Ersham¹⁵), there are a series of incentives for contributing to the functioning and improvement of the currency for all the actors involved. Developers (usually early ones) contribute to see the value of their coins increase, to receive group recognition, and to get power over the direction of the

¹⁴ I use this four cases because they exhibit different ideal models of DLT. The future of these projects may change quickly. For instance, Tezos's future seems particularly grim after its “crash” in October <https://www.bloomberg.com/news/articles/2017-10-19/one-of-the-biggest-icos-tezos-plummets-amid-internal-strife>. Dfinity is still to be launched. In spite of their various problems, bitcoin and ethereum have been able to withstand better the passage of time, albeit they are exposed to the turbulence of the blockchain economy.

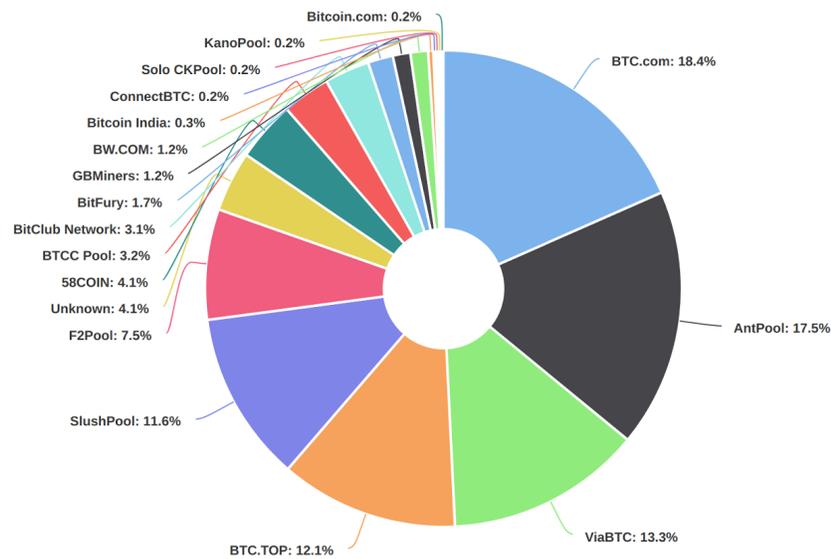
¹⁵ Ersham has approached the issue of governance from a clearly neoliberal standpoint, as reducible to an ideal market matter with only two variables in place: incentives and coordination.

currency. Miners work to see their bitcoins to rise in value, to get more of them, as well as to obtain potential transaction fees. Users similarly benefit from increase in value of tokens, as well as from the peculiar properties of bitcoin (from anonymity to resistance to censorship). Coordination takes place differently depending on the actor. Developers coordinate through Bitcoin Improvement Proposals (BIPs) and mailing lists. Miners do so via computation. Users coordinate (when they do) via variables such as price of stock or direct transactions.

Challenges ahead result from various factors Two well known ones (De Filippi & Loveluck, 2016, Ersham, 2017, Tapscott & Tapscott, 2016) are incentive misalignment and centralization.

Incentive misalignment is affecting and will affect various actors. A first group is new developers: since they do not own the usual initial share of tokens (they sometimes go on to create new chains or companies, or exceptionally get funded by foundations or universities). This feeds into power concentration around old core developers, which in turn makes them more attractive to bribe. On the other hand, as rewards (tokens) for solving blocks are depleted (bitcoin has a limited number of coins to be issued), there is no incentive for continuing mining beyond transaction fees, which allegedly will be an object of competition to the point of reducing them to unsustainable levels and thereby de-incentivizing miners.

A second challenge is the tendency to concentration in mining: there are incentives for investing in huge processing power and thereby harvesting an increasing amount of new tokens, but this stimulates the emergence of huge monopolies which, in turn, make the system more vulnerable to the 51% attack. The result, visible today, is that blockchain mining is centralized, with 4 hash pools (which may as well be owned by a single entity or person) having more than 60% of computational power.



Bitcoin has been considered a neoliberal project in pursuing Hayek's and Friedman's dream to “end the monopoly of nation-states (via their central banks) on the production and distribution of money” (De Filippi & Loveluck, 2016: 3). Bitcoin hybridizes the rational choice and the technological approaches to governance we described above, it codifies a market approach and non-cooperative game theory (De Filippi & Loveluck, 2016). People assume others will be trying to cheat and bitcoin aims to solve the problem of trust computationally. That is fine in so far as there are not 51% or more nodes of the network in accordance to approve forged blocks (the so called 51% attack).

It is thereby interesting to find metaphors from representative democracy applied in this context to illustrate how the governance of the system works. According to Ehrsam (2017), developers submitting pull requests (as the Senate submits bills), miners deciding whether or not to adopt them (as the judiciary), nodes running or not running a given version (as the executive) and users being able to revolt (by selling bitcoins massively and thus reducing its value on the currency exchange market or by boycotting bitcoin use). But there is no equality of one person, one vote, here, nor formal accountability of any of these groups. It is a clear neoliberal view of democracy, an oxymoron.

De Filippi & Loveluck (2016) have casted a different look. They suggest there are two main layers, two main communities and two circuits of governance around bitcoin. There is an “infrastructural layer”, that of bitcoin as a decentralized network operating according to a set of protocols. Then, there is the “layer of the architects”, charged with developing the technology. On one side there is the community of users and miners that use the infrastructure to carry on operations. On the other there is the

community of developers who write the code. Only the latter can actually decide upon changes on the code and, thereby, the infrastructural governance of bitcoin.

The key role of this community was made explicit in the first big dispute to date: the block size dispute (De Filippi & Loveluck, 2016; Ehrsam, 2017). This dispute began as a discrepancy among core developers concerning the size of the bitcoin blockchain blocks, otherwise, the number of transactions included in them. Allowing to include more would speed bitcoin processing, thereby making it more attractive as a mode of payment; but it would also require more computing power, thereby definitely excluding smaller players from the mining game. The result ended with a number of heated public discussions and various hard forks (the first being Bitcoin TX, followed by others such as Bitcoin Classic), which implied the division of the bitcoin community and the banning of forkers from bitcoin communication channels. According to De Filippi & Loveluck (2016), what the crisis around “block sizes” made explicit was the lack of a governance structure linking the infrastructural layer where users and miners live and that of decisive core developers.

The first thing the dispute made clear was the existence of a politics and governance of bitcoin beyond its infrastructural governance. Second, it showed its flaws. Third, many have recognized that these flaws resulted precisely from the techno-centric idea of technology as sufficient mechanism of governance, which brought about a technocratic tyranny of structurelessness. Fourth, it made obvious the need of open an explicit debate around, as well as a formal model of, governance. Otherwise, it manifested the need to open up the levels of what we have defined as technopolitical governance and metagovernance. Fifth, for many, such a new model should be a more democratic one.

In spite of the discourse around decentralization, which is based on the plane of infrastructural governance (governance by the infrastructure) the technopolitical governance model in bitcoin ends up showing a centralized structure: core engineers, huge mining pools and user representatives/mediators such as Coinbase or Mx.go have a heavy weight on whether a given update is run or not. The discourse on Blockchain has emphasized it that freedom from intermediaries at the infrastructural level would imply a fully distributed system. Collapsing infrastructural governance with technopolitical governance in order to avoid a discussion on the latter. Code is law, mathematics do not lie and the blockchain cannot be tampered with, unlike what happens with fiat currencies. Nevertheless, the actual situation, as we just saw, points to a rather different conclusion.

Ethereum governance: code is law and proof of stake

Ethereum is an “open-source, public, blockchain-based distributed computing platform featuring smart contract (scripting) functionality” (CoinDesk, 2016). It provides a virtual

machine (the Ethereum Virtual Machine (EVM) in which to install and run software units called “smart contracts”, contracts that are self-executing once a set of conditions are met. This operates as a new level of complexity in terms of possible operations in relation to bitcoin, and affords a much wider variety of things to be transacted (f.i.: mortgages), operations to be performed (f.i.: voting), and things to be built (f.i.: distributed autonomous organizations). The platform also incorporates a bitcoin-like cryptocurrency, “ether”, that allows payments in the network.

But when it comes to governance, Ethereum has much in common with bitcoin. Because of this, we will focus on the differences, and will begin by stating the biggest one. Ethereum is to be soon based on “proof of stake”, a type of consensus protocol for public blockchains clearly different from bitcoin’s Proof of Work. Instead of rewarding participants for solving cryptographic puzzles, the system ranks validators according to their stake (the deposit they are willing to lock in order to enter a validation round) and then gives turns for “proposing and voting on the next block, and the weight of each validator’s vote depends on the size of their deposit¹⁶”.

There are two major types of procedures. The first is chain-based Proof of Stake (POS hereafter), in which the algorithm pseudo-randomly (weighted by stake) finds a validator per time slot among the postulated ones. The validator then has the right to add a block to the chain. In the second, BFT¹⁷-style proof of stake, the right to validate is assigned randomly, but agreement is reached through “a multi-round process where every validator sends a vote for some specific block”¹⁸ per round, until agreement is reached. Validation depends on agreement on the last block and not on the computation over the whole chain.

This method has clear impacts for governance. First and foremost: anyone can become a validator by holding some Ether (ethereum’s value token), closing the gap between miners and users. This drastically reduces the centralization and monopoly risks of bitcoin. Core developers maintain similar incentives, but their coordination seems so far to have been smoother due to “1) a culture more open to change because Ethereum was created as a reaction to what could not be done in a rigid Bitcoin environment and 2) direction from Vitalik who is widely trusted in the community” (Ehrsam, 2017).

Its own “block size” debate took place in 2016, when the DAO project, a crowdfunding initiative to invest in the first distributed autonomous organization in history (a set of smart contracts that acted as an organization that applied its rules without ambiguity)

¹⁶ Explanation available at <https://github.com/ethereum/wiki/wiki/Proof-of-Stake-FAQ>.

¹⁷ BFT is an acronym of Byzantine Fault Tolerant, tolerance of a computational system to failure resulting from inability to reach consensus.

¹⁸ Explanation available at <https://github.com/ethereum/wiki/wiki/Proof-of-Stake-FAQ>.

ended up with a hack worth 50 million dollars. As in the case of bitcoin, some members of the community resorted to a hard fork.

Weaknesses include again the centrality of a core, charismatic developer, Vitalik Buterin, and the inclusion of new developers without initial tokens.

Tezos governance: vote is law and code¹⁹.

Tezos is a distributed virtual machine similar to ethereum, but introduces a key new variable. It does so, precisely, on the plane of governance. It includes an on-chain mechanism that opens the possibility for anyone to amend the protocol rules. This surely is a key jump because it implies to connect the plane of infrastructural governance with that of technopolitical governance, the application of the system rules allow to change those rules. Furthermore, it includes rewards for distributed protocol development (on top of the classical ones for building consensus around the blockchain). This addresses several problems: first and foremost, the concentration of decision-making around technocratic actors such as core developers or even miners. Incentives for new developers (or bug finders, or other contributors) and, furthermore, it does so following a decentralized system.

Such a system is interesting because it shifts power towards users and away from the more centralized group of developers and miners. On the developer side, anyone can submit a change, and most importantly, everyone has an economic incentive to do it. Contributions are rewarded by the community with newly minted tokens through inflation funding. This shifts from the current Bitcoin and Ethereum dynamics where a new developer has little incentive to evolve the protocol, thus power tends to concentrate amongst the existing developers, to one where everyone has equal earning power. This also enables users to directly coordinate on-chain, dramatically increasing their power and reducing the power of miners compared to a system like Bitcoin or Ethereum.

On top of that, Tezos smart contracts that define constitutions for given organizations. allows to define. "Tezos tokens not only power smart contracts in the network, but also allow votes on protocol amendments".

¹⁹ As mentioned earlier, we include Tezos, in spite of doubts about its future as a project after its "crash" in October <https://www.bloomberg.com/news/articles/2017-10-19/one-of-the-biggest-icos-tezos-plummets-amid-internal-strife> as the development of the concept of a self-amending ledger.

Dfinity governance: AI is law

If Tezos explicitly and formally poses the question of the governance of the blockchain, what we have called its technopolitical governance, so does Dfinity. Nevertheless, there is a central difference at the level of technopolitical meta-governance, of the principles and values operating behind the dfinity model and that of Tezos and, surely, the democratic governance paradigm we believe is more appropriate for DECODE.

Dfinity aims to make of an artificial intelligence the ultimate arbiter of any amendments to the protocol. This means to get back to square one, but with a twist. In the words of the designer of Dfinity itself, Bitcoin pretended to define its governance by the code, following the principle “code is law”, Dfinity wants to turn this into a new model in which governance follows the rule “AI is law”. But as we saw, the code is law rule in bitcoin only applied to the enforcing of rules, not to its making: there was an informal, technocratic human decision maker behind the software curtains. Now, the goal is to make sure it is algorithms that make the rules as well. This next generation blockchain “combines crowd wisdom and traditional AI technologies to freeze miscreant smart contracts that harm the interests of those using the platform” (Williams, 2017).

The mentioned twist is the following: in some cases of AI (f.i.: some types of neural networks) we do not know why or how, given a set of inputs, the system arrives to a set of outputs. This brings back the phantom of the third party, whose goals are not always more clear or predictable. On the other hand, it only hides one step back the core developers behind the initial code. It brings back a form of foundational human technocracy that is then followed by a post-human technocracy, technocracy squared.

A potential reason to do so may have to do with another key innovative feature of Dfinity: the possibility of amending the ledger. This clearly opens the phantom of a centralized third party supervising transactions. This is a feature that responds to situations such as the DAO hack, and it is an attempt to allow the amendment of hacks via on-chain coordination and, moreover, without having to fork the network, as happened in the case of Ethereum.

It obviously brings about the questions of what is the blockchain worth when it may be so open to change.

A note on the blockchain governance paradox

We disagree authors such as Lehdonvirta (2016), who considers that addressing the question of governance is self-defeating, or, in his explicitly provocative terms “once you address the problem of governance, you no longer need blockchain”. This argument suggests that putting in place a governance framework requires institutions and trust in them, but that is precisely what the blockchain was trying to avoid.

But most of the virtues of blockchains are impervious to the question of governance and third parties: trackable databases, resistant to unrecorded tampering and attacks, facilitating anonymity, etc. Nothing of this is at risk because of the so called “blockchain governance paradox”.

But what about the elimination of intermediaries and third parties? To connect infrastructural and technopolitical governance via on chain governance in the way models such as Tezos or Dfinity aim to do still allows to avoid external third parties. The question remains of whether to consider the nodes sustaining the blockchain as a distributed third party. Even so, other measures can be devised so that the effects of changes resulting from processes of protocol amendment have carefully set temporalities or effects. Many recent altchains (blockchains alternative to bitcoin's) show that the question of how to introduce technopolitical governance into infrastructural governance will probably be a key feature for the future of blockchain technologies.

The problem noticed by Lehdonvirta, though, may point to a broader lesson from much philosophy of technology and Science and Technology Studies: every attempt at technologically controlling a given system generates a new system involving the original one and the technology, and usually brings about the unexpected. There remains open the question of whether more traditional models involving third parties or some form of iterative cybernetic system of blockchain governance (as in Tezos and Dfinity) is the most resilient approach to the relation between governance and blockchains.

Exits, forks, and governance

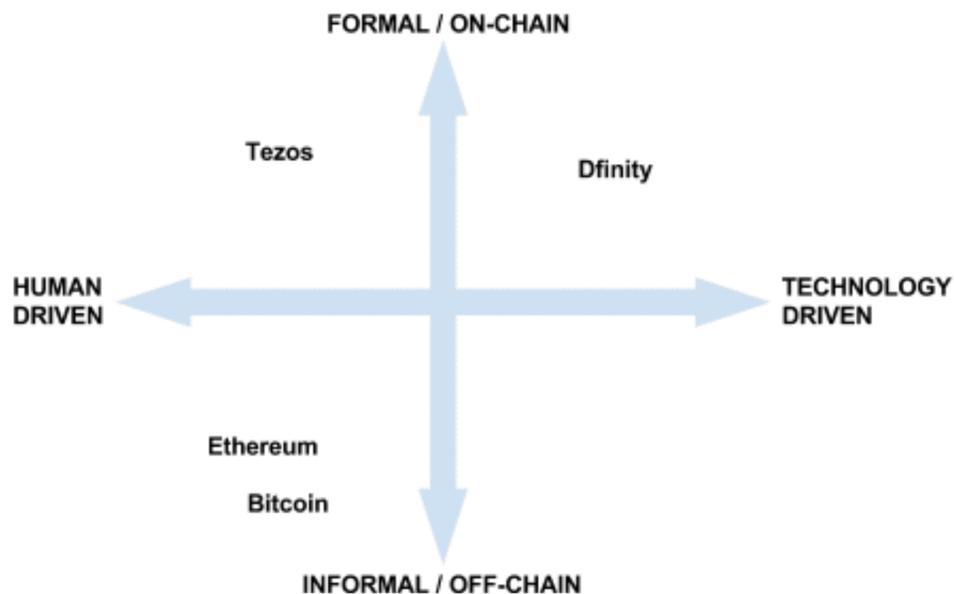
By talking of Like in other forms of social collectives, mere exit is always a possibility. In principle, dislike with a given situation or decision (f.i.: by core developers) can be expressed by selling assets and leaving a given blockchain. This serves as a market-like type of pressure over core developers and other actors in the ecosystem. Similarly, other actors, such as nodes, may stop working for a given blockchain. Basically, the effects of decisions over other actors' behaviors, specially exit, are market-like type mechanism. This is a soft type of exit. There are harder ones.

Hard forks, or non-compatible development of a given blockchain, have been used for severe problems (f.i.: ethereum fork after the DAO hack). A key characteristic of the governance of most blockchains depends on their being open source software: anyone can fork a blockchain with all the data it contains. Obviously, the problem is to get people to migrate along with the chain. Although this facilitates diversity and reduces lock-in, forks usually undermine network effects and trust, and imply considerable quantities of work.

Mechanisms of infrastructural and technopolitical governance

As we have seen, there are clear differences between these four cases, specially, at the level of infrastructural and technopolitical governance. At the level of infrastructural governance, bitcoin and ethereum have stressed the non-modifiable character of the blockchain and (seemingly) its rules as a core element of their technology. This is different in the case of Dfinity and, potentially, Tezos. In this case changes in the blockchain appear as justified under certain circumstances, such as hacks.

At the level of technopolitical governance, the key difference is how changes in the code occur. In spite of Ersham's suggestions, the model in the Bitcoin and Ethereum cases is both technocratic and centralized, carried on by core developers and out of the chain itself. In the case of Tezos, decisions about the rules are to be vehiculated on-chain and in a formal manner, using a much more democratic and decentralized model. On the other hand Dfinity will similarly use its blockchain for rule amendment, but following AI instrumental calculations. Otherwise, while Bitcoin and Ethereum separate infrastructural and technopolitical governance, Tezos and Dfinity connect them: part of the governance by the infrastructure (infrastructural governance) is the governance of the infrastructure (technopolitical governance).



Cases of technopolitical governance of blockchains

Paradigms of meta-governance

For the purposes of this report, we believe it is necessary to distinguish two key models or paradigms of meta-governance: the democratic and the technoliberal. The former gives the possibility of defining and applying the rules of the game to a wider array of actors. In the extreme, all users (under certain conditions, such as identification, in order to avoid sybil attacks) have an equal say on key matters of governance. This usually coincides with a more decentralized model of development.

The technocratic or technoliberal model tends to rely on or accept asymmetries of power based in technical expertise (f.i.: Buterin in the case of ethereum; the AI in the case of dfinity) or economic power (miners in bitcoin) or still other parameters such as charisma and trajectory (De Filippi & Loveluck, 2016).

In spite of the emphasis on decentralization, only a democratic model can give depth to the alleged possibilities of DLTs (Distributed Ledger Technologies) for distribution of power in social systems.

Governance challenges

So far we have noticed some of the characteristics and governance mechanisms of four different blockchains. We want now to sketch some of the key governance challenges around them. Here we follow and synthesize the list in Tapscott & Tapscott (2017), who classify them following their trinitary division of levels of governance.

Challenges at the level of platforms

At the level of platforms, there seems to be a lack of standards. Blockchain technology is still recent and fastly evolving and proliferating, as we just saw in these four examples. In this line, there is a reverse risk: that any of the existing protocols (with bitcoin, the oldest, showing its rather obvious limits) becomes the industry standard. To promote a standard that includes a proper governance model at its core seems a necessary conclusion of what we have discussed so far.

Another lack that can be observed in the few cases analyzed is that of a robust infrastructure. Hacks and unintended centralizations have plagued the history of Bitcoin and Ethereum applications. A related one, which we may add as mostly connected to Bitcoin, is the lack of ecological sustainability of POW blockchains and the severe difficulties to revert this negative-externality for the whole network.

The debates around the status and promise of blockchains seem to have been driven first by hype, then by conflict. Thereby some notice a lack of constructive discourse. The undervaluing of public deliberative reason as opposed to technocratic reasoning may be behind this limit. As noted by Tapscott & Tapscott (2017), debate is a feature, not a bug, of society, as well as of technosocial projects such as blockchains.

Challenges at the level of applications

A first point to note is the relation between blockchain applications and regulations. In some cases technologies with similar functionalities are regulated.

Another problem, which we believe may well have to do with the incentive misalignment we mentioned earlier, is a lack of new skilled developers. Perhaps more importantly from the viewpoint of its potential applications in fields such as that of democracy, is the lack of user-friendly interfaces. The novelty and complexity of the technology and its functionalities implies that the practice of using it requires cognitive aids such as interfaces easy to understand and use. These interfaces are a relevant entryway into the blockchain universe and, if they are not designed by from the very conception of the blockchain, intermediaries (like Mt.gox or Coinbase on Bitcoin) will centralize the exchange and mass adoption of PLT through user friendly interfaces .

Challenges at the level of ecosystems

Atzori (2015: 30) has noticed how "although originally designed as disintermediation tools, the ecosystems of fully distributed blockchains are characterized by a great amount of third parties and profitable businesses offering intermediation services, with strong asymmetries of information and power between developers and users. Trend towards centralization, digital divide, lack of transparency in decision making process, and unaccountable power of core developers – all these factors call into question the egalitarian nature of current distributed networks".

Numerous authors coincide: there is a need of a regulatory framework for blockchain technologies in general. This is made both urgent and difficult because of their growing success: their varieties and implications challenge systematization and full understanding of their implications. Furthermore, as noticed by De Filippi & Loveluck (2016), these should be decentralized governance systems, potentially aided by blockchains themselves. Simultaneously, others appreciate risks (and, thereby, a complementary governance challenge) in the premature establishment of such a framework since it could "stifle the blockchain revolution".

Another challenge (unnoticed by Tapscott & Tapscott, 2017) has to do, precisely, with trust on concrete implementations such as cryptocurrencies. As cryptocurrency, bitcoin has proven to be highly unstable, with peaks of valuation in currency stock exchanges followed by marked downfalls. It is difficult to trust a currency qua currency (something that must serve as a means and unit for exchange as opposed to a store of value---f.i.: an investment asset---only) when its value is so indeterminate.

These double faced challenge connects with a third one, the fact that business deployment of blockchains moves faster than scientific research on the topic. This may include, specially, research in law and the social sciences.

Some appreciate a lack of diversity of viewpoints, but the growing literature cited in this report suggests that critical voices are not only proliferating but also impacting upon blockchain types.

There is also the risk that existing powerful economic or political actors take control of blockchains by seizing 51% of their computing power. This is the risk with bitcoin as stated above. As the presence and relevance of blockchains grows, this could become ever more tempting: success will rise the incentives for doing so.

Interestingly, Tapscott & Tapscott find a challenge in what seems a rather peculiar example: the possibility of unintended consequences resulting from factors such as the open source character of most blockchains. They suggest this makes easier for a terrorist to use the technology (f.i.: dropping a bomb with a drone instead of a package). Surprisingly, they do not mention a much more obvious situation, namely, the use of blockchain-based cryptocurrencies such as bitcoin for the worse versions of unregulated markets. Bitcoin as the currency of the darknet for all sorts of operations ranging from weapons to human trafficking and (more dramatically on its contribution to structural or objective violence, Zizek 2016) to an unregulable space of free speculative financial derivatives market. This connects with an issue recurrent in several levels: the connection of blockchains with legality. A primary result of the properties of bitcoin cannot be obliterated: there are reasons to believe that it has become the tool of much illegal activity on the internet.

Finally, there are challenges coming from the emerging possibilities of quantum computing, which may likely give away with the security of public key cryptography. Trust in numbers may be not be granted in the mid and long term.

Actors in blockchain ecosystems

As noticed by Tapscott & Tapscott (2017: 26) blockchains have moved quickly from open source communities to much more complex ecosystems, involving individual or collective stakeholders with very “different backgrounds, interests and motives”, and each of them “is a steward of the ecosystem”. Each of them with a different view of governance. These authors have outlined the following list:

- Blockchain innovators. This group includes early entrepreneurs who tended to be against any sort of formal governance or regulation as inimical of the cryptocurrency and DLT principles. As the industry grew, more of them have come to terms and collaboration with governance forms such as the MIT Digital Currency Initiative.
- Venture capitalists. This group has grown and complexified quickly, from insiders to relevant venture capitalists, and from there to financial services corporations or even pension funds. That means according PricewaterhouseCoopers' DeNovo platform, “funding in blockchain companies increased 79% year-over-

year in 2016 to US\$450 million”. 151 Ventures such as the Digital Currency Group, combine academics and other advisers to promote the establishment of a “better financial system through both investment and advocacy”.

- Banks and financial services. Today, dozens of big banks (from Wells Fargo to Société Générale) are both investing in the tech and trying to influence its development, posing risks similar to those around the control of the Internet.
- NGOs and civil society organizations. Organizations such as the Coin Center, which deploy advocacy as a central tool for shaping the trajectory of DLTs.
- Coders and developers. There is no equivalent of bodies such as ICANN, IETF or W3C to guide coders and developers. They tend to prefer it that way. Nevertheless, there are common practices “such as participating in online forums, posting protocol improvement proposals publicly for peer review, discussing and addressing other members’ concerns, advocating for particular solutions, testing proposed code and jumping in to debug code – that is, not just suggesting but implementing a fix. Bypassing peer review is a real no-no, while trolling to improve ideas is OK”.
- Academics and scholars. Education institutions, from MIT to Stanford, are supporting labs and research centers, or teaching courses on the matter.
- Governments, regulators and law enforcement. As blockchain applications become more numerous and involve transactions and contracts over more entities, from property to votes, regulators come to play a bigger role.
- Users. This group is particularly heterogeneous, and goes from technology enthusiast to financial investors. Positions toward governance and regulation vary from reluctance to favor.

Global Solution Networks for the the governance of blockchains

Tapscott & Tapscott (2017) have provided to a model for how to address the governance challenges of the blockchain ecosystem. In a classical “governance” approach they suggest to mobilize or generate 8 types of global networks:

1. Networked institutions. They first call for existing neoliberal institutions such as the World Economic Forum or other such as the Internet Society to lead a discussion on governance issues. These should include all relevant stakeholders, help to generate a shared understanding of governance challenges and solutions and generate initial actions for improving governance at the ecosystem, application and platform levels.
2. Standards networks. Tapscott & Tapscott call for the establishment of a Bitcoin Engineering Task Force (BETF) “as a loosely self-organized, grassroots technical group”, with open meetings comprised of the stakeholder groups mentioned above. This organization may insert itself within others such as IETF or W3C, be

oriented to define and promote standards (f.i.: protocols) and the general sustainability of DLTs,

3. Advocacy networks. Oriented to “forestall regulatory, legislative, judicial or executive action that might stifle further innovation”. Actors such as the Chamber of Digital Commerce, networked institutions such as the WEF, heads of state and corporate CEOs should define roadmaps and action plans so that governments at every scale monitor and check the potentials and harms of blockchains in practice, interact with the communities and among themselves before regulating.
4. Policy and watchdog networks. These will be oriented to “monitoring of blockchain problems and challenges”. These multi-stakeholders networks may address issues such as early regulation or that of blockchain energy consumption.
5. Delivery networks. Here, initiatives such as Hyperledger Project or the Enterprise Ethereum Alliance appear as referents working to improve protocols and developing applications for increase DLT performance. Companies using a given blockchain could be a fit member of this type of network.
6. Knowledge networks of education. These networks will be primarily oriented to promote and implement education in the area both in mainstream universities as well as in online ones such as coursera or edX. The areas could range from mathematics and computer science to economics and sociology.
7. Knowledge networks of applied research. Entities such as the Blockchain Research Center can develop research either to describe or design use cases.
8. Knowledge networks of scientific research. These networks, involving institutions such as the MIT Medialab, could launch new lines of theoretical exploration into blockchains and catalyze new expertise.

On the evolution of blockchains

Something that can be easily derived from what we mentioned so far is the high rate of Blockchain evolution, which sometimes consider a “Cambrian explosion”. New blockchains emerge with new properties at a high speed. Perhaps more interestingly, it is worth noting how they inspire themselves and learn from the limits of previous models. POS is an attempt to address some of the limits of POW, while the virtual computer character of Ethereum is a way to break with the currency-only functionality of Bitcoin. Tezos, in turn, responds to the obvious problem of governance generated by situations such as the block size debate, allowing amendment of the protocol rules. Finally, Dfinity does the same, but adding the possibility of reversely altering the ledger for trying to address the frequent hack problems, which has required to get back a more technocratic governance model, now made explicit in the formula “AI is law”. Andrew

Feenberg (1999) suggested how technologies incorporate social struggles into their code. Many of the conflicts and mistakes have helped in the new iterations.

3.2.2.5. Governance by blockchains

Some authors (Davidson, De Filippi & Potts, 2016) have suggested that the key lens to look at a technology such as blockchains is not so much that of the Schumpeterian “neoclassical approach” with its attention to “productivity”, but rather an institutional-evolutionary approach that looks at the impacts of blockchains upon institutional efficiency. Under this approach, the main innovation brought about by DLTs takes place on the plane of governance. Even if the argument around this point is far from closed, in this section we briefly distinguish four key objects of attention stressed in the literature connecting distributed ledger technologies and governance: organizations, corporations, governments, and social processes more broadly.

Organizations: the DAO (Distributed Autonomous Organizations)

A strong strand of the literature on the relation between blockchain and organizations has attended to a concrete form of it: the DAO, or Distributed Autonomous Organizations.

A DAO is an organization whose structure is distributed by being built on a blockchain, and whose rules are formalized and automatically applied through software (Buterin, 2014; Garrod, 2016; Jentzch, 2016; De Wit, 2017). Frequently, these rules can only be altered if a defined amount of shareholders (or “token holders”) vote for changing the code. Decentralized decision making and management are built into the software (Buterin, 2014, Wright & De Filippi, 2015; Garrod, 2016). In this way it addresses two key problems tied to the “human factor” in organizations (Jentzch, 2016). The first is that people do not always follow the rules; the second is that they may not agree about how to apply them (De Wit, 2017). Not matter how democratic, fair, equitable or stakeholder-agreed is a law or contract, executive power is always prone to be biased or to failure at executing or interpreting the law. Allegedly, DAOs dispense with this, thereby preventing opportunism, by using a blockchain that formally (computationally) guarantees the transparent and unambiguous execution of a contract (McDonald, Allen & Potts, 2016). In principle, a DAO tied to an AI system could run automatically, either according to fixed or self-correcting criteria.

A different strand of literature has focused on the ways in which distributed ledger technologies may be deployed by organizations with a more traditional form. Better bookkeeping, clearer mechanisms for accountability as well as for enforcing decisions and rules, the possibility of participating anonymously, etc. are among some of the alleged benefits and impacts of this application (Swan, 2015; Tapscott & Tapscott, 2016).

Corporations: the DAC (Distributed Autonomous Corporation)

A subtype of DAO are DACs, or Distributed Autonomous Corporations. According to Glazer and Bezenberger (2015), the difference between a DAO and a DAC is that the former has a tiered community while the latter has a centralized one. Differently, Buterin (2014) suggests that the difference lies in the fact that DAC pays dividends to shareholders and DAOs do not. People can earn money from their contribution to the ecosystem but not from investment in the DAO.

Like in the case of DAOs, a different strand of literature around corporate organization and governance has focused on the ways in which distributed ledger technologies may be deployed by organizations with a more traditional form. The virtues of DLTs (transparency, accountability, rule and decision-making enforcement, anonymity, etc.) equally apply here, not for the benefit of democracy or autonomy of the organization, but for the trust and guarantees for investors.

Governments: from open governments to bitnations

Blockchains have been heralded as a technology for governing without government. Nevertheless, they may as well be a key infrastructure for the advance of open governments (Swan, 2015). The basic idea behind is that of a form of government that deploys information and communication technologies to increase the transparency of, participation in, and collaboration with government (Lathrop & Ruma, 2010). Blockchains can contribute to this in numerous ways. Public blockchains and smart contracts can turn different aspects of public administration (f.i.: finance) into a much more transparent, granular and automatic issue; they may give participation processes a new degree of trustworthiness (as we will see when talking of the DECODE pilot), with non-modifiable tallies and the possibility of anonymity for participants. Some (Atzori, 2015) believe permissioned (accessible and modifiable only by some nodes) tokenless (without value or currency tokens) blockchains will be more useful for most governmental purposes.

However, probably one of the most famous implementations of blockchains with an explicit reference to the practice of governing has followed the traditional cyberlibertarian tradition of the Declaration of Independence of Cyberspace: that is the idea of bitnation. Bitnation (<https://bitnation.co/>) is an application based on an ethereum blockchain giving its users the possibility of creating organizations self-defining as nations and providing some of the services usually provided by nation States, such as IDs, contracts, or educational networks. A core idea behind the project is to make of nations voluntary and digital rather than forced and territorial forms of association and provision of collective goods and services.

In a moree democracy-oriented fashion (and applying to any kind of social group) Sovereign is “a blockchain liquid democracy that enables direct voting on issues or the ability to delegate voting power on specific topics to peers over a secure network without central authority” (Democracy Earth Foundation, 2017: 2). The Democracy.earth project aims to situate Sovereign within a wider purview in order to contribute to a borderless global democratic system.

3.3. Decoding democratic governance

3.3.1. A preliminary approach to the relation between democratic governance and distributed ledger technologies

3.3.1.1. Sketching democratic governance

Governance is a concept which is not necessarily nor even frequently connected to that of democracy. The idea of a democratic governance appears, from a descriptive viewpoint, as a potential sub-type of governance (Bevir, 2010). As democracy has become a celebrated political concept and form, it frequently implies a normative load: to speak of democratic governance appears to be something to be hoped and struggled for. To an extent, that is the case here too. Democratic governance is to be opposed to both neoliberal and technoliberal governance.

The concept of democratic governance has several elements. First of all it implies an understanding of governance, which we have already sketched above. Secondly, it implies a conceptualization of democracy and the democratic, which involves, in turn, to map different models of democracy (for a map of models see Held, 2006 and section 5.1.4 below). It is important to noticed how “democracy” is a contested political form (Rosanvallon, 2008). We cannot attempt to properly explore the question of democracy here, nevertheless, we want to preliminarily address it, for it shapes both the wider context and the specific declination for our approach to blockchain governance.

A good entypoint is Pierre Rosanvallon's suggestion that democracy is “simultaneously, a civic activity, a regime, a form of society, and a mode of government” (Rosanvallon, 2011: 225)²⁰. Rosanvallon's definition points toward democracy at the macro-scale, so to speak. Nevertheless, we may as well think of these four elements as four democratic dimensions applicable to every democratic system: the dimension of activity (civic activity), the dimension of regime (a set of institutions), the dimension of relationships

²⁰ Otherwise, democracy involves practices that, above (section 3.1.2.) we have allocated under the labels of governance, government and governmentality.

and their conditions (a form of society--a society of equals, Rosanvallon, 2013), and the dimension of rule (a mode of government).

We can then use two other neat approaches to democracy to outline two key principles that are to cross those four dimensions: that of the egalitarian irruption and that of empowered inclusion. The former has been particularly well developed by philosopher Jacques Ranciere (2006: 55), for whom politics (which in his work is frequently exchangeable for democracy) is “the government of anyone and everyone”. This principle of equality in ruling points to the common person, appealing to the non-extraordinary (anyone) and the universal (everyone). Ranciere stress the fact that such a a form of government always happens by the irruption of the excluded in the political arena, those who would be excluded from ruling by the “logics of police... of the natural government of social competences” (idem).

On the other hand, Mark E. Warren's (2008: 386) has more explicitly suggested the principle of “empowered inclusion” as the central democratic principle, which he bases on other authors, from Habermas to Held. According to his democratic maxim of “empowered inclusion of those affected in collective decisions and actions”, “every individual potentially affected by a collective decision should have an equal opportunity to influence the decision proportionally to his or her stake in the outcome”.

Both principles speak of equality and empowerment. Ranciere ties it to a logics of irruption from the outside of the system; Warren ties it to a logic of inclusion from within it. Ranciere speaks of radical equality, Warren adds the weighting of “affectation” by collective decision making. This must be taken with caution as not all stakes are equal in kind (f.i.: a Finally, Ranciere speaks clearly of “government”, in a more classical and stronger sense; Warren, of “influencing”, in what sounds closer to the usual terminology of governance. Both principles can be dialectically complementary.

3.3.2. The technopolitical loop of networked democracy: digital infrastructures for democratic governance and democratic governance of digital infrastructures

If New Public Management emerged in a context of fiscal and economic crisis charged by neoliberal speakers to the welfare state, blockchain emerged in the context of a financial and political crisis associated to the multiple flaws of neoliberal logics and representative democracy. A widespread distrust of financial and state institutions has a perfect ground for blockchain technologies, which combine renewed versions of neoliberal principles with radical hopes for new forms of democratic governance.

The relation of democratic governance and distributed digital infrastructures must be approached from two angles at least: that of how such infrastructures contribute to the

democratic governance of social fields, and that of how such infrastructures are to be democratically governed. These two aspects easily (although not necessarily) potentially feed back into each other.

A clear example of this is the Decidim project. Decidim project is probably a paramount example of the idea of democratic governance, it is so because of its reflexive deployment with the MetaDecidim instance of the software for its governance. The project departs from a call to question democracy as a political form (specifically, its modern reduction to representative democracy), extended in its range of models and possibilities (opening it to forms of radically participatory, deliberative, economic and autonomous forms) and applied onto its own conditions, among them technological infrastructures, such as Decidim itself. This makes of it a case of reflexive modernity (Beck, Giddens, & Lash, 1994).

We believe that the process of thinking through the loop or double bind between democratic governance and DECODE will benefit from the ongoing work done on this regard within the Decidim project. This makes special sense given that one of the key DECODE pilots will imply a connection of these two platforms.

4. Democratic governance of open source software and communities

In section 3 we have analyzed different general aspects of the concept of governance and its connection with blockchains. In this section we dig in more detail into relevant aspects of governance of open source software projects and, more concretely, the Decidim project²¹. We believe the Decidim project is specially relevant on this regard because it aims to be not only an open source software project but, beyond that, a democratic software project. Otherwise, Decidim aims to be a software that not only a skilled person can contribute to but one that anyone can contribute to shape. This implies a number of challenges that are still being worked out by the Decidim project and the Metadecidim community. We believe these challenges and advances could be relevant for thinking through the democratic governance of DECODE software and ecosystems. This is especially relevant as one of the key DECODE Pilots will be run in connection to Decidim, oriented to potentiate the quality of democratic processes such as citizen initiatives by providing full data control to citizens (anonymity, granular data donation, etc.), data dashboards for collective intelligence, publicity and integrity of the results, etc. Decidim poses a new technopolitical paradigm: a democratic one against the technoliberal one defining projects such as Bitcoin.

4.1. Models of governance of open source software communities, resources and technologies

4.1.1. *Elements of governance in peer-production communities: the open source software paradigm*

Probably the key paradigm of an online peer-production community can be found in open source software. These communities are of special interest here because it is probable that the DECODE software project will have to rely on an open ecosystem that involves volunteer-driven contributions, self-organisation and self-regulation (Benkler, 2006). Such characteristics distinguishes free software communities from other forms of organisation such as bureaucracies and corporations, and usually requires to find innovative forms of incentivizing, coordinating, and regulating contributions (Demil & Lecocq, 2006).

²¹ More info at <https://decidim.org>

Elinor Ostrom's work on the commons has been used to understand some of the characteristics of free software projects, classically, in works such as Yochai Benkler's (2006) wealth of networks. Bassi et al. (2017) (decode project D.1.8) have synthesized the situation in the following table

	Ostrom's design principles	Adaptation to free software
1	Clearly defined boundaries	The boundaries of a free-software project are defined by the lines of the code and the license
2	Congruence between appropriation and supply rules, as well as with local conditions	The problem in this case is different because software does not allow exclusive use. In addition, there are different issues that could impact on appropriation and supply
3	Collective-choice arrangements	Some projects adopt institutional entities to allow the governance of the project. The more a project is important, the more an entity governs its development
4	Monitoring	Everybody is a potential supervisor, since the code is open
5	Graduated sanctions	Free software licenses provide for mechanisms that provide for sanctions (with different degrees of progressiveness)
6	Conflict-resolution mechanisms	There are different non-for-profit service providers to support enforcement
7	Minimal recognition of rights to organize	In free software this right is not minimal> everybody can fork the project and/or reuse the code
8	Nested enterprises	This last point is different in free software

Ostrom's design principles, taken from Bassi et al. (2017)

These are 8 different points to be taken into account in constructing a democratic governance for DECODE in the mid and long term.

Community boundaries: Identifying what and who is within the community

The question of who are the people contributing, benefiting or interested in a given project is a relevant one for its advance. We can distinguish two ideal types of (sub)communities within free software projects.

The first is the developer community. Most stakeholders/participants in this community are developers and most decisions are taken by them. Users are not really involved in governance. The minimal rules of such a community are defined by the terms of the license. A license is not a sufficient condition for the existence of a community, but is usually a key element for both marking its boundaries and defining it as “free software” (D1.8).

However, as we point in the following sections, there usually are many other, informal spaces, that help to mark the boundaries of the community. The presence and contributions in software production platforms and repositories (f.i.: github) is a key marker of belonging to the community. Then, there are other spaces such as community discussion fora, mailing lists, bug reporting platforms etc., which can serve to mark the pertinence to the developer community.

In synthesis: participation in nodal points (repositories, fora) and legal compliance (license use and respect) are the two key markers of belonging to a community of free software developers.

A second ideal type is the user-oriented community. Here there is a broad set of people who support the software. Frequently, this group is crucial to finance, support, document, spread, defend and promote the software and its development and it is often the case that some of its members intervene in decision making (roadmap, priorities, governance structure). Here we can situate discussion fora, mailing lists, bug report and tracking platforms and other support channels too.

Most projects combine developer and user-oriented communities into a wider hybrid community, with different participants and stakeholders intervening at different levels.

Stürner (2013) adds two more types of Free/Open Source Projects whose constitution narrows or expands upon the developer-centered and user-oriented communities explained above: single vendor projects (where a single company drives the whole software development and service delivery) and open source competence centers (where a number of local stakeholders, often with the support of public funding, promote a set of projects). We shall not consider these here. Single vendor projects don't afford for a democratic governance model and competence centers are too constrained to local conditions and problem domains.

Incentives, functions and duties within the community or ecosystem

Incentives in open source software projects

What are the motivations in the community? If we understand the premises regarding each participant's motivation for participating in the community, it becomes easier to understand how a particular governance model (or aspect of a governance model) will affect that motivation. Understanding motivation of a given community (individual and collective motivation) should enable either leaders or the community itself to identify mechanisms for promoting achievement of goals. Generally speaking, motivation can be divided into :

- Intrinsic. Personal enjoyment driven by discovery, mastery, personal value recognition, etc. Conviction (f.i.: political convictions).
- Extrinsic. Economic or social rewards

Extrinsic motivations can be subdivided in various subtypes:

- Financial motivation .
 - Financially motivated participants.
- Participation motivation
 - Power: participation in decision making.
 - Recognition: participation in a recognized project.
- Use motivation
 - Benefiting from improvements in the software.

For any project aiming at a democratic governance, it is important to find an equilibrium or compensation between paid and unpaid members, as well as between active and passive ones and a fair distribution of symbolic capital or social recognition of the contributions.

Roles and motivations

Contributors usually differ in their role and contributions to the project. Motivations also vary among them. Open Source Communities (OSC hereafter) usually involve :

- Programmers. People who contribute code to the project. Their incentives can go from mostly intrinsic (f.i.: fun), to mostly extrinsic (payment, power within the project, etc.).
- Bug reporters. People who find bugs in the code. Their incentives can range from benefiting of an improved software to reputation within the community. Usually their incentives are non-monetary.
- Coordinators / Managers. People who oversee and coordinate the activity of other actors. Incentive is usually extrinsic, remunerated position or part of other

job description/function. Interest in strategic focus of the project, efficient coordination.

- Content-contributors: People who contribute with content in cases like wikipedia or other types of software that feed with user-generated content. Main motivation is
- Users. People who use the software. Their usual motivation is to benefit from the software.
- Financers. People who fund the project. Their motivations range from personal convictions to public recognition but when financial contributions are significant (e.g. beyond crowdsourced micro-financing) financiers are most frequently motivated by some kind of strategic need (e.g. the software is critical for their service-delivery business model or mission when financing comes from the public sector or non-profits) or to gain strategic advantage over the project's governance and roadmap.
- Community supporters. People who contribute to support channels. A frequent motivation is personal satisfaction and peer recognition (often gamified by forum badges and strategies alike). More rarely, payment is involved.
- Evangelisers. People who work and generate narratives to convince others to use the software. Their incentives can range from reputation to economic.

On a study involving 300 surveys, Oreg and Nov (2008) discovered that programmer's main motivation is reputation-gaining and self-development, whereas content-contributors (to wikipedia on their study), display a more altruistic motivational drive.

Open Source Community Sustainability and financing

One of the core (if not the most important) goals of a governance model should be the sustainability of both the code and the community. We can understand OSC sustainability as the "set of conditions that are sufficient for a software product to reach the end of its natural life for at least one customer, or, in other words, conditions that are sufficient for a software product to complete the product life cycle [...] However, there are two absolute requirements for sustainability; a sustained need for the software and a sustained capability for creating and maintaining the software" (Metcalf, 2007).

Sustainability usually requires funding (what we have labelled as external factors above). There are multiple methods of obtaining financing for the project: public subsidy/contracting, deployments, grants and donations, "sales", private investment.

The key subsequent question is: how does this impact on governance? In terms such as availability and sustainability of finance, symbolic implications of finance, implication or participation of the financers in project management, etc.

An additional critical aspect of sustainability goes beyond the “product oriented” approach proposed by Metcalfe, and involves the *mission* and *vision* of the project itself. It is rarely the case that the only goal of a software project is the product itself (a web browser, a collaborative editing web, an operating system) but there is often a goal that the product itself is aimed at targeting (creating open standards on the web, promoting free and collaborative knowledge production, enhancing software sovereignty and creating an open software ecosystem). This end-goal is critical for a deeper understanding of governance and mid and long terms sustainability, particularly when conflicts arise at the level of product governance and when future oriented and contextually sensitive strategic decisions are to be taken.

In this sense, OSCs that conceive sustainability only in relation to the very product are more prone to fall under problems of financiers taking too strong a role in governance or becoming socially or operationally unsustainable when governance conflict arise regarding externalities, context-sensitive strategic decisions or operations, etc.

Collective-choice arrangements

While the discourse on blockchains, specially around bitcoin, tried to obliterate the question of governance, the topic has been much more frequently an object of discussion among online peer-production communities (Fuster, 2010).

OSC Governance models

There are several models, from centralised control by a single individual or organisation (benevolent dictatorship) to distributed control awarded in recognition of contributions (meritocracy). The decision making processes usually range from fully centralised to fully decentralised. There are a series of classical ideal models of governance in open source software development projects (Gardler & Hanganu, 2013; Ritvo et al, 2017; Id Law Partners 2017):

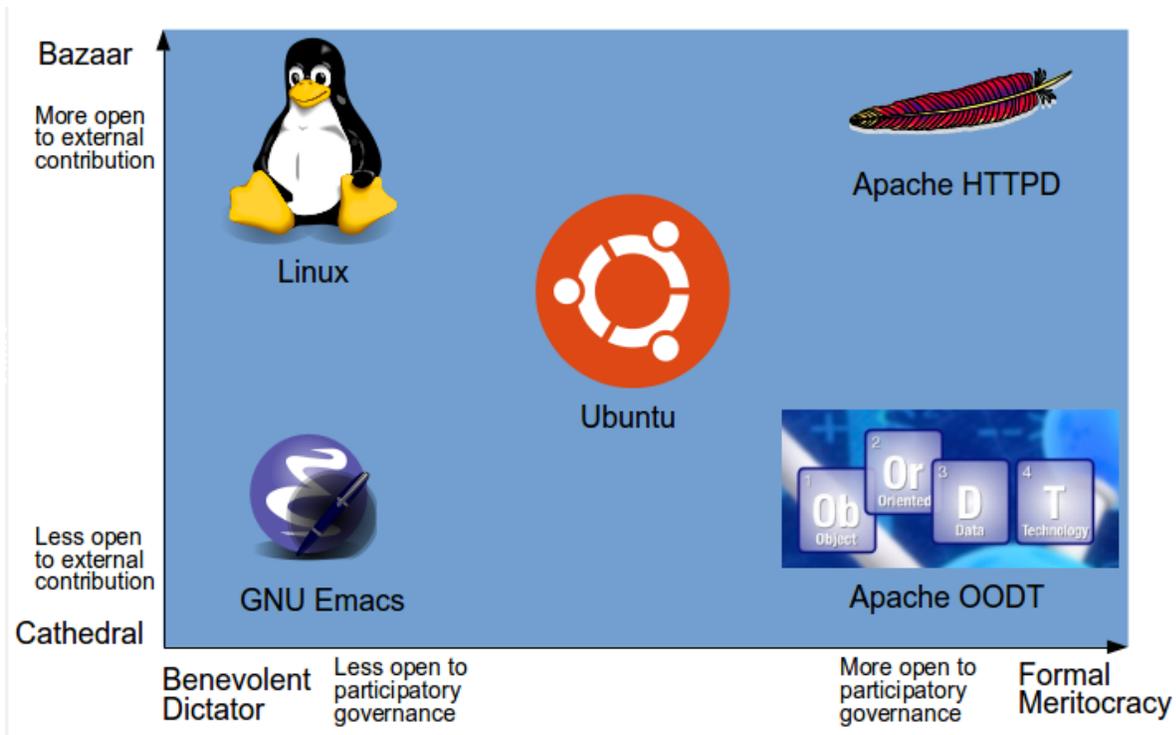
1. Autocracy: A key reference here is that of the **benevolent dictatorship**. In this case, general orientation and key decision making is made by the project founder or leader. Part of its role is to ensure that decisions are in what this person (or small group) conceives as the best interest of the project, rather than the interests of any particular individual or organisation. This frequently implies to balance the conflicting requirements of community members. The role is frequently that of imposition but that of arbitrator and coordinator, whose goal is to allow discussion among community participants to proceed and only indicate a preference in the unlikely event that there is no visible consensus emerging. This means that, although the decision making power is centralised, the distributed community is expected to inform (or reclaim) the decision through debate.
2. A second classical model is **meritocracy**. In this model decisions are made by the most proficient and/or participative members of the community. This implies

a distribution of power in comparison with the previous model. In principle, it implies a flatter social structure and less hierarchy; in practice, contributors who have earned the respect of the community (through frequent and useful contributions) tend to have a 'louder voice'. It generates a need for more formal decision making process mechanisms given that no single person is able to break a deadlock. New entrants to the community can more easily feel empowered and engaged. Everyone has a voice and rewards those who make valuable contributions by providing mechanisms for recognition, such as increased visibility. Action based on the consensus emerging from the community (often silent or passive consensus) follows meritocratic leaders.

3. **Comitology** (delegated governance model in Ritvo et al. 2017) is a model in which relevant decisions are taken by appointed committees. These are usually filled with core developers. Sometimes this model combines with the previous two, generating governance models of committee-based autocracy and meritocracy. In hierarchical models, an executive committee acts as benevolent dictator, but limited by committees. In poliarchic ones, the community is structured in a series of committees that represent different stakeholder interests. However, within each committee, decisions may be either explicit or through lazy consensus, with each committee having a benevolent dictator or group meritocratic leaders.
4. Another model is that of **incorporation**. In this cases the high level matters of the project is governed by a foundation or other non-profit, with management structure. The foundations deals with legal and financial issues ONLY, and provides umbrella for community activities. However below the management structure, the project is managed following an autocratic, a meritocratic or a comitocratic model, or a combination of them.

We can combine this **autocracy-meritocracy** axis concerning decision making with a second one, which concerns contributions. Following Raymond Aaron's binary schema, it is possible to distinguish between those projects following the "cathedral model", and the bazaar model. In The former the source code is available after a given version is released but not while it is produced, which implies a more closed and hierarchical model. In the bazaar model the code is available during its development stage, which also makes it more open and horizontal to contribute.

Crossing this double axis we have the following image, which includes several examples:



Governance Models and Contribution Models. (Gardler & Hangau 2013)²²

We can follow the following some examples of governance model with different OSS projects attending the previous image:

- Bazaar + Benevolent Dictator (BD): Linux
- Cathedral / closed (centralised, BD): Emacs
- Centralised / Closed Meritocratic: Apache OODT
- Decentralised / Open meritocratic: Apache HTTPD
- Benevolent Dictator supported by meritocratic Committees: Ubuntu.

Monitoring: from open source to open development

Another key aspect in the maintenance of a peer production community is monitoring. There are multiple ways in which this can take place. Two key ones are open source and open development.

To begin with, any free software project involves open source software. This implies anyone can see and audit the code.

Open Development adds to that form of infrastructural transparency or visibility another layer. It tries to make visible the processes within the community itself. Firstly, this implies

²² Available at: <http://oss-watch.ac.uk/resources/governancemodels>

to ensure transparency in the the technical development process. Platforms such as Github visibilize both contributors and their contributions to the code, thereby contributing to processes of peer review and monitoring. On the other hand, clear definition and respect for roles and responsibilities within production processes (release manager, committers, etc.) facilitate monitoring too.

Transparency in community management processes

- Decision taking in all dimensions
- Conflict resolution

The monitoring itself can take several forms: by peers (such as the github platform), by groups (such as self-appointed quality groups), by institutions (such as foundations, quality evaluators, etc.).

Sanctions: Free software licenses and beyond

Like in any other community, sanctions in free software projects can be either formal or informal. In this case, the most basic formal instrument for sanctioning is the license of the software.

Free software communities have been paradigmatic in the definition of practices and dispositives for open, peer-production. A key referent in the shaping of the free software movement, Richard Stallman, defined early on the four basic freedoms:

“A program is free software if the program's users have the four essential freedoms:

- to run the program as you wish, for any purpose (freedom 0)
- to study how the program works, and change it so it does your computing as you wish (freedom 1). Access to the source code is a precondition for this
- to redistribute copies so you can help your neighbor (freedom 2)
- to distribute copies of your modified versions to others (freedom 3). By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this.

A program is free software if it gives users adequately all of these freedoms”.

Stallman crucially designed the first software license oriented to safeguard these freedoms, the GNU General Public License. In formal terms, for a software to be free software, it is enough for the right holder to publish its code under this type of license. In practice, other requisites, ranging from open development to the existence of a community define the sustainability and quality of a free software project.

The terms of the license express the rules that can be legally enforced. There are other formal ways of enforcing community rules and standards. One of them can be institutional rules: in projects such as wikipedia or mozilla, a foundation with a set of publicly established rules can promote or discourage certain courses of action or force

members of the community out or reduce their decision privileges or permissions. It is often the case that Codes of Conduct, Social Contracts or End User License Agreements of the software used to run the online communities serve as a legal or formal framework to impose such sanctions .

Informal rules are more frequent in areas such as core development or public fora. It is frequent for core developers to have a considerable range of freedom to accept or not a given change to the code. Similarly, exclusion of concrete voices from a project's public channels (as happened in the bitcoin block size debate, De Filippi & Loveluck, 2016) is a possibility too.

Conflict resolution

In any open source software community there are potential conflicts at different levels. These are some of them:

- Technical direction of project: Roadmap, Releases, Peer review, etc.
- Community infrastructure and vision, direction: definition, maintenance, implementation.
- Community organization. How, when and the effect of involvement.
- Relationships between key stakeholders goals / motivations

There are different mechanisms through which these conflicts can be addressed.

- Forums and debate: lists, meetings, face to face meetings.
- Formal resolution: board (appointment, process, communication)
- Voting by one (benevolent dictator), in committee (comitology), voting by community as a whole (meritocratic/democratic).
- Forking

The governance structure needs to establish a conflict resolution procedure through different tools for each level of participation (users, technical, legal, etc.).

Barriers for formalizing a governance model

As we noticed in the case of bitcoin and other blockchain projects, a central question for any free software project is that of whether its governance structure is formal or informal. When is formal governance (in terms of community rules, legal structures, coordination forms, supervision bodies, etc.) needed, and when is it not needed? The question is that of when does a formal and express governance structure become necessary to ensure objectives and sustainability. Formal governance is frequently obliterated in projects at a small, early stage, with an homogeneous community with similar motivations and objectives. On the other hand, it frequently becomes necessary as the community becomes larger, with heterogeneous stakeholders and activities.

Certain barriers have been identified against expressing or formalising a governance model (Garder & Hanganu, 2013). These barriers should be understood and taken into account in the creation and communication of a governance model.

Barrier	Considerations
Perceived as bureaucratic and red-tape, loss of spontaneity	Creates higher requirements for documentation, formal processes, loss of spontaneity
Loss of direction	Loss of agility and responsiveness through heavy management processes.
Loss of control by existing leaders	Existing leaders fear loss of control and direction of the project, while continuing to invest time/resources in the project. However a well-designed governance model should ensure that control remains precisely where the project leadership wants it (including through democratic process)
When communities split (forking)	Risk to have a fork (or several) and divide the community.
The project is too young or too small	No description about contribution process or how the contributions will be managed.

Recommendations for addressing governance issues

On the basis of the foregoing, the reflection to be made (from a practical perspective on relation to DECODE project) includes:

- Define which stage is the project, implement control mechanisms appropriate to stage of development and actors
- State clearly project and community goals (common to all project, specific to individuals/entities) and revise periodically
- Maintain/increase Involvement

- Provide inspiration and identify clear channels and outcomes to make contributions
- Identify risks/threats to balance/sustainability
- Identify decision making processes
- Determine governance mechanisms to avoid conflicts, reduce or face risks/threats, increase efficiency,
 - ◆ Need to match player motivation, goals and other factors (more variety of players, more variety / complexity of mechanisms)
 - Appropriateness of mechanisms / motivation, goals and stage
 - Efficiency of mechanisms
 - Maintain motivation, feeling of self-determination
 - ◆ Avoid asymmetric information
 - ◆ Avoid over-control

The lack of a complete articulation of governance structure/accountability can be positive, as it allows for flexibility, adaptation and evolution of the governance structure and the incorporation of new participants.

4.1.2. Case study: democratic governance of Decidim

Decidim.org

Decidim is a digital common's infrastructure for participatory democracy. Decidim is a participatory democracy platform 100% free and open software. It hosts participatory processes, government strategic planning, citizen initiatives and other (self)governance services. It allows, hibridate and integrate digital and physical participation, it is not "digital democracy" it is "a digital infrastructure for political democracy". It's a public-common democratic infrastructure in the sense that it is promoted and have the most important part of the funding from the public administration (Barcelona City Council), it has a GPL Affero v3 License which means that everybody can read, copy, modify and contribute to the code (becoming common) as long as we keep the same software license, and democratic because the process of design and development has been opened and participated by the citizens of Barcelona and for a growing community around the project.

Decidim is designed to helps citizens, organizations and public institutions self-organize democratically at every scale Co-producing public policies (strategic planification or

participatory budgeting), promoting multitudinous deliberation processes and Enacting distributed decision-making processes.

Decidim tries to provide coverage, structure, standardize and give democratic quality criteria in the participatory democratic processes, initiatives, consultations and organs or assemblies. It is flexible attending the needs of promoters of a participatory process but is strong in terms of democratic possibilities (transparency, traceability, integrity, deliberation, physical meetings, supports,...). At the same time Decidim wants to be a political network with security and privacy guarantees.



Homepage of Decidim.org

Decidim makes possible for thousands of people to organize democratically by making proposal, joining public meetings, creating deliberative discussion, deciding through different forms of voting, and monitoring the implementation of the decisions.

Decidim allows to articulate participatory process that helps to structure and deploy almost any kind of democratic process. One example would be the participatory budgeting where citizens are able to directly decide how to spend funds from a public

budget. At the same time Decidim allows to open calls for proposals, discuss and set up priorities with citizens or members of the organization, estimate the price of the projects and open them to voting, and monitor the results. It makes possible for people to create, manage and push citizen initiatives (e.g. to open a proposal, create a new participatory process, promote a consultation) to reach their goal. It is possible to define types of initiative, specifying the number of signatures or supports they need to achieve, and participants get access to collect support and bring their initiative to power. Decidim allows to create a site for any kind of working group, assembly, committee or participatory organ, to help people join their meetings, support their proposals, follow their minutes or audit their activities.

Decidim is not only a digital platform, we're an application for people from all ages and origins. Decidim is designed to help solving the digital divide and to create new forms of multi-layered, augmented participation. Modular, scalable, configurable: upgrade and expand.

Unlike other existing platforms, Decidim's architecture is modular, scalable, easy to configure and integrated with other tools or apps (data analysis, maps etc.). The platform has been designed in such a way that processes, assemblies and mechanisms can be set up easily and deployed from an administration panel, where no knowledge of programming is required to install, configure and activate it. The components (participatory components) that are integrated are independent from each other and can be developed, activated and deactivated independently.

We are witnessing an increasing dependency of the public sector on private corporate digital infrastructures. In order to regain sovereignty and guarantee citizen digital rights, public-common democratic infrastructures are required at several governance scales (city, region, states, Europe). Decidim aims at becoming the new kind of socio-political network of federated municipalities boosting democratic participation based on Free/Open Source Software, Transparency, Integrity and Data Protection principles.

Metadecidim, a democratic technopolitical community

Decidim is an open and collaborative community, an ecosystems of small and medium size businesses, organizations and citizens: Metadecidim is how the community is called in Decidim project. Metadecidim has different layers of intervention: LAB, SOM and JAM.

LAB Metadecidim is an open and collaborative research space which revolves around the challenges that technology raise with respect to the transformation of political participation. New systems, such as Decidim, are changing the traditional paradigm of citizen participation in the political sphere. On 2017 the LAB has host several events about relevant aspects of Network democracy and Decidim challenges such as

Democratic innovation guided by simulated models, Democratic governance of digital commons infrastructures, Digital ontologies of participation, Investigating new democratic governance models for new scales of cities, Strategies of engagement for democracy, Digital identities, verification and democràtic processes or Political Gamification²³.

SOM Metadecidim²⁴ is a productive ecosystem, where citizens can think, prioritize development lines, decide on improvement projects and discuss the uses and future possibilities of the Decidim platform. Is the most important part of the Decidim Community and one of main goals is to empower citizens to appropriate Decidim, contribute to its development and be co-participe in its construction.

The SOMs are a monthly open meetings of the community (made up of technical staff, hackers, researchers, experts, organizations of civil society and citizenship in general). Sessions are organized around thematic areas of work or specific assemblies. The active axes are these:

- TECH (technologies): experimentation and reflection on useful technologies for Decidim, platform architecture, development community and gitflow, installation of the Decidim, technical documentation, etc.
- PX (participant experience): where you know and share the experience that users have of Decidim in order to improve the usability and the participation experience in the platform.
- COM (story): narratives of reflection, imagination and techno-political seduction, for the construction of common and creative discourses about participation, Decidim and democracy.
- LAB (research): To go deeply into the debates open in the monthly session of the Decidim.lab, as well as in other research challenges connected with the development of Decidim and online democracy.
- GOV (governance): dedicated to collectively discussing the governance of the community and the steps to follow in its development.

Finally the community has the **JAM Metadecidim** the annual conference of Decidim project. Three days of workshops, conferences, panels, interventions, presentations and other activities related to networked democracy, political participation, digital technologies and Decidim Software.

²³ <https://meta.decidim.barcelona/assemblies/eix-lab/f/87/>

²⁴ <https://meta.decidim.barcelona/assemblies/eix-comunitat?locale=ca>

Decidim Social contract

Decidim social contract²⁵ is a code for democratic guarantees and open collaboration. This is the social contract that all members of the Decidim project are committed to follow. Initially The social contract is an agreement between the city of Barcelona and the rest of the cities who have accepted. In order to be recognized by the Decidim project the use and development of the Decidim platform by an institution or social group of any kind involves the full and integral acceptance of, and commitment to, this social-contract, attending the following principles.:

- Free software and open content

The code of the platform, along with the modules, libraries or any other code that is developed for its functioning and deployment, will always be Free Open Source Software with an Affero GPLv3 license or latter versions [<https://www.gnu.org/licenses/agpl-3.0.en.html>] whenever the code is newly developed and with licenses that are compatible with the above one when code re-used.

The data available through the platform, is open and it, will be published and licensed under Open Data Commons Open Database License [<http://opendatacommons.org/licenses/odbl>], published under standardized and accessible formats (such as CSV, JSON, etc.) and, whenever possible, with tools that facilitate the analysis and visualization of data.

- Transparency, traceability and integrity

The platform must ensure and maximize, at all times, the transparency, traceability and integrity of documents, proposals, debates, decisions, or any other object, mechanism or participatory process.

- Equal opportunities and quality indicators

The platform should promote, with the aim of ensuring its democratic quality, the use of quality indicators developed on the basis of the data obtained from participatory processes, mechanism and user activity. Sharing of the setting of the different components as well as open data will be promoted for the definition of these indicators

Equality in political participation of citizens is one of the fundamental principles of any democratic system and the platform, not only has to ensure equal opportunities with

²⁵ <https://decidim.org/contract/>

respect to the uses and functions, but also the access right. In this sense the entity in charge of the platform assumes the commitment to promote actions that advance in the direction of providing access and support to the platform for all citizens alike universally. Giving tools and resources appropriate to the platform is available to anyone who wants to use.

- Data confidentiality

The confidentiality and privacy of the personal data that people might provide to participate in any of the functionalities and/or possibilities of participation that the platform provides shall be guaranteed at all times. In no case shall personal data be transferred to third parties. Personal data will not be used beyond what is strictly necessary for the purposes of user registration and improvements on the usability of the platform. Whenever platform technology makes it possible, the expression of political preferences or will in decision-making processes shall remain inaccessible even for the administrator of the platform or the server/s that host it.

- Accountability and responsibility

A commitment to citizens shall be taken to respond to all queries and contributions in the shortest time possible. A commitment shall also be adopted to follow-up the results of participatory processes and to respond to those demands specifically request it. Finally, a commitment shall be taken to study the incorporation of indicators to monitor the participation processes once they are finalized, in order to systematically evaluate its implementation.

- Continuous improvement and inter-institutional collaboration

Priority will be given to the collaboration and the exchange of experiences between the institutions involved in the project, with the aim to improve, fix and build new developments for the continuous improvement of the platform.

- Terms of use

All points of this code should be reflected at EULA (end user license agreement) document that each organization that delivers services using Decidim establishes with users, and it should never be contradicted.

The contract is understood to be open to revision. Nevertheless, the mechanisms for such revision have to be defined in the participatory process of defining the governance model of Decidim developed in the following section.

The governance model of Decidim

The governance model of the Decidim is in the process of debate, reflection and definition due both to the novelty of the project and to the will of its promoter and founder team to democratically open the way in which this project should self-govern.

This implies that we are facing a dynamic governance model in the sense that at the time of writing this article it is in the revision and improvement phase. Even so, and as a common aspect of the whole project, a strategy of defining the governance model is proposed that iterates over minimum structures that become more complex as they improve, not aspiring to have a unique, great and perfect model. of governance, but have a first MVP and go iterating and improving on that model.

The governance model of the Decidim has been initially organized on three large blocks, in which the three major layers of project governance are structured; legal governance, code governance and community governance. Although both aspects are closely interrelated, this division has been established in order to first be able to diagnose the governance status of the present project and at the same time organize the aspects that will touch each of these categories and on which they will iterate. . In this way, the following structure is proposed:

□ Legal layer

The main decision attending the legal layer is the formal legal entity that the project adopt. Decidim is in process to define the legal structure studying the different options in order to preserve the public-common character of the project and the democratic principles. There are some legal structure options on the table as the constitution of a Foundation, an Association or other contractual relationship as a Consortium. But it not have to be deprecated to explore informal legal structure or just to don't have legal structure.

In order to constitute any formal legal for the project, it have to attend some terms of Governance, as the foundational documentation, internal regulation for a foundation case or other relevant aspects for any other legal structure as the governance rules, the contribution policies or the trademark policy. One of the most advanced contributions of Decidim in this aspect is the social contract, which defines some collaboration, ethical and democratic conditions to use and contribute to the project.

Defining the legal model requires attend the Branding/Trademark including registration process (and its costs), define the uses, the license of use, solving open questions as

what trademark, territory, logo, the owner or what licensed rights should be granted to the community.

At last the legal layer include the Intellectual property, its management and the license of the project which include:

- Initial ownership of rights
- Contribution policy
- Assignment of rights (CLA)
- Contributor License (CLA)
- Project license (DCO)
- Copyrights in materials, web, texts, designs,

Decidim is licensed under the GNU Affero General Public License v3.0²⁶. Permissions of this strongest copyleft license are conditioned on making available complete source code of licensed works and modifications, which include larger works using a licensed work, under the same license. Copyright and license notices must be preserved. Contributors provide an express grant of patent rights. When a modified version is used to provide a service over a network, the complete source code of the modified version must be made available.

It is important to attend the fact that the owner decides on license, license change, license alternatives, and also legal defense assuming the responsibility for infringements.

□ Code layer²⁷

The Decidim is a GitHub project which includes thirteen repositories, where one of them implements the core framework. The platform also uses development supporting tools, mainly to provide package management, perform code quality and promote communication among developers (Cabot & Cánovas, 2017).

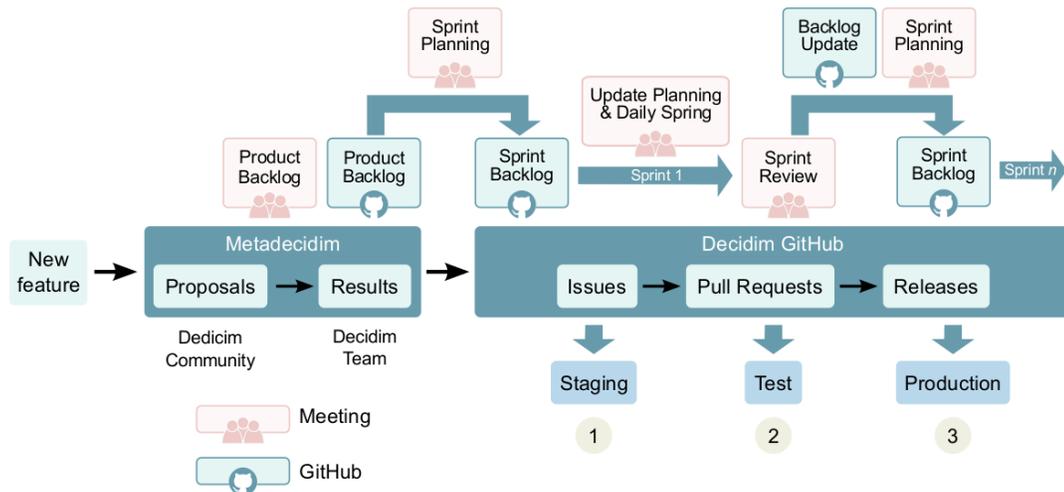
The Decidim project is being developed in GitHub, a Web-based Git version control repository hosting service overpowered with extra functionalities like bug tracking, feature requests, task management and wikis. The project includes thirteen repositories²⁸.

²⁶ The full license: <https://github.com/decidim/decidim/blob/master/LICENSE-AGPLv3.txt>

²⁷ This section is based on the work of Jordi Cabot and Javier Cánovas from SOM research Lab (IN3/UOC), “Code Governance in Decidim” (2017)

²⁸ Available at <https://github.com/decidim>

Decidim is deploying a custom development process which relies on (a) Metadecidim to discuss change features for Decidim and (b) GitHub to address their implementation. Next we briefly describe this development process, which is illustrated in the following figure.



Agile development process followed in Decidim; sprints and product cycles and meetings. (Cabot & Cánovas, 2017).

The Decidim GitHub project includes a document describing the code of conduct²⁹. This document defines set of rules to guarantee a harassment-free experience for everyone willing to contribute in the project.

One of the main dynamics in the development process is the integration with Metadecidim: Initially everything goes through the Decidim leaders (core or product owners). Metadecidim has an open space to collect proposals. If the proposal have funding and goes in accordance with the social contract, the request goes to github and the programmer in charge (hired by the financing entity) executes. There are 2 types of developments:

- Fix (minor thing): Bugs or minor developments. With a PR and code review is enough to be accepted.
- New functionality: the repo Decidim is opened, they work in a branch of Decidim or they work in their own installation / fork.

At the same time all the developments planned they have a circulation process with the community. The community can test and give feedback to the developers in order to improve and correct the developments.

²⁹

Available at https://github.com/decidim/decidim/blob/master/CODE_OF_CONDUCT.md

The decisive figure right now are the key developers (who approves or not modifications). In an open model a person not included in the project making a certain modification could intervene. One of the option studied is to avoid discussions on github and convey any modification through meta.decidim.

The governance model in the code layer implies to define the rules of contribution, decision making in acceptance or rejection and the implications of the contributions in this 3 levels: **issues** (small contributions or proposals), **pull requests** (code contributions done it to the Decidim code) and **releases** (the set of new features and fixed bugs included in a new version or subversion of Decidim). Finally the main challenge is the **integration of Github** (the code repository) and **meta.decidim** (the community platform for the democratic governance of Decidim). This integration should solve some problems and limitation on decision making process, allow the communication between programmers and non-programmers, and structure democratic process of the whole chain of design, deliberate, decision and follow of any kind of development.

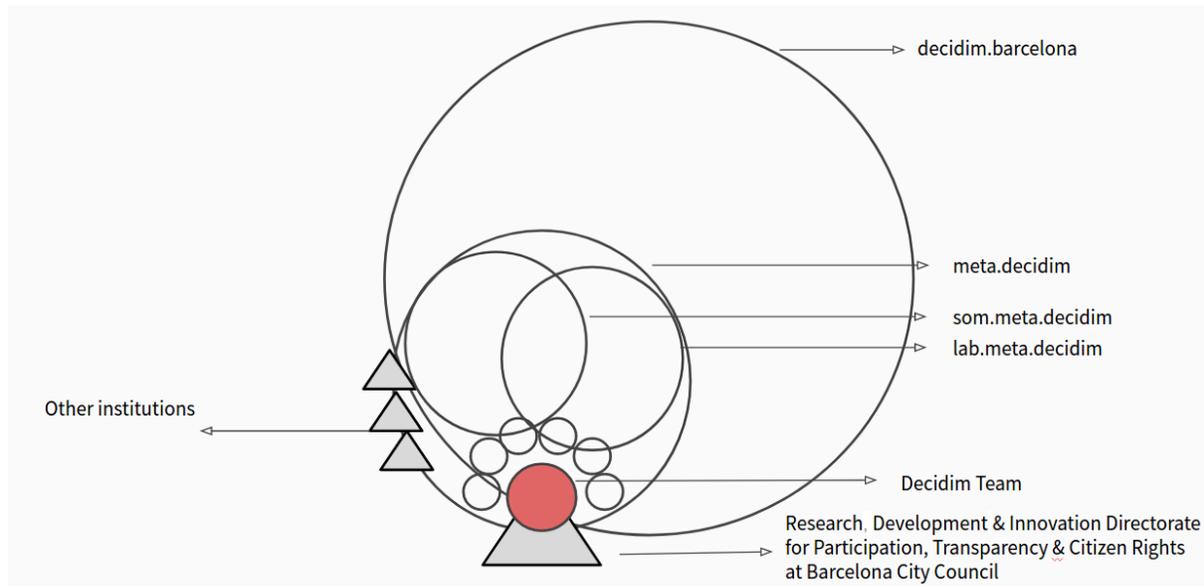
□ **Community layer**

The governance layer of the Decidim community is the most important layer and contains all those fundamental elements that define how a community is organized and decides even on the other two layers analyzed (legal and code).

Decidim is a young software project and its governance model is young too. Actually the community is defining, with the promoters of the project, the governance model attending the community layer. The promoters of the project has decided to open the design and definition of the governance model to the community (Metadecidim³⁰) and during the second half of 2017 a working group has been involved in the task of develop the steps to have an initial governance model proposal.

The governance model definition process include two main goals: 1) Map the roles and responsibilities in the project from its beginning until today and 2) Define an initial democratic model for Decidim community.

³⁰ meta.decidim.barcelona



Roles and instances of governance in Decidim.

Source: personal collection

The main starting principles which the Decidim Community is working are: 1) Democratic principle, including the challenge to have a democratic model and the democratic process to access it (openness, transparency, etc..) and 2) Dynamic principle in order to have an initial minimum and working model and improve it periodically with iterations and revisions.

The strategy followed by the lead group of governance model in Decidim Community is to initiate during the beginning of 2018 a participatory process to define the initial governance model (v.1.0). The process will be organized in different stages (diagnosis, proposals, deliberation, validation and resultation) and categories (legal, code and community) and subcategories. The process will start with some initial documentation and proposals promoted by the lead group and it will be opened to gather other proposals from the whole community.

The main aspects identified to be defined in the participatory process are:

- Vision-Mission-Principles (What How and Why)
- Legal aspects: Trademark, Software License and the legal structure (Foundation, consortium, etc...)
- Code
 - ◆ Elaboration of the Governance.md which describes how to contribute in the project and who take the last decisions about issues, pull requests and releases.
 - ◆ The role of meta.decidim and the integration with github

- Community:
 - ◆ Funding
 - ◆ Organizational Structure
 - Taking decisions model
 - Comites.
 - resolution of conflicts
 - Communication flows
 - Inclusion
 - ◆ Membership of Decidim and membership levels (Orgs, people,...).
 - Vote privileges
 - Commitment

Initial challenges

The governance model of Decidim has some initial challenges attending their principles and goals which can be adapted by other similar projects.

- How to deal with different degrees of involvement (developers, technical staff, volunteers, translators,...) with different profiles (technology, participation, etc.)?
- How to deal with the binomy Open vs Meritocracy? There is a need about the balance between to be open and to recognize the personal contribution to the project.
- How to coordinate decision making in different scales (local, regional and international)?
- How an international community is communicated? How the deliberation processes are produced? In which languages?
- How we can design a public-common institution to maintain the Decidim project and defend and preserve the democratic principles of the community?
- Is it possible to elaborate of an ethical code / code of good practices about the community having an initial governance rules during the participatory process?

4.2. Preliminary schema for the democratic governance of DECODE ecosystems

4.2.1. Specific dimensions (of Decode) to consider

A first issue to consider is that of the **degree of autonomy** in contributing to the development of the technology. This can go from a high level of decentralization, in which various actors can do so without having to pass by a single center of approval

(something allowed by modular architectures and microservices) or whether there is a center that has to approve those innovations (something typical of monolith architectures). One of the intermediate option would be the Heterogeneous (de)centralization, being some decentralised, some organised/coordinated, some obligatory). According to this become important to consider the types of “centralised” structures as hierarchical structures or common coordination structures (all groups), or individual (specific groups)

The second issue is the **degree of virtualization** of the community. Attend the scope of any community is so relevant in terms of distance (and the frequency of physical or digital meetings and coordination), the languages used by default and the translation systems. This is related to attend the local conditions of each territory and the congruence between appropriation and supply rules. One of the goals should be to find the balance between the local rules and the universal principles of the project.

The third issue is to define the **potential control patterns** and the coordination mechanisms in the community for control the development of the project, monitor all the activity of the community and supervise the whole community system. In this sense the approach has to be based on distributed, democratic and networked mechanisms.

The fourth issue, very specific of technological projects, is the definition of how are the **development process and cycles**. It is needed to attend some dimensions are the decentralisation, sequentiality, if the process need more direction, if its granular or modular. The definition of the cycles implies the definition of the sprints and the sprint plans in order to get an agile development,

The fifth issue is the attendance of **the barriers to entry to the community**. it should be take into account the main target of the community (users, developers, others,...). If the project clear define who wants to involve it is easy to define the boundaries of the community. At the same time it remains important other possible barriers as age, gender, technological skills, language, or the amount of information and knowledge needed to understand well the project.

The final issue is to look into the **main success factors** to measure the community and how they can be measured. It should be a relevant question the utilization of enforcement and sanction mechanisms, the reputation and acceptance of a leadership and the legitimacy of leadership and the grounds for legitimacy (elected, contributions, appointed, etc.).

In each case, consider how these issues affect governance, and vice-versa, how governance can affect these matters

4.2.2. Issues to be considered for DECODE in practice

Above and beyond the general considerations regarding OSC governance set out in section (4.1.1), for the process of defining the DECODE governance structure, the following practical issues should be discussed and defined.

1. Roles and responsibilities

- What are the specific different roles and their authority within the project
- What is their level of commitment
 - Users
 - User
 - User experience – understanding users, feature requests
 - Technical
 - User support – supporting users (technical)
 - Bug-fixer (developer) – reactive development
 - Committer (developer) – proactive software design and development
 - QA (developer) – follows issue tracker
 - Graphic designer
 - Release manager (formal process of release)
 - Documenter (install, FAQs, tutorials, User guides, Developer guides)
 - Management
 - Committee member
 - Executive manager (general oversight and coordination)
 - Technical manager (roadmap, architecture)
 - Community manager (organize community events, first level conflict resolution)
 - Other
 - Evangelizer / marketing / promotion
 - Finance (donations, etc.)

.2. Decision making process

What are the decision making processes going to be, in the different levels (developer, user, wider) or aspects (technical, organisational, legal)

3. Roadmap

Who and how is the technical roadmap going to be considered?

4. Language

What is the main language of communication going to be?

5. Legal

Who and how are legal issues going to be managed?

- IPR management
- Contributions
- Trademark

6. Community management mechanisms

What are the community management mechanisms going to be? Taking into account the overall goals of governance/community management, and the chosen basis (direct, indirect, trust based, etc)

- Goals: to promote contributions and interactions, orient and synchronise efforts, resolve conflicts; to enable participation in a collaborative problem-solving process
- management mechanisms: social based on (a) formal processes embodying democratic decision making and (b) trust,

In practice, what mechanisms are going to be implemented?

- ceremonies, peer review, etc.)

7. Technical tools

Determine technical tools supporting the project

- Code Repository
- Bug tracker

8. Communications tools

Determine communication tools supporting the project and the community

- Website
- Community participation software
- Forums

- Mailing list
- IRC
- Blogs

9. Activities and tools for community members

What specific activities are to be engaged in on a formal or regular/periodic basis, to enhance engagement

- Code - Code contributions are one of the primary ways technical people give back to communities, which are often measured in commits.
- Open meetings - Groups and boards hold open meetings that often allow community members to be informed and participate.
- Elections / Voting - Community voting is a means of collecting feedback from community members on initiatives or membership.
- Retrospectives - Members need opportunities to provide feedback (and not just through issue queues). Retrospectives share what people have learned and help identify next steps to evolve community efforts.
- Meeting notes - Notes should be shared to allow non-present community members the ability to review at a later time.
- Issue participation - Community members help to organize bugs, plans, and documentation needs inside of issue tracking systems. This also allows members to collaborate and test work (patches, pull requests) before finalizing an approach.
- Wikis / documentation - Communal knowledge should be captured within wikis that, 1. Should be routinely updated by any community member, 2. Afford information sharing that
- E-mail Lists / Notifications - Threaded communication and notifications over email and/or web archival tools.
- Direct Messaging channels - Tools like Slack, IRC, and more provide the ability to set up both generic and specific channels (groups) and one-on-one messaging that allow for community members to communicate more directly.

5. The DECODE pilot: distributed ledger technologies for a democratic governance of society

In this section we try to outline the complementary side of the relation between democratic governance and distributed ledger technology. If above we tried to present the Decidim model as a potential referent for the democratic governance of a DLT such as DECODE, now we look at how a DLT like DECODE could contribute to processes of democratic governance in society. That is precisely the goal of the DECODE-decidim pilot to be run in Barcelona in 2018.

In order to understand its potential contribution to democratic governance in the network society, we first briefly introduce some aspects of the network society itself, networked democracy, and platform/data/surveillance capitalism, as well as the potential of Decidim as a third generation network for radical democracy. Finally, we briefly describe the core elements of the pilot and its potential impacts upon networked democracy.

5.1. Mapping networked democracy

5.1.1. *The rise of the network society and informational capitalism*

As it is well known, the core of the Internet begun to be built as a research and military information network in the 1960s, in the US (Leiner et al., 2009). The model behind it was that of a distributed network able to withstand nuclear attacks by avoiding central hubs and being able to redirect information packages through a variety of paths (Baran, 1964). In the early 1990s, CERN scientist Tims Berner-Lee developed the software for the first web browser. Combined with Uniform Resource Identifiers and Locators (URI/URL), it allowed to find digital resources anywhere within a growing open network of networks, in a smooth way: it was the origin of the World Wide Web (WWW).

These developments went hand in hand with the spreading of personal computers. As a result, the 90s saw the rise of the internet and the WWW to the status of a phenomenon of global proportions. Actually, they themselves greatly contributed to push globalization forward as a historical process, beginning with the acceleration of global finance (Castells, 1996). According to Castells (1996), at the core of the economy ticking behind globalization there was information. Its production, appropriation and exchange became key in the generation of economic value. The

result was what he considered a new form of capitalism: informational capitalism or informationalism.

Digital networks came to pervade the shape of people's lives, organizations and social processes more broadly. As a result, the "network form" became a sort of historical transcendental, found everywhere in the social field, to the point of defining a "network" society" (Castells 1996, 1997, 1998).

At the turn of the century, the alter-globalization movement called for an alternative to the imperating neoliberal globalization, one tied to a radicalization of democracy, social justice, human rights, as well as economical and ecological sustainability. This "movement of movements" had sociotechnical networks as a key part of their organizational core. It generated a "cultural politics of networking" in which networks operated not only as technologies, but also as a model for the definition of social norms and political forms (Juris, 2008): free association and information, non-hierarchical and flexible organizations, distributed but synchronized action, autonomous networked media, etc.

Particularly since the 1990s, there have been multiple names for the intermingling of democracy with information and communication technologies: teledemocracy, cyberdemocracy, electronic democracy or e-democracy, continuous democracy, and much more frequently in the last few years, digital democracy (Rodotá, 1997; Hacker & Van Dijk, 2000; Monterde, 2015). We use the expression "networked democracy"³¹ as a generic label (we use synthetic works for such a map: Hacker & Van Dijk, 2000; Van Dijk, 2000; Dahlberg, 2001, 2011; Fuchs, 2008; Fung et al., 2013). We follow Hacker and Van Dijk (2000: 1), who define it as "a collection of attempts to practice democracy without the limits of time, space and other physical conditions, using ICT or

³¹ We prefer the formula "networked democracy" to that of "digital democracy", much more common on the literature, for a number of reasons. The first is that "digital" seems to point to processes happening online, but much of what is interesting about new forms of democracy lies in the connection between the online and the offline. "Networked" seems better to reflect the multi-layered character of emerging ICT-mediated democratic processes. Furthermore, "networked" allows to emphasize (as Latour, 2005 has done), the "work" implied in the assembling of any social reality: otherwise, it opens itself to constructivism. This is especially important when academic and political discourse on the matter focuses on the "possibilities", "risks" or "impacts" of ICTs for democracy, frequently under reifying and instrumentalist views of technology as a "value neutral" mean (Feenberg, 1999). There is a limit to both expressions that is somehow more evident in the case of "digital democracy": they betray a form of techno-centrism or internet-centrism (Morozov, 2011) in which technologies seem to become the key definer of new forms of democracy. When taking the place of traditional adjectives such as "participatory" or "direct" it contributes to political obscurity.

CMC instead, as an addition, not a replacement for traditional ‘analogue’ political practices”.

Democracy is not a singular reality. Throughout history it has taken many forms in theory and practice.

5.1.2. Democracy and the rise of data and surveillance capitalism

In spite of the challenges of movements such as the alter-globalization, the entanglement of neoliberalism and informationalism grew hegemonic. By the late 2000s, corporations such as Google or Facebook were heralding a new form of informationalism, variously qualified as “platform”, “data” or “surveillance” capitalism. These three names speak of three key elements of the emerging data economy, which are also at the core of the DECODE project: digital infrastructures, data, and social actors. The fourth element from a political perspective is the paradigm by which their relationships are govern. The current model has been so far that of neoliberal governance, mainstream discourses on blockchain seem to announce the advent of a technoliberal one.

Nick Srnicek (2017) has shown how platforms, that is, digital infrastructures, have become the basic means of production of a valuable resource (data) out of its source (human activities). They are a way of extracting, processing, and using it in valuable ways. Complementarily, authors such as Steve Lohr (2015) have emphasized the resource, data, as the basis of a new world of data-driven politics, science or economies. Finally, Shoshana Zuboff (2015) has put the emphasis how the current model of data production, appropriation and use is generating surveillance-based capitalism in which big data brings ever closer a Big Brother dystopia. A few become the owners of platforms and data, who can surveille social life through aggregated data as a step previous to experimenting with and shaping it.

Against such a paradigm of technoliberal governance, the model heralded by Decidim is that of a democratic one. DLTs technologies such as DECODE can contribute much to the advance in this direction.

5.1.3. Decidim and metadecidim: third generation networks for radical democracy

Boosted by a multitude of actors, networks have come to permeate more and more facets of people’s personal and collective lives in the last decades. But there are different kinds of networks, promoted by different actors. We believe Decidim and

metadecidim³² are a third generation of digital networks: a political and a technopolitical network.

In the 90s, the World Wide Web was the paradigm of a first generation of digital networks: informational networks. The WWW was characterized by allowing the publication of information and contents on web pages reachable from any terminal connected to the internet. Although these pages offered different possibilities for interaction, their architecture often enforced various limits to it. The typical model was that of a page with ready made contents, barely modifiable by the people who visited it.

These limits to the interaction also limited the volume of information that websites could obtain from their users. This didn't prevent the flourishing of new economic opportunities supported by digital media, specially based on advertisement: in the 90s Internet and the web was connected to the arise of that Castells called "informational capitalism", a new step of the capitalism where the production and the appropriation of information become the key in the economic value production. Around the turn of the century, projects like Indymedia, a participatory network of alternative information built by activists and independent journalists, embodied an intermediate step towards what was later called "web 2.0".

Already in the second half of the 2000s, the proliferation of a second generation digital networks begun: the so called "social networks". According to authors like Tim O'Reilly, platforms like Facebook and Twitter made of users' interaction among themselves and with the contents (instead of information) the core of their construction. This, attached to the progressive increase of data extraction, storage, and processing allowed by big data techniques allowed the rise of a specific form of informational capitalism: data capitalism.

In the last ten years, corporate social network such as Facebook have grown to the rhythm of an economy based on the study and governing of people's digital attention and behaviour. In so doing, they have become mediators of everyday life and social communication, but with a much greater capillarity than traditional media like television or newspaper. In this way, social networks, which de-intermediate some aspects of social communication (e.g., the need to go through the editorial filter of a newspaper or television), mediate it again. What Castells (2009) defined as "mass self-communication" (multichannel communication from person to person, from one to many, and from many to many) has as gone hand in hand with what we could define

³² Decidim (decidim.org) is a digital platform of participatory democracy developed by the Barcelona City Council. Metadecidim (meta.decim.barcelona) is a digital platform for the participatory redesign of Decidim and the governance of the community around it.

as a "mass capture", the capture of mass data and human activities. One of the most visible effects at the political level has been the centrality of social networks in Trump's strategy and victory in the last US elections (Bode et al., 2018). Corporations such as Google or Facebook accumulate more information and capacity of acting over the life, digital or not, of every person, than any mass media or State until now.

This leads us to what we may call a technopolitical and social heteronomy, and has made that authors like Shoshana Zuboff (2015, 2016) to warn against the emergence of a capitalism of vigilance. These platforms feed from, and feed on, the contemporary society of hypervisibility and exhibition (perhaps a modulation of the society of the spectacle announced by Débord). As an alternative to commercial social networks, also in the second half of 2000, emerged alternative social networks, from Diáspora (with more than 1 million users) to n-1, a platform widely used during the 15M movement. This work was extended across Europe with the D-CENT project that pioneered networked models of democracy (Javier Toret, Antonio Calleja, A. 2014; Aragon et al. 2015) coupled with open standards-based distributed and privacy-aware technologies.

We consider Decidim an example of an emergent model of third generation networks, that we call "political networks". The project is embedded in multiple long-term processes³³. The software of Decidim, which began as a participatory platform designed to meet the needs of the Barcelona City Hall in terms of citizen participation, is currently used by more than a dozen of cities and, more importantly, in the coming months it will be used by cooperatives and other social organizations. This feeds the hope of benefiting from Metcalfe's Law, whereby the value communication network value is the square of the number of nodes: in other words, a network is more valuable if it has many people with whom to carry out activities. (e.g.: to communicate). The horizon of the project is to permeate a broad spectrum of circuits and social spheres.

In any case, the differential characteristic of political networks lies in what can be done in them and with them. Digital networks such as Decidim have three fundamental characteristics: firstly, they reduce the centrality of the figure of the prosumer (someone who produces and consumes digital content) and replaces it with that of a clearly political actor; secondly, they do so by articulating spaces that allow the construction

³³ Among them, the digital transition of traditional political institutions (whose participation processes have not yet been taken over by corporate platforms and whose progress has been slowed by the challenges and suspicions stirred by participation within institutions and traditional representative dynamics) 2- the processes of democratic transformation opened since the beginning of the 15M movement; 3- the tradition of free software and hacktivism; 4- the awareness of threats to privacy and personal security, and even technological sovereignty, revealed by the leaks of Wikileaks and Edward Snowden.

of collective identities, wills and intelligences beyond the mere expression, aggregation or circulation of individual tastes and preferences; thirdly, they connect these with decisions that affect the collective plane as a collective.

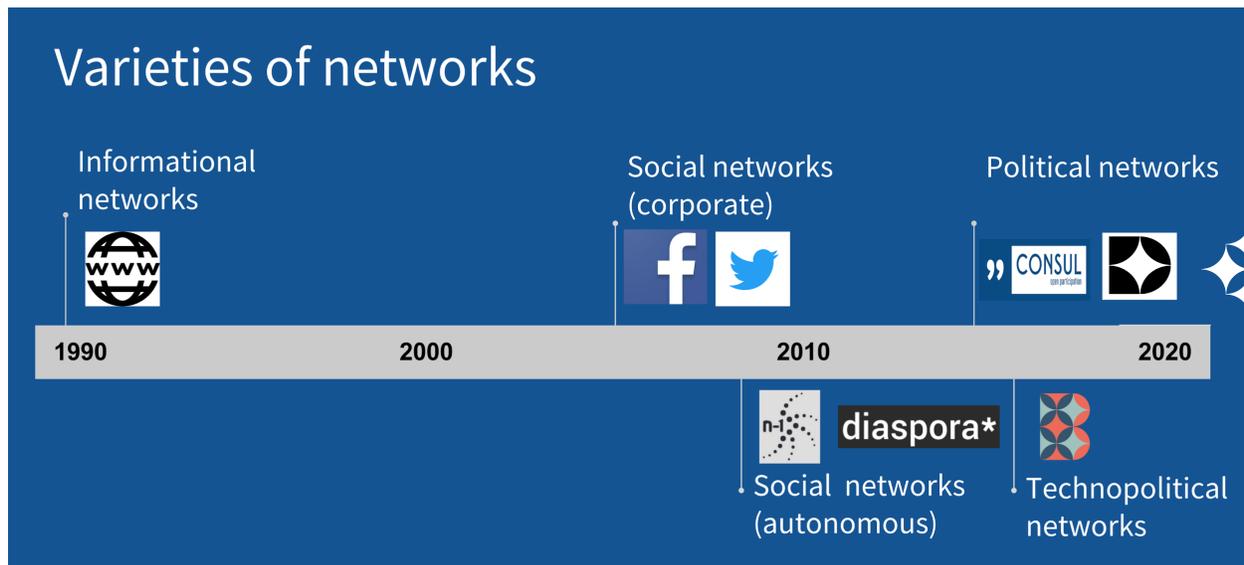
In this sense, the differences in naming are indicative: instead of a Facebook (a book of facebook), Decidim ("we decide", in English) places the political bond at the center of its construction. It doesn't appeal to individuals in a network but to a "we", a decisive "we". As municipal platforms, political networks provide intervention in institutions and the construction of public policies. Further, its regulative principle is that participants should take part as peers (in our interpretation of the Latin "pars capere" of participation). This applies to political processes run by the State or by any other social organization.

Resuming: in informational networks the key is information; in social networks, interaction; in the political ones, decision. Each generation collects and modulates characteristics of the previous ones. In the same way that social networks built upon, and questioned, the model of informational networks (according to the usual reconstruction of the transition from web 1.0 to web 2.0), political networks build upon, connect with and diverge from, the logic of social networks. Promoting a free multitudinous (no longer mass) self-communication, avoiding its capture, at least on the level of participation (and, potentially, much beyond), is key for the health of 21st century democracy.

Beyond its condition as a political network status, Decidim is a radically participatory platform. Otherwise: it allows the control and intervention of its participants in all layers of its technological structure, from its internal code (its back end) to its interfaces and participant experience (front end). This is even more distant from the user model of commercial social networks, in which users aren't able to decide on aspects such as the code, the rules of use or data policies.

In this sense, we could suggest that metadecidim, an open space and citizen community built around the Decidim project in order to decide over all his aspects, constitutes not only a political, but a "technopolitical", network. This is a network which places the construction of his technologies at the center of its political action. Confronted with the corporate digital network model of Facebook or Twitter, in which both the code and the data generated by users are proprietary and closed, Decidim is a model of digital network developed with public funding and citizen control. This is an example of what could be defined as a "public-common infrastructure": financed with public money, designed with, and governed by the citizenry, an infrastructure that increases the technopolitical autonomy of those who use it. Metadecidim makes of Decidim a digital commons. The data and contents generated in it are also a commons, otherwise, they remain under the control of the participants (in all that

concerns their privacy) and in the public domain (in all its public facets, e.g.: comments in threads). This also implies that the different forms and rules around information, communication and relationships in Decidim are open to modification by the community.



Varieties of digital networks

Political networks such as Decidim are also facing obvious challenges and limits: to reach broad population sectors, to promote their empowered inclusion, to connect effectively with collective decisions (especially in the field of public policy), to develop the sociotechnical systems required for cover all their development needs (from the digital identity management to its connection with the territory), to guarantee its economic sustainability over time, etc.

In any case, political networks like Decidim and technopolitical networks like Metadecidim set a horizon of third-generation, non-corporate networks, opposed to the various forms of data capitalism, and guided by principles such as social and technopolitical autonomy, free self-communication, digital commons and radical democracy. In the end, the Decidim project aspires to serve as both a device and a model for political transformation in a period of crisis of representation and the neoliberal hegemony itself, towards a more real and networked democracy. A network society of anyone and everyone.

5.2. DECODE technology for networked democracy

In our view, there are two planes in which DECODE can contribute to democratize social processes. One is the economic plane. By redefining the data economy in terms

of data rights, data commons, cooperatives, free infrastructures, etc. a stronger material base is put for democracy as a form of society, a society of equals (one of the meanings in Rosanvallon, 2011, 2013): networked democracy as a network society of equals. We will address this dimension of DECODE in a future deliverable (D2.5). Here we want to illustrate and explore some of the possibilities of DECODE technology on the political plane. That is the basic goal of the DECODE pilot with Decidim.

5.2.1. Decode pilot: i.digital and citizen i.initiatives

The possibilities of DECODE technologies in relation to Decidim have three keys aspects. The first concerns the possibility of building a new technology for personal data management (specially, identification), the second regards the possibility of creating a public ledger for democratic processes such as citizen initiatives, the third has to do with the development of a data visualization dashboard usable in data-enriched democratic processes.

DECODE wallet and i.digital

DECODE involves the creation of a wallet application. In this wallet, the user will primarily host two things: concrete sets of personal data and, more importantly, a concrete set of smart rules according to which these data can be accessed and used. With the wallet, the user will be able to provide just enough information to be identified as a citizen and exercise their political rights via Decidim. All of this while preserving its anonymity.

The potentialities go even further. Since the Decidim platform is designed to operate as a democratic dispositive not only for public institutions but also for all sorts of social organizations, each organization may decide what type of data are necessary for identification and exercise of participation. One could imagine decentralized networks and institutions of validation of personal credentials allowing people to do different things in different organizations.

DECODE i.initiative ledger

In the case of democratic processes such as citizen petitions, the user will be able to give support. More importantly, the results of the initiative (the number of supports) will be registered and publicly available at a DECODE ledger. Here, again, we have new opportunities for other social organizations, whose decision making processes could become more transparent and trustful.

DECODE data dashboard

Part of the DECODE project involves the creation of a data dashboard that will feed with public data and personal data donated by DECODE wallet users. Thanks to the

DECODE technology, the data donation will be granular and rigidly defined: the user will be able to set exactly what data, for how long, for what purposes, to whom, etc. will be donated. In the case of Decidim, the dashboard may contribute to data enriched participatory processes. For instance, citizen initiatives could ask supporters to provide data relevant for the cause (f.i.: data on the user's home rent to empirically support an initiative reclaiming the regulation of the housing market).

Democratic transformations

There are several transformative lines that result from these DECODE innovations when applied to the field of networked democracy. I will only summarize a few.

Recrafting visibility: transparency, anonymity, and data autonomy.

Modern governmentality is defined, among other things, by the attempt of the State and corporations to make society legible (Scott, 1998; Miller & Rose, 2008). Otherwise, to introduce, stimulate, or find in social settings structures open to calculation and measurement, by State or corporate actors. Making society legible is a key step for remaking it in a variety of ways. The current form of the data economy has greatly accelerated such process (as shown in more detail in D1.7): the acceleration of data extractivism (extraction of data to read social processes) has gone hand in hand with the rise of what we may call "data intractivism" (use of data for social engineering). DECODE technology affords what we may consider as double inversion of this situation.

On the one hand, DECODE technology boosts people's control over their data, so that there are aspects of themselves that will be seen only if they choose it. Otherwise DECODE fosters data autonomy, or the control of an individual or collective over the data they produce in digital environments. DECODE technology affords privacy by default: people gain control over what others see of them, and thereby can choose over their privacy. This opacity is the thickness of freedom.

On the other hand, DECODE technology, in connection with infrastructures such as Decidim, will make State-sponsored participatory processes much more transparent and unchangeable by third parties. Otherwise, DECODE fosters State transparency and integrity. Concrete aspects of individuals become less legible, the State and other organizations in society become more so. To use a literary metaphor: if the first move is oriented to block or blind Big Brothers, the second is oriented to chain them.

Boosting collective action and intelligence

Privacy can be connected with a complementary political right: freedom of expression. Non-identification is a barrier to punishment, be it by the State, corporations or other people. This barrier is, in turn, a safeguard for freedom of expression (negative freedom, as absence of constraints, in the sense of Isaiah Berlin). However, this also brings the

question of what happens with certain undesirable forms of expression (f.i.: hate speech).

Above we mentioned the relevance of platforms such as Decidim to potentiate forms of free mass self-communication. DECODE technology further helps to prevent the processes of mass capture (masses of data, people and human actions) carried on by corporations such as Facebook. While, according to ex-employees, Facebook data mining is oriented to mine people's psychological weaknesses (what we may call "weakness mining") for profit³⁴, democratic technologies such as DECODE and Decidim are oriented.

Furthermore, DECODE smart contracts will be designed to afford a granular access to an individual's data. On the basis of this, two applications will potentially boost both collective action and collective intelligence.

People participating in platforms such as Decidim will be able to release concrete personal data to specific users, such as people with whom they share concrete attributes. This may favor association between them. In the case of persecuted groups, this may happen with neither Decidim nor other users of the platform knowing. This may facilitate collective action.

People could also release concrete information to be fed into a data dashboard. In connection with a platform such as Decidim, this DECODE dashboard would then foster data enriched participatory processes, thereby boosting collective intelligence. This model is to be opposed to the current model in the data economy, that of corporate intelligence.

There is also a potential in DECODE technology for the constitution of autonomous networks of identification which could be particularly relevant in combination with platforms such as Decidim. These are not to be thought as a substitution of the State (like bitnations) but as networks that foster a thicker, autonomous social fabric, a key in the constitution of a healthy democracy.

³⁴ See footnote 2 above, for references.

6. Conclusions

As a project, DECODE is more than a technology. It is a new sociotechnical vision of the data economy and the society built in relation to it. The existing model has a key referent: the market. DECODE has an alternative one: democracy. Democracy as a form of government of anyone and everyone, as a form of society of equals, as a regime of rights, and as a civic activity. The consequences of this shift are profound. In this report we have essayed a preliminary exploration.

As we have seen, the question of the governance of blockchains is still incipient. Among other things, because of the very discourse around blockchains as technologies designed to avoid third party control while avoiding the ambiguity that is typical in governance (or social life, more broadly). The question of what we have defined as “technopolitical governance” of blockchains, otherwise, the decision making around their structures, has been repeatedly stressed as an urgent matter. The meta-governance question of the models has been less so. Calls for articulating a governance framework for blockchain ecosystems such as those of Tapscott & Tapscott (2017) express many of the key points of traditional neoliberalism. DECODE is oriented towards democracy.

Under the current conditions in the network society, technological infrastructures such as DECODE and decidim can operate as complementary dispositives for democratic deepening. DECODE can serve digital infrastructures for participatory democracy such as decidim as a back end that potentiates people’s privacy, freedom of expression and assembly, collective intelligence, as well as data and infrastructural autonomy (as they afford distributed running). Vice versa, metadecidim may serve DECODE as a referent for how to address the question of governance, both on chain and off chain. The challenges for the on chain and the off chain models are different, though.

A brief comment about off chain governance mechanisms, first. Decidim and metadecidim spaces could play the role that is today played out by discussion forums play in cases such as bitcoin or ethereum. With considerable advantages, first and foremost, the possibility of easily and formally linking those discussions to democratic decision making over the technology.

When it comes to on chain governance, the challenge is still open of how to connect technopolitical and infrastructural governance. Furthermore, there remains the question of whether a democratic governance would be viable in practice. More than a set of recommendations or solutions, here we have tried to map a series of problematics and aspects to consider when addressing it. As we noted in the introduction, resolving the numerous open variables is a matter of practice and democratic experimentation.

7. Bibliography

Allen, D., MacDonald, T. (2016). The entrepreneurial problem of the blockchain. Working paper.

Antonopoulos, A. (2014). Bitcoin Security Model: Trust by Computation. O'Reilly- Radar. Retrieved from <http://radar.oreilly.com/2014/02/bitcoin-security-model-trust-by-computation.html>

Aragon, P. et al. (2015) Networked models of democracy. D-CENT project. Available at: <https://dcentproject.eu/wp-content/uploads/2016/06/D2.5-1.pdf>

Atzori, M., (2015) Blockchain Technology and Decentralized Governance: Is the State Still Necessary? Available at SSRN: <https://ssrn.com/abstract=2709713> or <http://dx.doi.org/10.2139/ssrn.2709713>

Bassi, E., Ciurcina, M., De Martin, J. C., Fenoglietto, S., Rocchi, G., Sagarra Pascual, O., Bria, F. Legal frameworks for digital commons DECODE OS and legal guidelines. Public Report.

Baran, P. (1964). On distributed communications networks. IEEE transactions on Communications Systems, 12(1), 1-9.

Beck, U., Giddens, A., & Lash, S. (1994). Reflexive modernization: politics, tradition and aesthetics in the modern social order. Stanford University Press.

Benkler, Y. (2006). The wealth of networks: How social production transforms markets and freedom. New Haven, CT: Yale University Press.

Berners-Lee, T., & Fischetti, M. (2000). Weaving the Web: The original design and ultimate destiny of the World Wide Web by its inventor. Harper Information.

Bevir, M. (2007). Encyclopedia of governance (Vol. 1). London, UK: SAGE

Bevir, M. (Ed.). (2010). The SAGE handbook of governance. London, UK: SAGE.

Björk P., Johansson H. (2001). Towards governance theory: in search for a common ground. IPSA papers.

Bode, L., Budak, C., Ladd, J. M., Newport, F., Pasek, J., Singh, L. O., Soroka, S. N. & Traugott, M. W. (2018). Words that Matter: How the News and Social Media Shaped the 2016 Presidential Campaign. Brookings Institution Press.

Bohannon, P. (1958). On anthropologists' use of language. American Anthropologist, 60 (1), 161-163.

Bria, F. (2017) "People should control their digital identity". Retrieved on 20-12-2017 from: <https://www.citymetric.com/horizons/people-should-control-their-digital-identity-barcelona-s-chief-technology-officer-decode>

Bria, F., Primosig, F. (2015) Internet as common or capture of collective intelligence. D-CENT project. Available at: https://dcentproject.eu/wp-content/uploads/2015/06/D3.3-Annex-Internet-Identity-Seminar_annex.pdf

Bria, F. et al (2015) Research on Identity Ecosystem. D-CENT project. Available at: https://dcentproject.eu/wp-content/uploads/2015/08/D3.3-Research-on-Identity-Ecosystem_part1-1.pdf

Buterin, V. (2014). Daos, dacs, das and more: An incomplete terminology guide. Ethereum Blog, 6. Retrieved on 13-12-2017 from <https://blog.ethereum.org/2014/05/06/daos-dacs-das-and-more-an-incomplete-terminology-guide/>

Cabot, J., & Cánovas, J. (2017) Code Governance in Decidim. [Technical Report] Research, Development & Innovation Directorate for Participation, Transparency & Citizen Rights. Barcelona City Council.

Castells, M. (1996). The Rise of the Network Society. The Information Age: Economy, Society and Culture Vol. I. Oxford, UK: Blackwell.

Castells, Manuel (1997). The Power of Identity. The Information Age: Economy, Society and Culture Vol. II. Oxford, UK: Blackwell.

Castells, Manuel (1998). End of Millennium. The Information Age: Economy, Society and Culture Vol. III. Oxford, UK: Blackwell.

CoinDesk (2016, June). Understanding Ethereum (Report).

Dahlberg, L. (2001). Democracy via Cyberspace Mapping the Rhetorics and Practices of Three Prominent Camps. *New media & society*, 3(2), 157-177.

Dahlberg, L. (2011). Re-constructing digital democracy: An outline of four 'positions'. *New Media & Society*, 1461444810389569

Davidson, S., De Filippi, P., & Potts, J. (2016). Disrupting governance: the new institutional economics of distributed ledger technology. Unpublished manuscript. Available at SSRN <https://ssrn.com/abstract=2811995>.

De Filippi, P. (2014) Bitcoin: A Regulatory Nightmare to a Libertarian Dream. *Internet Policy Review*, 3(2). Available at SSRN: <https://ssrn.com/abstract=2468695>

- De Filippi, P. & Loveluck, B., (2016) The Invisible Politics of Bitcoin: Governance Crisis of a Decentralized Infrastructure. *Internet Policy Review*, Vol. 5, Issue 4.. Available at SSRN: <https://ssrn.com/abstract=2852691>
- Della Porta, D. (2013). *Can democracy be saved?: participation, deliberation and social movements*. Cambridge, UK: Polity Press.
- Demil, B. and Lecocq, X. (2006). Neither Market nor Hierarchy nor Network: The Emergence of Bazaar Governance. *Organization Studies*, 27(10), pp.1447-1466.
- Democracy Earth Foundation (2017). *The Social Smart Contract*. Available at <https://www.democracy.earth/#paper>
- Dowding, K. (2010). Rational choice theory. in Bevir, M. (ed.). *The SAGE Handbook of Governance*. London, UK: SAGE.
- Duménil, G., & Lévy, D. (2011). *The crisis of neoliberalism*. Harvard University Press.
- Echeverría, J. (1999). *Los señores del aire: Telépolis y el tercer entorno*. Barcelona, España: Destino.
- Ehrsam, F., (2017), *Blockchain Governance: Programming Our Future*. Medium. Entry available at <https://medium.com/@FEhrsam/blockchain-governance-programming-our-future-c3bfe30f2d74>. Retrieved 12-12-2017.
- Feenberg, A. (1999). *Questioning technology*. London, UK: Routledge.
- Finnemore, M., Sikkink, C. (1998). International norm dynamics and political change. *International Organization* 52(4):887–917.
- Foucault, M., (2008). *The birth of biopolitics: lectures at the Collège de France, 1978-1979*. Springer.
- Fuchs, C. (2008). *Internet and society: Social theory in the information age*. New York, N.Y.. Routledge.
- Fung, A., Gilman, R., & Shkabatur, J. (2013). Six models for the internet+ politics. *International Studies Review*, 15(1), 30-47.
- Fuster, M. (2010). *Governance of online creation communities: Provision of infrastructure for the building of digital commons*. Doctoral dissertation. Fiesole, Italia: European University Institute.
- Fuster, M. (2010). *Governance of Online Creation Communities for the Building of Digital Commons: Viewed Through the Framework of the Institutional Analysis and Development*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2842586

Gardler, R. and Hanganu, G. (2013). Governance models. OSSWatch. Available at <http://oss-watch.ac.uk/resources/governancemodels>

Garrod, J. Z. (2016). The Real World of the Decentralized Autonomous Society. TripleC: Communication, Capitalism & Critique. Open Access Journal for a Global Sustainable Information Society, 14(1), 62-77.

Geiselberger, H. (ed.) (2017). The Great Regression. Cambridge, UK: Polity Press.

Glaser, F., & Bezenberger, L. (2015). Beyond Cryptocurrencies-A Taxonomy of Decentralized Consensus Systems. 23rd European Conference on Information Systems (ECIS), Münster, Germany, 2015. Available at SSRN: <https://ssrn.com/abstract=2605803>

Glaser, F., & Bezenberger, L. (2015). Beyond Cryptocurrencies-A Taxonomy of Decentralized Consensus Systems. In 23rd European Conference on Information Systems (ECIS), Münster, Germany. Available at <https://balsa.man.poznan.pl/indico/event/44/material/paper/0?contribId=237>

Graeber, D. (2013). The democracy project: A history, a crisis, a movement. Spiegel & Grau.

Hacker, K. L., & Van Dijk, J. (eds) (2000). Digital democracy: Issues of theory and practice. London, UK: SAGE Publishing.

Hayek, F. A. (1945). The use of knowledge in society. (1945). The American economic review, [online] 35(4), pp.519-530. Available at: <http://home.uchicago.edu/~vlima/courses/econ200/spring01/hayek.pdf> [Accessed 30 Oct. 2017].

Held, D. (2006). Models of democracy. Stanford, CA: Stanford University Press.

Huffy, M. (2011a). Investigating policy processes: the Governance Analytical Framework (GAF), in Wiesmann, H. & Hurni, H. (eds.) Research for sustainable development: foundations, experiences, and perspectives (pp. 403-424). Geographica Bernensia. Available at SSRN: <https://ssrn.com/abstract=2019005>.

Huffy, M. (2011b). Governance: exploring four approaches and their relevance to research, in Wiesmann, H. & Hurni, H. (eds.) Research for sustainable development: foundations, experiences, and perspectives (pp. 403-424). Geographica Bernensia. Available at SSRN: <https://ssrn.com/abstract=2019013>.

ID Law Partners (2017) Open source Governance for Decidim. Informe sobre la estructura potencial de gobernanza de la comunidad Decidim [Technical Report] City of Barcelona.

Jentzch, C. (2016). Decentralized autonomous organization to automate governance. Whitepaper. Retrieved from <https://download.slock.it/public/DAO/WhitePaper.pdf>

- Juris, J. S. (2008). *Networking futures: The movements against corporate globalization*. NC, Durham: Duke University Press.
- Kisby, B. (2010). The Big Society: power to the people?. *The Political Quarterly*, 81(4), 484-491.
- Kooiman, J. (2003). *Governing as governance*. London, UK: SAGE Publishing.
- Krasner, S.D., (1982). "Structural causes and regime consequences: regimes as intervening variables", in *International Organization*, vol. 36, no 2, pp. 185-205.
- Kumar, K. (1987). *Utopia and anti-utopia in modern times*. Oxford, UK: Basil Blackwell.
- Lathrop, D., & Ruma, L. (2010). *Open government: Collaboration, transparency, and participation in practice*. Sebastopol, CA: O'Reilly Media, Inc.
- Lehdonvirta, V. (2016). *The Blockchain Paradox: Why Distributed Ledger Technologies May Do Little to Transform the Economy*. *Internet Policy Blog*, 21.
- Leiner, B. M., Cerf, V. G., Clark, D. D., Kahn, R. E., Kleinrock, L., Lynch, D. C., Postel, G., Roberts, L. G. & Wolff, S. (2009). *A brief history of the Internet*. *ACM SIGCOMM Computer Communication Review*, 39(5), 22-31.
- MacDonald T, Allen, T. & Potts, J. (2016). *Blockchains and the boundaries of self-organized economies: predictions for the future of banking*. In Tasca, P., Aste, T., Pelizzon, L., Perony, N. , *Banking Beyond Banks and Money* (pp. 279-296). Basel, Switzerland: Springer International Publishing.
- Mason, P. (2016). *Postcapitalism: A guide to our future*. Macmillan.
- Mauss, M. (1923). *Essai sur le don forme et raison de l'échange dans les sociétés archaïques*. *L'Année sociologique (1896/1897-1924/1925)*, 1, 30-186.
- Metcalfe, Randy: *Sustainability Study*, JISC/Oxford University, 2007
- Miller, P., & Rose, N. (2008). *Governing the present: Administering economic, social and personal life*. Polity.
- Monterde, A. (2015). *Emergencia, evolución y efectos del movimiento-red 15M (2011-2015). Una aproximación tecnopolítica*. Doctoral dissertation. Barcelona, España: Universitat Oberta de Catalunya.
- Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system*. Retrieved from <https://bitcoin.org/bitcoin.pdf>
- Oreg, S., & Nov, O. (2008). Exploring motivations for contributing to open source initiatives: The roles of contribution context and personal values. *Computers in Human Behavior*, 24(5), 2055–2073. <https://doi.org/10.1016/j.chb.2007.09.007>

Pechenick, E. A., Danforth, C. M., & Dodds, P. S. (2015). Characterizing the Google Books corpus: Strong limits to inferences of socio-cultural and linguistic evolution. *PloS one*, 10(10), e0137041.

Peters, B. G. (2011). *Institutional theory in political science: the new institutionalism*. London, UK: Bloomsbury Publishing USA.

Rancière, J. (2006). *Hatred of Democracy*. London, UK: Verso

Rhodes, R. A. (1994). The hollowing out of the state: The changing nature of the public service in Britain. *The Political Quarterly*, 65(2), 138-151.

Ritvo, D. T., Hessekiel, K. H., & Bavitz, C. T. (2017). Challenges & Opportunities Concerning Corporate Formation, Nonprofit Status, & Governance for Open Source Projects. Retrieved from <https://dash.harvard.edu/handle/1/30805146>

MIT.

Rodotà, S. (1997). *Tecnopolitica. La democrazia e le nuove tecnologie della comunicazione*. Roma, Italia: Laterza.

Rosanvallon, P. (2008). *Counter-Democracy: Politics in an Age of Distrust*. Cambridge, UK: Cambridge University Press.

Rosanvallon, P. (2011). *Democratic legitimacy: Impartiality, reflexivity, proximity*. Princeton, NJ: Princeton University Press.

Rosanvallon, P. (2013). *The society of equals*. Cambridge, MA: Harvard University Press.

Sahlins, M. (1985). *Islands of history*. Chicago, IL: University of Chicago Press.

Scott, J. C. (1998). *Seeing like a state: How certain schemes to improve the human condition have failed*. New Haven, CT: Yale University Press.

Searle, J. (1995). *The Construction of Social Reality*. New York, NY: The Free Press.

Srnicek, N. (2017). *Platform capitalism*. Cambridge, UK: Polity.

Stürmer, M. (2013, June 10). Four types of open source communities. Retrieved December 28, 2017, from <https://opensource.com/business/13/6/four-types-organizational-structures-within-open-source-communities>

Symons, T., Bass, T. (2017). *Me, my data and I: the future of the personal data economy*. Public report.

Swan, M. (2015). *Blockchain: Blueprint for a new economy*. Sebastopol, CA. O'Reilly Media.

Tapscott, D., & Tapscott, A. (2017). Realizing the potential of blockchain: A multistakeholder approach to the stewardship of blockchain and other cryptocurrencies. World Economic Forum.

Toret, J., Calleja, A. (2014) Collective intelligence framework in networked social movements. D-CENT project. Available at: https://dcentproject.eu/wp-content/uploads/2015/09/collective_intelligence_framework.pdf

Van Dijk, J. (2000). Models of democracy and concepts of communication. In L. Hacker & Van Dijk J., *Digital democracy: Issues of theory and practice*, pp.: 30–53. London, UK: Publishing.

Warren, M. E. (2008). Democracy and the State. In Dryzek, J. S., Honig, B., & Phillips, A. (Eds.). *The Oxford handbook of political theory* (Vol. 1, pp.: 382-400). Oxford, UK: Oxford University Press.

Williams, D. (2017). DFINITY In A Nutshell—A Non Technical Introduction. *Medium*. Retrieved from <https://medium.com/dfinity/dfinity-in-a-nutshell-a-non-technical-introduction-ec45ec5967c1>

Winner (1986). *The Whale and the Reactor*. Chicago, IL: University of Chicago Press.

Wit, J. (2017). DAO, can it be viable? An exploratory research on the viability of a blockchain based Decentralized Autonomous Organization. Unpublished Master thesis. Radboud University. Nijmegen, Netherlands.

Young OR. (1999). *Governance in World Affairs*. Ithaca, NY: Cornell University Press.

Zuboff, S. (2015). Big other: surveillance capitalism and the prospects of an information civilization. *Journal of Information Technology*, 30(1), 75-89.

Zuboff, S. (2016). The secrets of surveillance capitalism. *Frankfurter Allgemeine Zeitung*, 5.