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# PLATFORM GOVERNANCE FOR AN OPEN RESEARCH AND INNOVATION ECOSYSTEM IN A LOCAL KNOWLEDGE POLITY

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## Abstract

### *Versione in italiano*

*La tesi propone un'analisi teorica ed empirica sulla governance di piattaforme digitali e istituzionali per la creazione di ecosistemi di ricerca e innovazione fondati sul paradigma dell'apertura e della condivisione di prerogative, conoscenze, dati e migliori pratiche, sociali e tecnologiche, tra i diversi attori dei sistemi sociali e normativi che costituiscono le odierne società complesse. L'obiettivo specifico è di tratteggiare un modello di governance di piattaforma digitale e istituzionale (segnatamente inter-istituzionale e inter-sociale), che dispieghi e abiliti pratiche di co-produzione, co-valutazione e divulgazione dei saperi scientifici con le comunità locali e gli individui che la compongono, al fine di formare comunità politiche attive, propositive, informate e inclusive, su scala locale e con visione globale. A tale scopo sono stati adottati tre metodi ricerca: il metodo desk-based o documentale, il metodo action-base o dell'azione, il metodo empirico declinato in un'analisi descrittiva e una qualitativa.*

*Il metodo classico desk-based prevede una rassegna della letteratura tematica multidisciplinare sui temi della governance, delle piattaforme, dell'autogoverno e della co-regolazione delle piattaforme, della scienza aperta, dei sistemi complessi, del pluralismo giuridico, dell'istituzionalismo giuridico, della teoria dei beni comuni, del filone di studi science, technology and society, diritto dei media, della blockchain e dell'intelligenza artificiale. Questo approccio teorico è arricchito da intuizioni provenienti da varie discipline, tra cui la filosofia e l'antropologia della scienza, la gestione aziendale, l'economia delle piattaforme e l'informatica. La revisione della letteratura passa in rassegna il dibattito accademico e le fonti c.d. "grigie", vale a dire i documenti di natura politica, atti legislativi e alcune pronunce giurisprudenziali. I risultati dell'applicazione del metodo desk-based si sono concretizzati nello sviluppo di un'analisi concettuale innovativa nella letteratura sulla governance delle piattaforme a valle di un processo di definizione dei termini della domanda di ricerca. Il metodo action-based,*

*applicato di fatto durante il corso del triennio di dottorato, è servito a fornire una comprensione empirica dell'ecosistema di ricerca e innovazione, delle aperture e chiusure alla società dei diritti, delle dinamiche di potere e della catena del valore scientifico. La 'ricerca azione' si è svolta in collaborazione con Innovaetica, una piccola impresa con sede a Roma che ha progettato ResearchProof for Academy, una piattaforma blockchain che consente all'utenza, di provenienza accademica, di attribuire la titolarità di diritti d'autore su prodotti scientifici con registrazione crittografica avente valore legale e data certa (mediante marcatura temporale), di pre-pubblicare dati e risultati di ricerca, anche parziali e negativi, e di pubblicare i risultati definitivi su un archivio ad accesso aperto. Il metodo empirico è stato applicato all'analisi di tre casi di studio e si è declinata in un approccio descrittivo-analitico e un approccio qualitativo. Il primo ha avuto ad oggetto i quadri di governance dell'European Open Science Cloud e dell'African Open Science Platform, due piattaforme spiccatamente istituzionali e istituzionalizzate, per origine, struttura e funzionamento, aventi l'obiettivo comune di creare un'infrastruttura di dati della ricerca trans-disciplinare, trans-settoriale e partecipata da tutti gli attori sociali, inclusi i singoli cittadini (in consonanza con le politiche internazionali di Scienza Aperta e quelle europee di Citizens Science).*

*Il metodo qualitativo invece è stato applicato a un caso strutturalmente e funzionalmente diverso, ma simile nell'intento di democratizzazione della scienza. Si tratta del caso della Global Surgical AI Collaborative, una comunità globale di chirurghi di medicina robotica organizzata in una società senza scopo di lucro e, al contempo, una piattaforma digitale per la condivisione e l'analisi collaborativa dei dati chirurgici mediante sviluppo e impiego di tecniche di machine learning. Il metodo qualitativo è stato attuato mediante somministrazione di un'intervista semi-strutturata composta di domande aperte rivolte a uno dei membri fondatori della Collaborative.*

*La tesi è strutturata in quattro capitoli che costruiscono progressivamente l'argomentazione per un nuovo modello di governance per le piattaforme digitali. Il Capitolo I definisce il perimetro concettuale della governance, delle piattaforme, dei paradigmi di ricerca e innovazione aperti, dell'amministrazione condivisa dei beni comuni e del significato di comunità politica. Il Capitolo II fornisce una panoramica dei formanti della governance di piattaforma (formanti giuridico, tecnologico ed etico), degli attuali modelli di governance (centralizzato, decentralizzato e ibrido) e traccia linee orientative di una proposta per un modello di governance di pattaforma per un ecosistema di ricerca e innovazione in una comunità locale. Il Capitolo III è dedicato all'analisi empirica dei casi di studio e dei risultati. Infine, il Capitolo IV presenta osservazioni conclusive e indicazioni di massima per proseguire la ricerca nell'ambito.*

*Attraverso l'integrazione di approcci teorici ed empirici, questa tesi mira a contribuire alla comprensione di come le piattaforme digitali possano governare ed essere governate da una comunità locale plurale, aperta e basata sulla conoscenza, per promuovere ricerca, innovazione e democrazie aperte.*

***English version***

*The thesis proposes a theoretical and empirical analysis of the governance of digital and institutional platforms designed to create research and innovation ecosystems founded on the paradigm of openness and knowledge sharing, including data and best socio-technical practices. This process involves the various and diverse actors of societal and normative systems that constitute and co-govern contemporary complex societies. The objective is to delineate a governance model for digital and institutional (i.e. inter-institutional and inter-societal) platforms enabling practices of co-production, co-evaluation, and dissemination of scientific knowledge with local communities and the individuals (whether citizens or not), in order to form active, proactive, informed and inclusive political communities at a local scale while maintaining*

*a global dimension. To this end, three research methods were adopted: desk-based, action-based, and empirical research methods articulated in both descriptive and qualitative analyses.*

*The classical desk-based method encompasses a review of multidisciplinary thematic literature addressing governance theory, platform and digital self- and co-regulation, open science, complex systems, legal pluralism, legal institutionalism, the theory of the commons, science technology and society studies, media law, blockchain, and AI law. This theoretical foundation is enriched by insights from various disciplines, including the philosophy and anthropology of science, business management, platform economics, and computer science. The literature review examines both academic discourse and so-called "gray" sources, such as policy documents, legislative acts, and seminal judicial rulings. The application of this method culminated in the development of an innovative conceptual analysis within the platform governance literature. The action-based method, applied throughout the doctoral triennium, provided an empirical understanding of the research and innovation ecosystem, its openness and enclosure dimensions, power dynamics, and value chain. The action research was conducted in collaboration with Innovaetica, a Rome-based small enterprise that developed ResearchProof for Academy - a blockchain platform enabling academic users to establish legally valid cryptographic registration and timestamping of scientific work authorship, pre-publish research data and results (including partial and negative outcomes), and publish final results in an open-access repository. The empirical method was applied to the analysis of three case studies following descriptive-analytical and qualitative approaches. The former focused on the governance frameworks of the European Open Science Cloud and the African Open Science Platform, two highly institutionalized platforms by origin, structure, and operation - sharing the common goal of creating a trans-disciplinary, trans-sectoral open research data infrastructure involving all societal actors, including individual citizens (in line with the global Open Science policy and the European Citizen Science policy).*

*The qualitative method, on the other hand, applied to a structurally and functionally distinct case that nevertheless shares the intent of democratizing science: the Global Surgical AI Collaborative, a global community of robotic surgeons organized as a non-profit corporation developing a digital platform for collaborative surgical data video assessment by training and using machine learning techniques. The qualitative method consisted of conducting a semi-structured interview with open-ended questions directed to one of the Collaborative's founding members.*

*The thesis is structured into four chapters that progressively build the argument for a new governance model for a digital platform creating an open research and innovation ecosystem in a local knowledge polity. Chapter I explores and defines the conceptual components of the research question, namely governance, platforms, open research and innovation paradigms, the common good(s) and shared administration and the meaning of the notion of polity. Chapter II provides an overview of what may constitute the formants of platform governance (legal, technological, and ethical formants). It further identifies the current three dominant governance models (centralized, decentralized, and hybrid), and outlines an ad interim proposal for the platform governance model. Chapter III offers the empirical case study analysis hinted at above. Finally, Chapter IV presents concluding remarks and directions for future research.*

*Through the integration of theoretical and empirical approaches, this thesis aims to contribute to understanding how digital platforms can govern and be governed by a plural, open, and knowledge-based local community to promote research, innovation, and open democracies.*

Alla Fiducia.

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# TABLE OF CONTENTS


## 0. INTRODUCTION

*0.1 Digital, data, knowledge sovereignty*

*0.2 Knowledge is power and power is knowledge*

*0.3 The research question. The Compass*

*0.4 A platform for a common digital sphere*

*0.5 Methods or routes to a destination*

*0.6 Roadmap*

## CHAPTER I: DEFINING THE PERIMETER

### 1. GOVERNANCE

*1.1 Piloting complexity*

*1.2 Governance vis-à-vis government (=, ∈ , ∉)*

*1.2.1 =*

*1.2.2 ∈*

*1.2.3 ∉*

*1.3 Networks*

*1.4 Governance as a communication channel in complex normative systems*

*1.5 A good democratic governance. Closing the gap between society and science*

*1.6 Good governance on the global stage. An a-democratic myth*

*1.7 Good governance as a balancing principle in the Council of Europe legal system*

*1.8 Territorial governance*

*1.9 Polycentric governance and blockchain governance*

*2.0 Ad interim remarks*

**2. PLATFORMS**

*2.1 Web development and platform models*

*2.2 Companies, information hosts, political actors and legal orders*

*2.2.1 Platform as companies*

*2.2.2 Information hosts*

*2.2.3 Platforms as political arenas, targets and actors*

*2.2.4 Platforms as socio-legal institutions*

*2.4 Platforms govern society. Can societies and communities govern platforms?*

*2.5 Meanings of Platform Governance*

*2.6 Platforms in Science*

**3. THE PARADIGMS OF THE OPEN RESEARCH AND INNOVATION ECOSYSTEM**

*3.1 Open Innovation*

*3.2 Open Government*

*3.3. Open Data*

*3.3.1 The EU Open Data Landscape*

*3.3.1.1 The Data Governance Act*

*3.3.1.2 The Data Act*

*3.4 Open Source*

*3.5 Open Research*

*3.5.1 Early open access scientific practices and policies*

*3.5.3 From the shadow libraries up to the institutionalization of OA*

*3.5.3 Open Science as a set of socio-technical practices and a multi-level regulatory framework*

*3.5.3.1 A set of socio-technical practices*

*3.5.3.2 A multi-level regulatory framework*

*3.5.4 The Open Science Paradigm*

*3.6 Open Society*

**4. THE COMMON GOOD AND THE POLITY**

*4.1 Common good as an ideal*

*4.2 Public, private and common Goods*

*4.3 Administrative law instruments to govern common goods in the Italian legal system*

*4.4. The Polity*

## CHAPTER II: A PLATFORM GOVERNANCE FRAMEWORK

**1. THE GOVERNANCE FORMANTS**

*1.1 The legal formant of the governance model*

*1.2 Overview of the state-of-the-art platform governance models*

*1.2.1 The centralized model*

*1.2.2 The decentralized model*

*1.2.3 The hybrid model*

*1.3 The ethical formant*

*1.4 The evolving technological formant*

**2. SKETCHING *AD INTERIM* PROPOSALS FOR THE MODEL**

*2.1 Actors*

*2.2 Mission, goals, functions, processes and services*

*2.3 Technological architecture and arrangements*

*2.3.1 AI on the platform and digital literacy building on the platform*

*2.4 Values and rules*

*2.5 Organizational and business model*

## CHAPTER III: THE EMPIRICAL ANALYSIS

1. *Analytical dimensions of governance*
2. *The governance framework of institutional platforms for open research and innovation on a macro-regional and global scale*

*2.1 The European Open Science Cloud (EOSC)*

*2.2 The African Open Science Platform (AOSP)*

*2.3 Global Surgical AI Collaborative*

*2.3.1 Open Science in GSAC and Perceived Criticalities*

3. *Analysis and conceptualization of the models. Further: Import-ability in a platform ecosystem for a local polity*

## IV. CONCLUSIVE REMARKS

# FOREWORD

In 'We have never been modern', Bruno Latour argues that the modern era has been defined by a schism between nature and society in what he calls the *Great Divide*[1]. Nature is seen as a separate realm of objective scientific knowledge, while society is seen as a realm of subjective cultural meanings. According to Latour, this division is a mystification. It is impossible to truly separate nature from society. Epidemics, climate catastrophes, artificial intelligence(s), and all matters of public and common concern tie the Gordian knot of scientific knowledge and the exercise of power. Natural, scientific, and technical facts and discoveries liaise with societal, cultural, political, and legal phenomena. Popular and specialized, political and scientific discourses merge in *the hybrid*, complex, interdependent, and integrative relationship between humans and non-human entities[2]. Robert Boyle, the father of empiricism in science, did not seek the gentlemen's opinion, but their observation of phenomena artificially produced in the protected space of a laboratory. We need to be receptive to the co-essentiality of subjectivity and objectivity, humanity, nature, and technology. Specialized and collective knowledge, wisdom, and discourses are relevant to this study and come into play in its inquiry into the governance of global and local, digital and institutional platforms for an open science-society-polity interface.

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[1] Latour B, We have never been modern, translated by Catherine Porter (Harvard University Press 1993).

[2] Haraway D, Manifesto cyborg. Donne, tecnologie e biopolitiche del corpo, a cura di L. Borghi, introduzione di R. Braidotti, Milano (Feltrinelli 2023).

# 0. INTRODUCTION

This *philosophiae doctor* (Ph.D.) dissertation represents the final and perhaps initial destination of a journey into the ecosystem and landscapes of the 'territory' of contemporary digital and knowledge societies.

In modern Western legal theory, a territory represents one of the three constituent elements of the State, as the superior legal and social entity governing human, individual, and social conduct and relations. This act of governing is expressed in the attribute of sovereignty over a territory based on diverse sources of legitimacy or 'funding myths'[3]: divine or natural will, social facts or contracts, or a non-derivative self-generating basic norm. In this theoretical context, the law always regarded territories as geographically identifiable and physically delimited pieces of land, sea, and atmosphere, inhabited by a given population subject to independent and effective power wielded by a stable public government.

Postmodernity, globalization, and digitization progressively deconstructed the dogmatic rigidity of modern statehood and, in general, legal theory and the acts of governing. Legal scopes, effects, and impacts can be extraterritorial[4], and legal territories are not only delimited by physical borders, in the process of constant

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[3] Teubner G, Constitutional Fragments: Societal Constitutionalism and Globalization (OUP 2012), p. 70.

[4] Such is the case of the European regulation of international data transfers as pointed out, e.g., by Poullet Y, Transborder Data Flows and Extraterritoriality: The European Position (Journal of International Commercial Law and Technology 2007). The protection of citizens' rights and the impact on global digital policy standards require 'going extraterritorial'. One of the key elements linked with debates about power and sovereignty is the extraterritoriality of law: Kuner C, Data and extraterritoriality, in Parrish A, Ryngaert C, Research Handbook on Extraterritoriality in International Law (Cheltenhamp/Northampton 2023). More in general: Cremona M, Scott J, EU Law Beyond EU Borders: The Extraterritorial Reach of EU Law (OUP Oxford 2019); Bradford A, The Brussels Effect: How the European Union Rules the World, Preface (OUP, 2020). Bradford describes extraterritoriality as the "*unilateral ability to regulate global markets by setting the standards in competition policy, environmental protection, food safety, the protection of privacy, or the regulation of hate speech in social media*".

*deterritorialization* [5]. Is sovereignty still attached to the physical territories of the nation-states and their constituencies? Is it still exclusively or primarily attributable to them? Up until the beginning of the postmodern, global, and then digital era, these questions were tackled by a few illuminated intellectuals. In contemporary times, they sound rhetorical and find answers in factual realities. Beyond the State, new sovereign public powers emerged and proliferated[6], i.e. intergovernmental and regional organizations, the European Union, and independent supranational and national regulatory authorities. Beyond the public powers, constellations of private and hybrid powers appeared on transnational legal horizons[7] with effects on national, subnational, local, and community socio-legal realities.

Legal orders coexist with a-legal normative orders of social, economic, technological, cultural, and epistemic natures[8] that set out rules of conduct and

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[5] Punzi A, Prudentia Iuris, Materiali per una filosofia della giurisprudenza (Giappichelli Editore Torino 2013), pp. 73-74; Schmitt C, The Nomos of the Earth in the International Law of Jus Publicum Europaeum, translated by Ulmen GL (Telos Press New York 2006); Deleuze G, Guattari F, Anti-Oedipus (Minuet Paris 1972).

[6] Cassese S, Oltre lo Stato (Laterza Editore 2001), p. 8-15; Peters A, Global Constitutionalism Revisited, in University of Baltimore School of Law, Center for International and Comparative Law, ASIL Centennial Discussion of a Just World under Law: Why Obey International Law?; Weiler JHH, Wind M, European Constitutionalism Beyond the State (Cambridge University Press, 2003).

[7] *ex multis*, Zumbansen P, Calliess GP, Rough Consensus and Running Code: A Theory of Transnational Private Law (Hart Publishing, Oxford, 2010).

[8] *ex multis* Hildebrandt, Legal and Technological Normativity: more (and less) than twin sisters (Techné 12 Fall 2008).

"*If we leave the domain of law we may find other types of normativity, pertaining to constraints that have not been deliberately issued but which nevertheless induce or enforce, inhibit or rule out certain types of behavior. Latour's discussion of the Berlin key is a case I point. These key forces the user to open the door by pushing the key through the keyhole to the other side of the door, and after entering the house, the door can only be closed by turning the key and thus locking the door. This key demonstrates how a technological device actually regulates and constitutes the interactions of a resident, the key, her door and others who wish to enter the house. In this case the designer of the key has inscribed a program of action into the hardware, delegating the task of insisting on locking or not locking the door to the key. If we look at the normative impact of technological devices or infrastructures, we must admit that many of the effects they produce on our everyday behaviors have not been planned. Contemporary common sense would describe them as side-effects, even in the case that these unplanned effects outweigh explicitly. intended effects. When speaking of technological normativity, I do not focus on the intention of the designer, I simply refer to the way a particular technological device or infrastructure actually constrains human actions, inviting or enforcing, inhibiting or prohibiting types of behaviour.*".

orient behaviour of individual and collective agents. These a-legal normative orders, i.e. systems, function alongside formal legal systems, influencing and shaping behaviours in various spheres of life. Vertical and horizontal rules crisscross and design regulative networks with multi-level and -dimensional governing entities. Power geometries dissolve, merge, and consolidate, taking novel shapes and modularity. In this digital global epoch, public, private, and hybrid 'sovereign' powers govern also non-physical territories with their communicative media, resources, and means. Even the individual may be sovereign in the exercise of "*self-ownership*"[9] over her/his body, choices, and data in the digital world, provided that conditions for the exercise of rights and freedoms exist. Jurisdictional geographies expand their purview to cover *net-graphies* in cyberspace. That is the virtual territory where the promise of freedom of expression and communication resides, where information, knowledge, and their degenerations (mis- and disinformation) circulate and proliferate rapidly and incessantly. In this virtual territory, most research and innovation activities stem and flourish. Data-intensive and -driven research and innovation processes of value creation and distribution develop in the Webs. Innovative products and services circulate both in and out of the market, according to the business or non-profit model of choice in a tension between openness and enclosure[10]. In this territory, the cybernauts, governors of the global community of technologists, behemoth[11] companies, high-tech start-ups, or radical cyberpunks, produce and manage their resources to produce and co-produce, extract, capture or share

[9] Floridi F, The Fight for Digital Sovereignty: What It Is, and Why It Matters, Especially for the EU (Philos. Technol. 33, 2020), 369–378.

[10] Hess C, Ostrom E, Introduction: An Overview of the Knowledge Commons, in Understanding Knowledge as a Commons (MIT Press, 2007), p. 12.

[11] Pasquale F, Tech Platforms and the Knowledge Problem (American Affairs, II:2, 2018).

value from data-driven information and communication technology (ICT) in multistakeholder-ed processes.

In Europe and anthropologically similar parts of the world, society has been dubbed as a knowledge and learning society, and the economy as a knowledge economy[12]. Through this interpretative lens, knowledge represents a "*cognitive capital*"[13], i.e. an accumulating productive factor for enterprises, and something that "*turned from purpose into means*"[14], albeit for many intellectuals, knowledge is still a purpose acquired out of curiosity and passion, motivating for its own sake.

The European Union has espoused the vision and semantics of knowledge as a commodity and a boon for growth from the inception of this millennium. Having in mind to realize "*the most competitive and dynamic knowledge-based economy in the world*"[15], the Lisbon Strategy inaugurated the European Research Area with "*the ambition to create a single, borderless market for research, innovation and technology across the EU*". This policy has become foundational to the European Union's efforts to

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[12] Combining existing knowledge with creating new knowledge is key for innovation and economic development, which indeed depends on the availability of this resource. Ramakrishnan, M, Shrestha A, Soar J, Innovation Centric Knowledge Commons, A Systematic Literature Review and Conceptual Model (J. Open Innov. Technol. Mark. Complex. 2021); Schumpeter JA, The Theory of Economic Development (Harvard University Press: Cambridge, MA, USA, 1934); Conceição P, Gibson DV, Heitor MH, Sirilli G, Beyond the digital economy: A perspective on innovation for the learning society (Technological Forecasting and Social Change, 67 2–3, 2001), pp. 115-142.

[13] Castelfranchi C, Six critical remarks on science and the construction of the knowledge society (JCOM: Journal of Science Communication. 6, 2007).

[14] *id.*

[15] "*5. The Union has today set itself a new strategic goal for the next decade: to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion. Achieving this goal requires an overall strategy aimed at: - preparing the transition to a knowledge-based economy and society by better policies for the information society and R&D, as well as by stepping up the process of structural reform for competitiveness and innovation and by completing the internal market; - modernising the European social model, investing in people and combating social exclusion; - sustaining the healthy economic outlook and favourable growth prospects by applying an appropriate macro-economic policy mix.". In truth, the European Communities had established a European multiannual framework program for research since 1984 with the original aim of supporting cross-border cooperation in pre-competitive research and development (R&D conducted jointly by competing organizations to develop new commercially applicable technologies).*" European Council - Presidency Conclusions (Lisbon, 23 and 24 March 2000), Council of the European Union, Nr: 100/1/00, para 5.

create a common European cultural *acquis* underpinned by the free movement of researchers, scientific knowledge, and innovation[16]. Today, the ERA stands as a primary EU policy objective, and it can be affirmed that the said freedom constitutes the *fifth* freedom of the European Treaties[17]. This and other policy actions focussing on research and innovation emerged as responses to the current and recurrent global and regional health, food, and climate emergencies that shook public trust in scientific and governmental institutions. The underlying goal is to integrate science more tightly with society, which culminates in the Responsible Research and Innovation (RRI)[18] policy[19], i.e. the process of uniting scientific and social innovators in mutual responsibility for scientific and technological choices.

[16] Article 179 of the Treaty on the Functioning of the European Union incorporates the ERA as a primary objective of the European Union:
*Article 179 (ex Article 163 TEC)*
*1. The Union shall have the objective of strengthening its scientific and technological bases by achieving a European research area in which researchers, scientific knowledge and technology circulate freely, and encouraging it to become more competitive, including in its industry, while promoting all the research activities deemed necessary by virtue of other Chapters of the Treaties.*
*2. For this purpose the Union shall, throughout the Union, encourage undertakings, including small and medium-sized undertakings, research centers and universities in their research and technological development activities of high quality; it shall support their efforts to cooperate with one another, aiming, notably, at permitting researchers to cooperate freely across borders and at enabling undertakings to exploit the internal market potential to the full, in particular through the opening-up of national public contracts, the definition of common standards and the removal of legal and fiscal obstacles to that cooperation.*
*3. All Union activities under the Treaties in the area of research and technological development, including demonstration projects, shall be decided on and implemented in accordance with the provisions of this Title.".*

[17] Being free movement of people, goods, capital and services the traditional four freedoms enshrined in the Treaties of the European Union.

[18] Von Schomberg R, Prospects for Technology Assessment in a framework of responsible research and innovation, in M. Dusseldorp and R. Beecroft (eds). Technikfolgen abschätzen, lehren: Bildungspotenziale transdisziplinärer Methoden (Wiesbaden: Vs Verlag, 2011).

[19] RRI has been integrated into various EU research and innovation programs, such as Horizon 2020 and Horizon Europe. These programs fund projects that incorporate RRI principles, fostering a collaborative and responsible approach to research and innovation. For example, the Co-Change project establishes networks of researchers to implement sustainable changes in research practices through change labs. "*The goal of Responsible Research and Innovation (RRI), a priority of Horizon 2020 (the EU Research and Innovation program for 2014-2020), was to make sure that research was aligned with the needs and views of society, from the point of design through to the implementation. It aimed to promote a dialogue between researchers, businesses, policy-makers, NGOs, and citizens, and to incorporate foresight into science to mitigate any unintended consequences of a potentially beneficial new technology. Alongside the science itself, RRI supports an ethical research culture and community with principles such as promoting open access data, science education, as well as gender equality in research.*". From https://sciencemediahub.eu/2021/09/08/responsible-research-and-innovation-in-the-eu/.

*0.1 Digital, data, knowledge sovereignty*

State or supra-state sovereignty in part loses and looses, in part acquires control over the virtual territory or strives to retain control or gain it anew. There is much debate on the meaning of digital and data sovereignty[20]. "*To exercise control over any territory, it is necessary to exercise control over the online activities available in that territory*"[21]. Public legislators and pro-active judicial bodies[22] contend this control with self-regulating private algorithmic powers[23]. Data protection, cross-border data transfer, data sharing and data spaces[24], cyber-security and resilience, digital competition, digital labor, and digital finance, the digital vulnerability of consumers[25], and emerging technologies themselves (AI, IoT, DLT, cloud computing) are subjects and objects of top-down, bottom-up and co-regulatory agendas, simultaneously global and local. Sovereignty asserted by hard and soft rules is unequally distributed and decentral amongst peers and non-peers, supra-States, States, public subnational entities, and non-state actors of disparate natures and geographical provenances that contend or relinquish bits of power. Multinational and transnational corporations, online or offline platforms exploiting technological and informational asymmetries[26], small or medium decentralized and autonomous organizations, local communities, and individuals exercise their bits of sovereign and regulative power through cyberspace.

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[20] Woods AK, Litigating Data Sovereignty, 128 (Yale Law Journal 2018), p. 328, pp. 366-371.

[21] Chander A, Sun H, Data Sovereignty from the Digital Silkroad to the Return of the State (OUP 2023).

[22] Pollicino O, Judicial Protection of Fundamental Rights on the Internet: A Road Towards Digital Constitutionalism? (Bloomsbury Publishing 2021).

[23] Bassan F, Il potere dell'algoritmo e resistenza dei mercati in Italia. La sovranità perduta sui servizi (Rubbettino, Soveria Mannelli, 2019).

[24] Commission, Communication on A European Strategy for Data, COM (2020) 66 final.

[25] De Franceschi A, Consumers' Vulnerability in the Digital Economy: Personal Data as Counterperformance and Digital Obsolescence, in European Journal of Consumer Law, 2022, pp. 73-93.

[26] *ibid.* n. 11.

*0.2 Knowledge is power and power is knowledge*

What power? What is the essential source of power? Knowledge. Those in power have easier and better access to knowledge and the capacity to draw out the vectors of knowledge creation, validation, recognition, modes of access and enjoyment, integrity, and reliability. Knowledge crafters have the power to mold the social perception of truth and world-views and inform the exercise of power by others. The finest type of knowledge, whose granularity makes it the most promising source of social empowerment, is scientific knowledge, which rests on rigorous methods, observation, experiments, evidence, skepticism, critique, verification, and falsification.

The empowering power of science manifests also in that it constitutes "*public expression of rationality*"[27], i.e. the advisory role of science in policy, which serves as a cornerstone for validation and legitimacy in reinterpreting the will of decision-makers as rational. Institutional scientific assessment bodies have the primary function of elaborating, assessing, and verifying scientific information for actionable policies. Such is the case of the Intergovernmental Panel on Climate Change[28] concerning the public release of scientific information on climate risks and policy advice on how to tackle climate change for informed decision-making and mitigation strategies. The body has been aptly depicted as a "*direct and powerful channel of communication between governments and the scientific community*"[29].

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[27] Tallacchini M, Il governo della scienza dall'autoreferenzialità alle interazioni sistemiche tra scienza, policy e democrazia (Rivista di Filosofia Neo-Scolastica, CX 2018), pp. 718-735.

[28] On the Panel and for an overview of the various international science–policy initiatives of the 1970s and 1980s that preceded the IPCC's establishment, see De Pryck K, Hulme M, eds. Governance In A Critical Assessment of the Intergovernmental Panel on Climate Change (Cambridge University Press 2022), pp. 9-58.

[29] *id.*

In knowledge and technological innovation-based societies, scientific knowledge assures transparency and reliability of a legitimate exercise of power. This is argued to be detrimental to inclusive and democratic processes, often portrayed as irrational, unreasonably expensive, and inefficient[30]. However, inclusive and democratic processes may well be rational, less expensive, and efficient, where a direct and powerful communication channel is created between the scientific community, the citizens, the people, civil society organizations, firms, and, of course, the public guardians of democracy.

Thinkers of various disciplines - philosophers, sociologists, economists, and lawyers - have acknowledged the correlation between power and knowledge, while identifying the role of scientific enterprise in steering/governing societies toward better living conditions. Knowledge thus governs. Those who govern possess, gain, and accumulate knowledge. Governing entities decide if, how, where and to what extent knowledge is distributed. The dogmatic difference (bindingness)[31] between soft and hard legal or a-legal normativities wanes in the face of epistemic authority[32], science-based public decision-making, or "*serviceable truth*"[33], which are nowadays fully endogenous to policy-making. The power of better argumentation[34], the symbolic and informational capital enshrined in

[30] *ibid.* n. 27.

[31] d'Aspremont J, Bindingness in J. d'Aspremont and S. Singh (eds), Concepts for International Law, Contribution to Disciplinary Thought (Edward Elgar 2019), pp. 67-82, Amsterdam Law School Research Paper No. 2015-44, Amsterdam Center for International Law No. 2015-19.

[32] An expression seen in/and aptly described by Klabbers S, The Normative Gap in International Organizations Law, The Case of the World Health Organization (International Organizations Law Review 16 2019), pp. 272-298.

[33] Jasanoff S, Serviceable Truths: Science for Action in Law and Policy (Texas Law Review 2015), pp. 1723-1749.

[34] Habermas J, The theory of communicative action (Beacon Press, Vol. 1, 1984).

knowledge[35], the power/knowledge binomen[36] as both an oppressive and productive force that shapes perceptions, defines norms and constructs realities and identities, philosophically interprets and explains the exercise of power through knowledge.

As multiple academic voices have communicated, the rule of law coexists with the rule of code or *lex cryptographica*[37], the private regimes of merchants or *lex mercatoria*.[38] There is also what can be termed as *lex scientiae*, the rule of science that gives substance to specialized regulation (*e.g.* in pharmaceutical regulatory science)[39], fills regulatory voids in emergency circumstances, and designs new rules of conduct and standards in any scientific discipline. Public emergency measures issued by national governments, and supranational and international organizations during the COVID-19 pandemic laid bare the necessity of science-based advice to policy-makers and open scientific dissemination to build well-informed and more aware democratic public opinions. These rules of science mandate cautious risk-based regulatory approaches, based on a rule of doubt rationalized in the precautionary principle, when extensive scientific knowledge in a certain matter is lacking. Also, the substantial rules of scientists positively

[35] Bourdieu P, On the State Lectures at Collège de France 1989-1992 (Polity, Cambridge University Press 2014).

[36] Foucault M, The Birth of Biopolitics: Lectures at the Collège de France 1978–1979 (Basingstoke, UK: Palgrave, 2008).

[37] Wright A, De Filippi F, Decentralized Blockchain Technology and the Rise of Lex Cryptographia (2015).

[38] Legal regulation coexists with technical regulation and the issue on which one should prevail over the other is open and characteristics of our time. On this topic, masterfully: Irti N, Severino E, Dialogo su Diritto e Tecnica (Laterza 2004).

[39] Institute of Medicine (US) Forum on Drug Discovery, Development, and Translation. Building a National Framework for the Establishment of Regulatory Science for Drug Development: Workshop Summary. Washington (DC): National Academies Press (US), 2011. 2, Defining Regulatory Science.

inform bolder legislative moves, *e.g.* the recently approved EU Nature Restoration Regulation[40].

Besides the substantial rules of scientists that fill the content of legal rules, a body of procedural and conduct rules of science have come to light in recent decades, establishing how science shall be produced, evaluated, and communicated.

It is precisely in these recent years that policymakers have acknowledged the importance of coupling the rule of science as a normative and life-saving force, and the rule of code as a means to make this force accessible, reliable, and activatable. The combination of enabling technology and a genuine intention on the part of science- and innovation-makers to open up streams of scientific data and knowledge is what is needed to democratize science and inform all members of societies, especially the marginalized ones (who form the majority of the global population).

*0.3 The research question. The Compass*

The research question functions as the compass to orient the rest of the research journey. Each of its components routes the research from the outset.

RQ:

*How can a platform govern, provide for and operationalize an open research and innovation ecosystem in a common good-oriented local polity?*

The 'how' question is oriented towards theorizing a governance model for a digital inter-institutional and -societal platform that creates an open research and innovation ecosystem to meet the common needs of a local polity.

[40] Regulation of the European Parliament and the Council on nature restoration and amending Regulation (EU) 2022/869 COM/2022/304 final.

The intent is to propose a digital open research and innovation platform ecosystem where the public system (i.e. the public administration) and the other societal systems (to be seen) cooperate. This cooperation begins with the scientific system transferring activatable[41] scientific knowledge to a local polity to build trust in science and enhance participation in civic policy-making. The proposed digital platform both governs and is governed by a polity dedicated to attaining public and common goods. This governance is supported by the new norms of open scientific knowledge and the ethical and beneficial use of computational technologies. While the analog and the digital realities mirror each other and communicate, the platform centers around the empowering role of science for society. In this context, the word 'science' encompasses the scientific endeavor of consolidating and expanding human and social knowledge, to improve and save human and natural lives, existences, and ecosystems. Science thus includes all the taught disciplines that adopt scientific methods and ethics to lead and serve informed societies, communities and individuals. The platform would then catalyze science-based open research and innovation processes to lay the groundwork for inter-societal and -institutional dialogue in a local polity. These processes will be extensively described throughout the dissertation.

With the ongoing globalization of scientific practices facilitated by technology, scientific developments from one region of the world have become, at least potentially, more easily accessible to scientific and non-scientific communities located in other regions. In the digital platform, which operates in a local territory, scientific processes and findings conveyed by an active scientific community open to the wider international scientific community, are bound to

[41] Activatable knowledge means knowledge that enables action in society.

meet the needs of the platform community of local stakeholders and tackle common local and global challenges. To this end, the platform infrastructure shall enable scientific and non-scientific knowledge transfer between the academia and other epistemic actors, governmental bodies, the industry, the third sector, the local communities, and engaged individuals, in line with the quintuple helix model of innovation[42].

The development of a digital and institutional platform for a *science-society-polity* interface may represent a stepping stone for the creation of a participatory and inclusive open research and innovation ecosystem in local territories of the Lazio Region. The proposal is coherent with the local[43], national[44], European[45,] and international[46] agendas on Open Science, European Data Spaces[47], and sustainable development, especially those embedded in the open science, citizen science, and city science initiatives developed by the EU Commission.

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[42] The Quintuple Helix innovation model focuses on the interactions among five key elements of society: the academia, the industry, the government, culture and the environment, with particular respect to harnessing knowledge to promote social, political, and economic development. From Carayannis EG, Smart Quintuple Helix Innovation Systems How Social Ecology and Environmental Protection Are Driving Innovation, Sustainable Development and Economic Growth (Springer International Publishing 2018).

[43] Regione Lazio, 'Lazio Digital Agenda 2022-2026' (2022).

[44] Italian Ministry of University and Research, 'National Research program 2021-2027' (2021); Decreto Ministeriale n. 268 del 28 febbraio 2022 - Programma Nazionale per la Scienza Aperta (PNSA) 2021-2027; Decreto Ministeriale n. 1082 del 10 settembre 2021 - Adozione del Piano Nazionale Infrastrutture di Ricerca (PNIR) 2021-2027.

[45] Regulation (EU) 2021/695 of the European Parliament and of the Council of 28 April 2021 establishing Horizon Europe – the Framework program for Research and Innovation, laying down its rules for participation and dissemination, and repealing Regulations (EU) No 1290/2013 and (EU) No 1291/2013 [2021] OJ L170/1; Commission, 'European Green Deal: Building Resilient Communities' (2020); Commission, 'EU Open Science Policy' (2021); Open Science Policy Platform, 'Progress on Open Science: Towards a Shared Research Knowledge System' (Final Report, April 2020).

[46] *ex multis* OECD, Science, Technology and Innovation Outlook 2018: Adapting to Technological and Societal Disruption (OECD Publishing 2018); United Nations, The 2030 Agenda for Sustainable Development (UN Department of Economic and Social Affairs 2015); UNESCO, Recommendation on Open Science (2021).

[47] *ibid.* n. 23.

*0.4 A platform for a common digital sphere*

The governance of the platform to be designed could be interpreted as the governance of a protected common sphere - a novel *Platform der Diskussion* other than the public sphere. It differs from the latter for it is characterized by the element of proximity of the interested groups and individuals to what from public turns into common in a democratic and polycratic[48] governance setting. This can be made possible in a virtual platform that establishes relationships between the public, the private, the civil society and the individual participating actors. The on-platform digital ecosystem shapes a protected common sphere, where diverging and converging stakes may find syntheses and conflicts. Combined, grouped, and normatively organized individual and social systemic spheres create a digital common sphere, where members of the platform community take care of common concerns. This concept of the digital common sphere draws from the public sphere of Habermas, i.e. the abstract *locus* where civil society convenes to express reasons in discourses and reach democratic deliberations to close the rift between public concern and private individualism. It would afford civil society and single individuals actual involvement in decision-making and opinion-shaping concerning matters of public interest turned into a common one.

In the recent sequel book '*Ein neuer Strukturwandel der Öffentlichkeit und deliberativer Politik*'[49], Habermas places digital platforms at the forefront of the current *structural transformation* and *deformation* of the public sphere, on global and local scales. In present times, digital platforms constitute the principal fora, where

[48] On the full meaning of democracy: Bobbio N, Il futuro della democrazia. Una difesa delle regole del gioco (Einaudi Nuovo Politecnico 141, 1984).

[49] Habermas J, The New Structural Transformation of the Public Sphere, Suhrkamp 2022.

public and private debates take digital form and stage, offering new modes of expression and opinion-shaping. The philosopher emphasizes the elements of fragmentation and de-professionalization brought about by the modes of information and knowledge communication in the digital world. He reminds us of the well-known plagues of the eco-chambers of information, hate speech, ideological polarization, and interferences in political affairs and electoral processes - to name a few - that undermine social, political, and individual lives, the quality of public discourse and the integrity of contemporary democracies. Numerous other issues cast a shadow on the trustworthiness of digital platforms, among others, the inscrutability of the evolution of artificial intelligence(s) and a lack of a unified global consensus on how and who should govern them[50], the growing occurrences of cybercrimes and cyber-warfare, mass data-driven surveillance pre-determining behaviors and digital identities[51], psychological disorders linked with digital addiction.

A host of commentators from the platform governance scholarship supports this real-pessimistic reading according to which digital life is fraught with dangers, divides, and discriminations, sharpening socio-economic and cultural imbalances.

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[50] On the current international AI governance initiatives, briefly: Renda A, Should the UN Govern Global AI?, Brookings commentary, February 2024, available at: https://www.brookings.edu/articles/should-the-un-govern-global-ai/. "*In the year since, a call for a pause on training these large-scale AI models and predictions that powerful AI could cause human extinction or a future without work sparked a rush of proposals for some form of global governance framework. One such proposal was from the United Nations' multi-stakeholder AI Advisory Body, which released an interim report offering future steps for global AI governance. Though it did not recommend any single model, the report concluded that "a global governance framework is needed." It identified seven layers of governance functions for "an institution or network of institutions," starting with expert-led scientific consensus and building to global norm elaboration, compliance, and accountability. We concur with the need to build broad consensus through many voices. But we emphasize that what is needed is a distributed and iterative approach, one that would be—as the UN AI Advisory Body itself put it "agile, networked, flexible" and makes the most of the initiatives already underway.*". For a general overview of AI governance proposals: Tallberg J, Erman E, Furendal M, Geith J, Klamberg M, Lundgren M, The Global Governance of Artificial Intelligence: Next Steps for Empirical and Normative Research (International Studies Review, Volume 25, Issue 3, September 2023).

[51] Zuboff S, The Age of Surveillance Capitalism (London: Profile Books 2019).

This narrative rests on the factual reality of the digital divide[52], algorithmic discrimination, and intersectional digital vulnerabilities[53], resulting in breaches of fundamental rights. It will be seen that this is the result of decades of digital platform regulatory *laissez-faire* which brought what has been termed a "*tech-lash*"[54] (a portmanteau for technology backlash). In practice, an unpredictable and fragmented platform governance scenario with a mosaic of content moderation standards, practices, and policy terms that further exacerbate knowledge and power asymmetries, or other exclusionary algorithmic practices.

Other scholars propound the optimistic idea of a platform social economy that empowers societal actors with opportunities to engage in virtuous participatory social, cultural, economic, and informational value creation and sharing dynamics. Such is the case of the platform cooperativists[55], the knowledge commoners[56], and the supporters of commons-based peer production[57], who propose the

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[52] Van Dijk J, The deepening divide: Inequality in the Information Society (Sage Publications, 2005), p. 1-22. The digital is the gap between those who have and those who do not have access to computers and the internet. Access means physical access (having a personal computer and Internet connection), motivational access (motivation to use technology), skills access (digital skills), usage access (number of applications and usage time).

[53] Such is the case of algorithmic discrimination exerted by automated decision-making systems in multiple economic sectors. While the scholarly debate mostly centers around consumer vulnerability, it is intertwined with the issue of data subject vulnerability in an economic environment dominated by the exploitation of big data. Calo R, Privacy, Vulnerability, and Affordance (DePaul L. Rev. 66 2017), pp. 592-593; Barocas S and Selbst AD, Big Data's Disparate Impact (California Law Review 671 2016); Pasquale F, The Black Box Society: The Secret Algorithms That Control Money and Information (Cambridge: Harvard University Press, 2015). Some behavioral economists shed light on the effects of manipulation and influence of consumption decisions by algorithmic systems (*ex multis* Sunstein C, Fifty Shades of Manipulation (Journal of Behavioral Marketing 2015).

[54] Owen T, Introduction: Why Platform Governance?, Models for Platform Governance (A CIGI Essay Series, center for International Governance Innovation 2019), p.3; Gorwa R, Regulating them Softly, Models for Platform Governance (A CIGI Essay Series, center for International Governance Innovation, 2019), p. 40.

[55] Scholz T, Platform Cooperativism: Challenging the Corporate Sharing Economy (Rosa Luxemburg Stiftung 2016).

[56] Hess C, Ostrom E, Understanding Knowledge as a Commons (MIT Press 2007).

[57] Benkler T, Nissenbaum H, Commons-based Peer Production and Virtue (The Journal of Political Philosophy 2004), pp. 394-419; Bauwens M, Kostakis V, Pazaitis A, PeertoPeer: eCommonsManifesto (London: University of Westminster Press 2019), pp. 1–10.

pooling and mutualization of resources as an alternative to the dominating proprietary and profit-driven model.

This research does not focus on identifying an economic governance model that is alternative to the dominant market-based one. Nonetheless, it supports a non-profit model based on empirical reflections that will be further elaborated. This research rather focuses on conceiving an ethics-, principles-, rules- and rights-based governance model that takes account of the diversity of needs and respective actors involved in the platform ecosystem.

Within this platform ecosystem, the abstract notion of the common good serves as an axiological yardstick inextricably linked with a fundamental rights-oriented interpretation. The governance model ought to unite a well-defined polity under the umbrella of shared inspiring values, principles, rules, and goals. The platform would thus represent the digital augmentation of a polity's value system that benefits from the open research and innovation paradigm to decrease the digital and knowledge divides. The platform would overcome the model of a mere service intermediary, to symbolize and function as a digital mirror of a polity. The polity roots its collective action and decisions in open scientific knowledge and its translatability in non-scientific discourses for good policies. Research results from affiliated research institutions would be directly disseminated and implemented in valuable use cases and policies in the territorial context of the polity served and represented in the platform. For the actual modeling of the platform governance model, it will be key to determine the size of the polity as well as the ethical, legal, and technological foundations of the open research and innovation platform ecosystem.

*0.5 Methods. The routes to destinations*

"*Ordering a plural and increasingly diversified society requires [..] observation, understanding of the specificity of the real and the exigencies it expresses*"[58].

The research journey adopts mixed methods as routes toward the research destinations (objectives).

The first method applied is the classic desk-based research that was developed in a multidisciplinary thematic literature review on governance, platforms, platform governance and regulation, open science, complex systems, legal pluralism, legal institutionalism, the theory of the commons, science technology and society studies[59], media laws, blockchain, and AI. This theoretical part of the research hinges upon suggestions from the philosophy and anthropology of science, business management, platform economics, computer science, and any other disciplines at the intersection with the core research topic. The material consulted spans academic, gray literature, including policy documents, legal acts, and case-law documents. This method is directed at elaborating a novel conceptual analysis in the platform governance literature and formulating an innovative platform governance model that takes into account the state of the art. For the

[58] Translation from Punzi A, La lezione della storia come apertura all'innovazione. Il realismo di Paolo Grossi e la regolazione della complessità (Rivista interazionale di Filosofia del Diritto 22021), pp. 177-195.

[59] Science, Technology and Society (STS) studies is an interdisciplinary field that examines the creation, development and effects of science and technology in their social, cultural and political contexts. It explores how scientific knowledge and technological innovations shape and are shaped by societal factors and human values. The field of STS integrates perspectives from history, sociology, philosophy, anthropology, and political science to understand the complex interactions between science, technology and society. Key themes in STS include the ethics of scientific research, the role of technology in societal change, the governance of scientific and technological innovation and public engagement with science and technology.
Jasanoff S, States of Knowledge: The Co-Production of Science and the Social Order (Routledge 2024);
Latour B, Science in Action: How to Follow Scientists and Engineers Through Society (Harvard University Press 1987).

elaboration of the latter, inspiration will be drawn from the universe of existing constitutional values and empirical case studies.

Another method is action-based research which is here applied to provide an empirical understanding of the research and innovation ecosystem, its power dynamics, constraints, and value chain. This approach was taken during the collaboration with Innovaetica, a Rome-based small enterprise, that proposed ResearchProof for Academy - a privacy-by-design blockchain platform that uses cryptography to allow its users to deposit and protect scientific results at any stage of the research cycle and stimulates knowledge sharing processes between research groups through pre-publication and open access publication[60]. The action-based research consisted of a 6-month collaboration on issues concerning the transparency of the governance of the European R&I ecosystem, and participation in a seed-funding program launched by a US-registered Foundation supporting the development and adoption of Algorand. The latter is a fast, secure, and carbon-negative blockchain platform that has already been experimented with by certain Italian public administrations[61].

A deeper understanding of the action research method was acquired thanks to participation in a workshop organized by the Italian Center for National Research within the framework of the FORSS project (Fostering Open Science on Social

[60] The platform generates a legally and internationally valid unfalsifiable timestamp for its users which proves the authorship of scientific results prior to their dissemination. It is part of the bigger ResearchProof initiative that currently works on a donation basis and, inter alia, provides the user with a repository for publication of non-peer-reviewed negative, single, intermediate or complete results and an open access journal for peer-reviewed works. For more information, please see: https://researchproof.com/ .

[61] IBS intelligence, Bank of Italy taps Algorand blockchain platform for digital sureties project, 16th December 2022: https://ibsintelligence.com/ibsi-news/bank-of-italy-taps-algorand-blockchain-platform-for-digital-sureties-project/ ; Fondazione Ugo Bordoni, Fondazione Ugo Bordoni and Algorand becomes partners, 16th December 2019: https://www.fub.it/fondazione-ugo-bordoni-and-algorand-foundation-partner/ .

Science Research) in March 2024. The FORSS is funded by the Ministry of University under the National Recovery and Resiliency Plan (PNRR) to strengthen and create an open research network infrastructure for social sciences across Italian universities and research institutions. In action research, knowledge is acquired using either or both quantitative and qualitative methodologies: a statistical collection of data, critical facts, structured and semi-structured interviews, surveys, questionnaires, territorial focus groups, and public forums. Action research overcomes the 'Cartesian error'[62] that separates mind from the body (hence the heart), reflection from action, self from alterity, "*leading for example to conventional health research that excludes patients, and education development research that excludes learners*"[63].

In this research, the empirical qualitative method is conducted via a semi-structured interview[64] made of both closed- and open-ended questions administered to the funding members of Global Surgical AI Collaborative, a global community of surgeons and a digital platform for open and collaborative surgical data sharing and analytics. The case-study analysis flows in Chapter III.

*0.6 Roadmap*

At the outset, it bears defining the conceptual perimeter of the inquiry. What is meant by the omnipresent buzzword 'governance'? What constitutes a platform and what are its different meanings? What are the constituent elements of a research and innovation ecosystem? What makes it open? What are the obstacles

[62] Damasio A, Descartes' Error, Emotion, Reason and the Human Brain (Avon Books New York, 2nd ed., 2005).

[63] Rizziato E, Fabrizio S, FOSSR Action research session: Transformative paths in research practices: co-developing social science infrastructures, March 2024, Zenodo.

[64] The text of the interview will be made publicly available on Zenodo and/or other research data repositories.

to this openness? What is meant by common good in legal and philosophical terms?

Chapter I breaks down the research question to set the conceptual baseline.

It does so by drawing the perimeter of the inquiry and defining: (i) the notion of governance, the meaning and interpretations attributed by the academic and gray literature; (ii) the notion of platform and its different characters; (iii) an open research and innovation ecosystem as a complex socio-technical ecosystem where multiple and interdependent normative societal systems cooperate. These are the scientific system, the public institutional system, the private organizational system, the organized system of civil society, and the individual-subjective systems; (iv) the 6 Os of the digital *Zeitgeist*: open innovation, open government, open data, open source, open research, and open societies; (v) the common good, the common goods, and the polity.

Chapter II deep-dives into the platform governance framework to be designed. To do so, it first attempts to conceptualize the notion of governance formant and then identifies three governance formants for a platform ecosystem. Further, it provides an overview of the state-of-the-art digital platform governance models, tracing the fundamental distinction between centralized and decentralized models. It then presents a provisional proposal for a platform governance model aimed at nurturing an open research and innovation ecosystem within a local knowledge polity that is locally based yet globally oriented. The proposal outlines the platform's mission to foster a knowledge-based democratic polity and its primary goals, which include creating a virtual environment for collaborative scientific knowledge creation, public communication, and open evaluation, and serving as a

forum for science-based policy proposals. Additionally, it details the technological and organizational arrangements necessary to support these functions.

Chapter III is dedicated to a descriptive analysis of the most prominent macro-regional open research infrastructures (the European Open Science Cloud and the African Open Science Platform). It follows the qualitative analysis based on a survey and a semi-structured interview directed at members of a nascent digital collaborative platform for surgical data sharing and dissemination organized in a non-profit organization funded by a group of robotic surgeons affiliated with universities and hospitals across the globe.

The descriptive analysis addresses case studies that share the common features of placing public governments and administrations, universities, technological service providers, and local communities at the center of the democratization of science, leveraging the transformative power of the open science paradigm and digital computational technologies to increase participation in science for better-informed citizenship and evidence-based policy-making.

The case studies have been selected according to specific criteria:

1. Science and scientific knowledge sharing are at the center of impactful agendas for society.
2. A focus on creating an open research and innovation ecosystem that engages multiple and diverse societal systems and actors.
3. The ecosystem takes shape in a network of nodes with local nodes playing a fundamental role.

The analysis describes the governance mechanisms according to an analytical framework inspired by previous literature on collaborative online communities. It follows a discussion of the research findings and an answer to the hypothesis of

whether these models or some or a combination of their features are importable within an open research and innovation ecosystem in a local knowledge polity. Chapter IV concludes.

## CHAPTER I: DEFINING THE PERIMETER

This legal research, while being situated within an interdisciplinary social sciences framework[65], begins from the primary task that the legal discipline is called upon to deliver: Defining. Definitions limit, circumscribe, and set semantical and axiological boundaries of concepts to attain clarity and certainty. This exercise may, at first glance, seem old-fashioned or resemble a lawmaker's duty, whose main task is to establish and maintain social order and peace with legal clarity. The first articles of legislative and regulatory acts conceptually determine content and purpose.

However, language clarity serves not merely as a descriptive tool but as a constitutive force to construe and construct social realities. Language, legal or a-legal, has a performative nature in that it changes the thoughts and attitudes of those who speak, listen, describe, prescribe, express, promise, bet, and create[66] .

[65] In harmony with the inter- and multidisciplinary vocation of the Luiss Law School's doctoral program Law & Business, this journey will adopt multiple observation points of the legal and social sciences.

[66] Carcaterra G, Presupposti e strumenti della scienza giuridica, Seconda ed. (Giappichelli Editore Torino 2012), pp. 108-120. Searle JR, Speech acts: an essay in the philosophy of language (Cambridge University Press 1969). Searle identifies the main characteristic of legal performative language that is to produce correspondence between propositional content and reality, e.g. the appointment of a President produces the reality of the person appointed being the President, provided the validity requirements of the appointment are met; if the state of war is declared, then the State is at war.

The purpose of this Chapter is to draw an analytical and discursive map that helps acquire the cognitive instruments to critique and propose innovative interpretations and designs of a platform governance model. In plural, complex, and artificially intelligent societies, the sharpest definitions of the law may fail to enclose ontology in deontology. The intrinsic uncertainty and incompleteness of all sciences[67], including the legal science, and mutability of the outcome of scientific and technological experiments, and applications, clash with the quest for certainty required by the law and ethics[68].

The "*law lag*"[69], as the alleged incapacity of legal normativity alone to be in step with the pace of scientific and technological advancement, calls for understanding socio-legal phenomena through multidisciplinary lenses. The central question posed and responded to by scholars and policymakers is whether the law steps in before, during, or after innovation, be it scientific, industrial, or social. Are legal norms meant to steer the proper development of innovation and society[70], follow its pace, or accompany it through constant scientific and societal interdisciplinary communication?

This chapter wears the interdisciplinary lenses of social - legal, political, and economic - and, to the extent possible, goes transdisciplinary by scouting into computer science and other disciplines, to break down and define the conceptual components of the research question.

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[67] Morin E, Introduction à la pensée complexe (Seuil Paris 1990).

[68] That perhaps the concept of governance can address. Ruggiu D, Diritti e temporalità. I diritti umani nell'era delle tecnologie emergenti (Il Mulino 2012).

[69] Jasanoff S, Can science make sense of life? (Polity Press 2019).

[70] Floridi L, The Ethics of Artificial Intelligence: Principles, Challenges, and Opportunities (OUP 2023).

## 1. GOVERNANCE

Every student and scholar in the social sciences has inevitably encountered and fancied the term 'governance' at some point in their studies. In the increasingly multidisciplinary academic work, even natural and computer scientists hardly ignore the general meaning of this omnipresent expression. However, its widespread diffusion confers a discreet degree of ambiguity and polysemy in the academic debate. Governance cleaves disciplinary discourses and, as an empty vessel, transforms them into governing tools.

Governance may be *ratione loci* global, regional, national, local, or cross-territorial. It may be public, private, community-based, or hybrid by virtue of the nature of the actors involved. Democratic or autocratic depending on whether decision-making is participatory or vertical. It may be good or bad and set in a market- or commons-based production context. *Ratione materiae*, governance may cover any objects susceptible to being normed. Literature abounds on corporate[71], network[72], digital, data, AI, blockchain[73] governance.

Governance transcends the confines of specific discourses and allows diversity to describe, prescribe, and communicate the meanings of plurality. It becomes a conceptual lens that subsumes complexity and connects different normativities.

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[71] Arienzo A, Dalla corporate governance alla categoria politica di governance, in Gianfranco Borrelli (a cura di), Governance (Dante e Descartes 2004).

[72] Bevir M, A Theory of Governance (University of California Press 2003); Boivar T, Public Governance: Balancing Stakeholder Power in a Network Society (International Review of Administrative Sciences LXXI, 2 2005).

[73] Atzori M, Blockchain Technology and Decentralized Governance: Is the State Still Necessary? (2015).

### *1.1 Piloting complexity*

Let us start from the etymological origin of the term. The word derives from the medieval Latin *gubernari*, meaning to direct, to rule, to guide. This in turn retraces to Plato's recurrent metaphor of the κυβερνητική, the steering, and piloting of the boat, that, in his political philosophy, depicts the political community of the city-states striving for the good life[74]. The physicist Ampère interpreted and translated the Greek term into '*la cybernétique*', meaning "*l'art de gouverner en général*" covering "*règles générales de conduit*"[75] in all disciplines and spheres of human life. Originally introduced by mathematician Norbert Wiener, the concept of cybernetics indeed helps understand the general scope of governance. The scientist considered cybernetics as an interdisciplinary matter that understands how complex systems, whether biological or artificial, regulate themselves and exchange information to achieve goals or maintain stability through control, communication, and feedback loops. Governance is cybernetics in social sciences that attempts to understand and regulate adaptive complex systems, be they natural, artificial, or social, and their way of regulating, communicating, and achieving goals.

### *1.2 Governance vis-à-vis government (=, ∈, ∉)*

Clearly, governance shares the etymon of, and a functional analogy with, the more clear-cut concept of government. To better grasp the meaning of

[74] Plato used the term κυβερνητική in the Gorgias, the Laws and the Republic, to refer to the "art of navigation" of a community or the political art of governance. Malapi-Nelson A, Cybernetics: The Book, the Club, and the Decline, The Nature of the Machine and the Collapse of Cybernetics: A Transhumanist Lesson for Emerging Technologies (Palgrave Studies in the Future of Humanity and its Successors. Springer 2017), p. 48.

[75] Ampère AM, Essai sur la philosophie des sciences (Bachelier Paris 1838), p. 141.

governance, it bears exploring scholarly understandings of the apparent opposition within the terminological pair. The opinions are divided into three main schools of thought that are here summarized as 'governance = government', 'governance ∈ government', and 'governance ∉ government'.

*1.2.1* **=**

Governance **=** government postulates the exclusivity or centrality of the role of public government in governance (classic state-centric theory). This idea dominated the academic debate until the '80s which marked the declining years of the centralized model in public management. Governance was ascribed to the Weberian state-based administration, i.e. the organized executive branch, on the argument that only the latter possesses formal legal legitimacy to exercise the core functions for the delivery of public goods and services. Despite the anachronism, some scholars still endorse this view, with their good reasons.

Some proponents of the contemporary debate on 'digital sovereignty'[76] give evidence of a "*return of the state*" in governing the digital and data spheres. The legal theoretical underpinning of the digital sovereignty discourse lies in the assumption that, in the virtually borderless digital world, state sovereignty over a well-defined physical territory is safeguarded insofar as it is accompanied by control over the online activities available in that territory[77]. As the Internet

[76] *ibid.* n. 21. *Ex multis*, see: Madiega T, Digital sovereignty for Europe, EPRS Ideas Paper Towards a more resilient EU EPRS (European Parliamentary Research Service 2020); Taylor J, Kukutai T, Indigenous data sovereignty: Toward an agenda, in Acton, ACT (Australian National University Press 2016).

[77] *ibid.* 20.

integrates with societies and economies, governments, regulatory bodies, and intergovernmental mechanisms increasingly assert their authority by legal measures. Within the EU Digital *acquis*, the GDPR, the EU Data Spaces and Open Data sharing, the AI Act, and the digital finance packages are just a few examples. The Chinese Firewall, the EU privacy shields, international data transfer agreements, and social media shutdowns by governments in different parts of the planet constitute evidence of the State's capacity to acquire and reinstate supremacy in digital governance in their internal affairs and external relations. At the same time, digital sovereignty, before and beyond the inter-state dimension, is contended between States and the most influential and market-capitalized digital platforms. Yet, it will be seen that other actors play their regulative roles in the digital realm.

### *1.2.2 ∈*

Empirical evidence substantiates the integration of private sector entities and civil society organizations in public affairs. The public and the private spheres cooperate. Governance does not coincide but intersects with government. Even the pre-Westphalian era and medieval Europe were characterized by the coexistence and cooperation of public and private powers (e.g. guilds, corporations, trading companies, and lobbies). In postmodern times, privatization and liberalization of public services and management came during the Thatcher-Reagan era. Public and private prerogatives hybridized through public-private partnerships, joint ventures, and de-hierarchization of public management with an injection of organizational managerialism and market dynamics in the *res publica*. This entailed corporate take-over of public resources

and services, the creation of quasi-markets, promotion of competition and consumerism by an entrepreneurial government[78]. The new public management has been in vogue since the '80s and developed throughout the '90s.

Contemporary theories of States as innovators[79], i.e. facilitators of open innovation, presuppose participation (and championship) of non-state actors in regulating and driving innovation and regard this as the turning point to return a central role to the State in the innovation ecosystem. With the beginning of the new century, the model was superseded by the 'New Governance Model' on co-production[80] and participatory mechanisms involving non-governmental actors, including citizens. The idea underlying this model is to consider the user-citizens as bearers of needs who can express their points of view regarding public service and cooperate in identifying the best solutions.

From a legal and regulatory perspective, the use of standards, certifications, accreditations, and codes of conduct in certain policy areas, are manifestations of a form of governance that is alternative, complementary, supplementary, or transmutative of positive law, as a product of the state, *vis-à-vis* its market equivalent[81]. This is the phenomenon known as self-regulation, i.e. a regulatory model in which businesses or industry organizations establish norms and standards for themselves, either as a preemptive measure or to complement, supplement or influence governmental regulatory frameworks[82]. Scholars have

[78] Osborne D, Gaebler T, Reinventing Government (Adison Wesley 1992), p. 20.

[79] Mazzucato M, The Entrepreneurial State: Debunking Public vs Private Sector Myths (Anthem Press London 2013).

[80] Krogh AH, Triantafillou P, Developing New Public Governance as a public management reform model (Public Management Review 2024), pp. 1–17.

[81] Bush L, Standards, Law and Governance (Journal of Rural Social Sciences 25 (3) 2010).

[82] According to Cusumano et al. 2021, self-regulation "*generally refers to the steps companies or industry organizations take to preempt or supplement governmental rules and guidelines that govern their activities*". Cusumano MA, Gawer A, Yoffie D, Can Self-Regulation Save Digital Platforms? (Industrial and Corporate Change 2021).

welcomed taxonomies[83] that classify various approaches to self-regulation, delineating its categories[84]. Additionally, self-regulation can be depicted as a regulatory mechanism wherein regulated entities either undertake rulemaking independently or rely on third-party oversight, such as *ad hoc* standardization bodies or industry associations. The established rules typically govern conduct among the regulated entities themselves or in their interactions with third parties, often evolving into widely accepted best practices within the industry. It is worth noting that self-regulatory regimes operate independently or in co-dependency with government intervention, and have a non-governmental, non-binding, and voluntary nature, lacking external coercive enforcement mechanisms. One of the most paradigmatic examples is the voluntary regulatory domain of corporate social responsibility, which still resists the introduction of top-down positive obligations of sustainability due diligence[85].

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[83] Black J, Decentering Regulation: Understanding the Role of Regulation and Self-Regulation in a 'PostRegulatory' World (Current Legal Problems, Volume 54, Issue 1, 2001), p. 118 ff. "1. *mandated private regulation, in which a collective group, an industry or profession for example is required or designated by the government to formulate and enforce norms within a framework defined by the government, usually in broad terms; 2. sanctioned private regulation, in which the collective group itself formulates the regulation, which is then subjected to government approval; 3. coerced private regulation, in which the industry itself formulates and imposes regulation but in response to threats [of] ... statutory regulation; and 4.voluntary private regulation, where there is no active state involvement direct or indirect* …".

[84] An opinion issued by the European Economic and Social Committee in April 2015, distinguished the following types of self-regulation:
"*a) Original or delegated self-regulation. Depending on the rules drawn up, this may simply entail a self-commitment on the part of the interested parties (also known as "private self-regulation"), or may instead involve a higher governing body (the state, regulatory and sectoral bodies, European Union) which sets certain binding parameters (also known as "public self-regulation");*
*b) Legal, customary or case-law-based self-regulation, whose source lies in law, particularly constitutional or supranational law (e.g. Community law), traditional "market practices and customs", today termed "good practice", or law reports;*
*c) National or transnational self-regulation (also known as "private transnational regulation"), depending on whether it only covers domestic matters or derives from agreements signed by private operators, businesses, NGOs or independent experts setting technical standards, interacting with international or intergovernmental organizations.*". Opinion of the European Economic and Social Committee on Self-regulation and co-regulation in the Community legislative framework. INT/754, Brussels, 22 April 2015.

[85] Commission, 'Proposal for a Directive for Corporate Sustainability Due Diligence' COM(2022) 71 final 23 February 2022; Colucci A, Sustainability clauses in agricultural multi-party contracts, (Journal of Law, Market and Innovation Torino Vol.2 Issue 2 2023) p. 109.

*1.2.3* ∉

Another understanding conceives of governance as devoid of the governmental element. In private governance[86], non-state actors such as clubs, industry associations, NGOs, companies, platforms, epistemic communities, and other private entities establish and enforce rules, voluntary standards, codes of conduct, and practices to regulate, nudge behavior[87], and ensure compliance.

Some consider governance as more holistically reflecting the intricate reality of dominance relations in complex societies[88] and the evolution of governing approaches where the distinctions between public and private sectors and spheres blur. The crux of governance lies in its emphasis on governing mechanisms that do not rely solely on governmental authority and sanctions, but on the establishment of a structure or order that emerges from the interactions among various governing actors influencing one another[89]. These are the detractors of "*governance without government*"[90], who have looked at governance through the observation of both local, global, and purely sociological phenomena[91].

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[86] Stringham EP, Peter E, Private Governance: Creating Order in Economic and Social Life (Oxford Academic 2015).

[87] Thaler RH, Sunstein CR, Nudge: Improving Decisions about Health, Wealth, and Happiness (Yale University Press 2008).

[88] Pierre J, Peters BG, Governing complex societies: trajectories and scenarios (Palgrave Macmillan 2005).

[89] Stoker G, Governance as theory: five propositions (International Social Science Journal 50, 1998), pp. 17-28; Kooiman J, Van Vliet M, Governance and PublicManagement in K. Eliassen and J.Kooiman (eds), Managing Public organizations, 2nd edn (Sage 1993).

[90] Rosenau JN, Governance Without Government: Order and Change in World Politics, in Governance without government, eds. Rosenau JN and Czempiel EO (Cambridge University Press 1992); Rhodes RAW, The New Governance: Governing Without Government (44 Political Studies 1996), p. 652; Peters BG, Pierre J, Governance Without Government? Rethinking Public Administration (Journal of Public Administration Research and Theory, Volume 8, Issue 2, April 1998), pp. 223-243.

[91] *id.* Rosenau, p. 6. Such as the choice of Eastern Berliners to massively flee to the other side of the Wall and the common uprising of Eastern and Western Berliners in 1989. This has been narrated by Rosenau as an act of governance.

From a thematic literature review, three essential differential elements between government and governance can be identified and reconstructed: the legitimacy basis, the governing subjects, and the governing modes. As for the first element, legal norms expressed in formally approved constitutions, laws and regulations bestow public bodies with the authority to lay down and implement binding commands sustained by police, enforcement, and review powers. Positive law attributes the power to govern the public good to subdivisions of the modern sovereign State apparatus, and the private and common good to specific bodies in an organization recognized by the law (companies, foundations, associations), always subject to the rule of Law and prevailing public interests. The governing mode traditionally associated with the government is hierarchical, vertical, top-down, command and control regulation[92].

As opposed, governance is anchored in post-positivism, breaks up with verticality, and creates relations of dependence, independence, and co-dependence between non-governmental actors and deuteragonist states, in governing processes. Legitimacy in governance is founded on values that are shared by a collective, based on the consent of the interested parties or stakeholders. From a legal angle, governance becomes a conceptual device for contractual coordination of power relationships, balance of rights and duties, and cooperation between multiple parties and actors. This inter-individual and -societal dimension clearly incardinates governance legitimacy in the legal institution of the contract. The principles of autonomy of the parties, good faith,

[92] Ogus A, Comparing Regulatory Systems: Institutions, Processes and Legal Forms in Industrialised Countries, center on Regulation and Competition (CRC) (Working papers 30609, University of Manchester, Institute for Development Policy and Management (IDPM) 2002); Sunstein CR, After the Rights Revolution: Reconceiving the Regulatory State (Harvard University Press 1990).

and freedom of contract animate the relational links and the promises of cooperation between the actors. Hence, the web of contracts could be seen as composing an open-ended principles-based constitution of hybrid public-private-societal governance[93]. This may be stipulated between social, institutional, and individual actors, in typified and non-typified ways. This view is distinct from the social contract theories that ground the legitimacy of the State on the institution of the social contract, such as Rousseau's general will or else interpreted intentions of subjects. In social contract theories, the contract has a symbolic meaning that acquires concreteness in national constitutions, public international law treaties, and customs. In a governance setting contracts are rather practical devices designed to warrant distributive and commutative justice, allocation of powers, rights, and resources among diverse agents through formalized, less formalized, or informal mechanisms. Parties to a contract today express their freedom to contract via legally formal, factual, or technological arrangements like smart (legal) contracts[94].

The concept of governance finds then legitimacy in the legal institution of the contract, but also in the numerous non-legal sources and forces underpinning and surrounding contractual legitimacy. This is spelled out in Teubner's

[93] Teubner G, Contracting Worlds: The Many Autonomies of Private Law (Social & Legal Studies, 9(3), 2000), pp. 399-417. At p. 400 "*contemporary private law [..] needs to transform itself into a constitutional law for global regimes of private governance*"; On non-state, global normative systems organized by means of contracts: Lomfeld B, Liquified Sanctity: Grotius and the Promis of Global Law, Asbach & Schroeder (eds.), War, the State and International Law (Aldershot: Ashgate 2009), pp. 179-194.

[94] Smart contracts first appeared in Ethereum. Presently, the blockchain community refers to it in connection to any sophisticated program stored and executed on a blockchain. Although early blockchains were primarily intended for executing a restricted set of basic operations, typically transactions involving a token akin to currency, recent technological progress has empowered blockchains to manage more complex operations capable of translating natural language contracts into machine readable language. Bassan F, Rabitti M, From Smart Legal Contracts to Contracts on Blockchain: An Empirical Investigation (2023); Schrepel T, Smart Contracts and the Digital Single Market Through the Lens of a 'Law + Technology' Approach (European Commission 2021); Durovic M, Jannsen A, The formation of blockchain-based smart contracts in the light of contract law, (European Review of Private Law 2018).

*Diskurstheorie*, which attempts to construct Derrida's philosophical deconstructivism. In the legal institution of the private contract flows a multitude of socio-cultural, artistic, and specialized discourses[95] and worldviews that become binding and enforceable or sacrificed following reasoned legal balancing exercises[96].

Governance gives voice to the multitude by selected and specialized dialogue formalized in a web of contracts and legitimated by other non-legal normative facts, such as social practices and technical rules.

Whereas governance as a system of norms and rules is an organizational structure legitimized by the consent of plural voices and reasons, reality shows that governments function even in the face of widespread opposition by dint of formal shields. Governance models in abstract enshrine, albeit in practice do not always realize [97], the principle of democratic participation, whilst government forms historically manifested, formally or substantially, in monarchies, oligarchies, tyrannies, and other non-democratic forms[98]. Governance is an "*ultra-legal*"[99] concept that transcends and does not trespass the boundaries of the rule of law

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[95] *id.* n. 92 at p. 403: "*Contracting that is supposed to play its multifaceted role today must do so under the new condition of fragmentation of global society into a plurality of specialized discourses. Here we see the historical background of Derrida's somewhat enigmatic formulation on private law: contract today can only be an interrelation between discourses*."

[96] Alexy R, Theorie der juristischen Argumentation. Die Theorie des rationalen Diskurses als Theorie der juristischen Begründung (Suhrkamp 1978).

[97] Democracy may be direct or indirect. The first entails direct participation in decision making. The second requires respresentativity. In a governance setting, not all agents may be representative of the community stakes.

[98] Bobbio N, La teoria delle forme di governo nella storia del pensiero politico (Giappichelli Editore 1976).

[99] Grossi P, Oltre la legalità (Laterza 2020). The attribute 'ultra-legal' describes a normative reality that exists beyond the formal rules of law and interacts with them, sometimes even by way of expressing already existing written constitutional norms. Reference is made to practices or norms that, whether codified in law or not, sprung from social needs and exert a significant influence on societal and institutional behavior and the law itself. This concept can be applied to social customs, moral principles, and other norms that govern behavior outside the scope of written law but still have a powerful regulatory effect on society. Grossi's work explores the relationship between law and society, and the term 'ultra-legal' captures the nuances of this interaction.

as the only source of authority and legitimacy. It rather gives substance to it. Society holds a normative power and it is up to societal needs to produce social norms that give concrete expression to existing or novel governing norms applicable in non-governmental yet normative and regulatory systems. Modes of governance configure polyhedric relationships, bottom-up and co-regulative phenomena.

*1.3 Networks*

The multiplicity of the world of governance is best described with the image of networks.

The 90s were the years of the network paradigm coinciding with the ascent of the Internet and the "*network society*"[100]. This image still reflects the structure of contemporary societies characterized by the omnipresent influence of information and communication technologies (ICTs) on most aspects of human life, action, and interaction. The network has reshaped the structure of society to the extent that some authors speak of "*gouvernementalité algorithmique*" as a new regime of digital truth embodied in the multitude of automatic systems that model social life, habits, actions, and identities[101]. Back-end infrastructures, and front-end interfaces, whose architecture and functioning compel or inhibit

[100] Castells M, Towards a sociology of the network society (Contemporary Sociology, 29(5), 2000), pp. 693-699.

[101] Rouvroy A, Berns T, Gouvernementalité algorithmique et perspectives d'émancipation: Le disparate comme condition d'individuation par la relation? (Réseaux 2013), p. 177, pp. 163-196. "[..] *le nouveau régime de vérité numérique s'incarne dans une multitude de nouveaux systemes auto- matiques de modélisation du « social » à la fois à distance et en temps réel, accentuant la contextualisation et la personnalisation automatique des inte- ractions sécuritaires, sanitaires, administratives, commerciales*".

behaviors, and influence preferences and choices,[102] are governance instruments of the network society.

The growing predominance of ICTs in human lives coincided with the shift away from theories of government towards governance. A radical view of the early time saw the Internet as an autonomous zone of individual freedom, outside the scope of governmental and market oversight. This picture reflected and reflects reality only in part[103]. However, understanding ICT governance involves acknowledging the major norm-producing influence of informatics engineering research, technological private corporations, market dynamics, new regulatory agencies communicating with the markets, intergovernmental arrangements, and decentralized decision-making processes between tech-savvy players[104].

As the network of networks[105], the network architecture, i.e. technology itself, is the first entity to dictate the governing rules set by its developers. Besides, the ICANN, an international non-profit organization, is responsible for maintaining the interoperability, security, and stability of the global infrastructure. Like

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[102] *ibid.* Hildebrandt n. 8. "*If we leave the domain of law we may find other types of normativity, pertaining to constraints that have not been deliberately issued but which nevertheless induce or enforce, inhibit or rule out certain types of behavior. Latour's discussion of the Berlin key is a case I point. This key forces the user to open the door by pushing the key through the keyhole to the other side of the door, and after entering the house, the door can only be closed by turning the key and thus locking the door. This key demonstrates how a technological device actually regulates and constitutes the interactions of a resident, the key, her door and others who wish to enter the house. In this case the designer of the key has inscribed a program of action into the hardware, delegating the task of insisting on locking or not locking the door to the key*".

[103] On closer inspection, Internet governance involves a complex interplay of regulative stakeholders: government agencies, international organizations, technical standards organizations, industry associations and Internet Service Providers. Among the International bodies: the International Telecommunication Union (ITU), a specialized agency of the United Nations, and the Internet Governance Forum (IGF) as a standard setting forum for informal dialogue forum; the World Trade Organization (WTO) and the Organization for Economic Cooperation and Development (OECD) address internet-related policy matters in their respective areas of focus. Also market dynamics and economic forces are drivers of Internet governance. As well, the decisions that shape the Internet arise from the interplay of supply, demand, competition, and the strategic interests of platform market players.

[104] Caplan R, Networked Platform Governance: The Construction of the Democratic Platform (International Journal of Communication 172023), pp. 3451–3472.

[105] Solum LB, Models of Internet governance (2008).

buildings and roads, the Internet's architecture allows and constrains users' behaviors. Its technical protocols, software, and algorithmic functioning establish the operational framework, profile, orient, and influence users' digital existence. The code itself embeds regulative decisions[106] about how the Internet functions and how users interact with it and one another.

This perspective has garnered substantial support among scholars of blockchain governance, who emphasize the capacity of technology to facilitate decentralized —or more precisely, distributed— decision-making processes and resource allocation while ensuring transparency and immutability in value transactions. The most polycentric and networked governance model is indeed embodied in the blockchain systems and networks of Decentralized Autonomous organizations. Independent from traditional corporate forms and legal recognition, devoid of central authority, DAO governance is entirely based on the use of computer codes, which self-enforce pre-determined rules according to binary logic, and digital tokens, which represent and enable the exercise of ownership rights and participation rights in governance.

*1.4 Governance as the communicative channel for open complex normative systems*

The academic debate on governance originated in the 80s inspired by the theory of complexity in sociology advanced by Niklas Luhman, in turn, based on Parsons's theory of functionally differentiated social systems. Borrowing the principles of self-reference and *autopoiesis* from the cognitive biologists Humberto

[106] Lessig L, Code, and Other Laws of Cyberspace (Basic Books 1999).

Maturana and Francesco Varela[107], Luhmann theorized a constructivist theory of societal complex systems according to which there is no single societal system, but many closed systems that generate themselves and their environments. Each societal system operates according to its logic form and communicative medium, and can only understand or use its truths and distinctions. The economy, law, politics, military, medicine, science, and other systems specialize by their function and semantics and cannot replace one another. They can only communicate or *irritate* one another to establish strategic operational and *structural couplings*. Structural couplings arise as a system grapples with recursive environmental challenges that require interference or intervention from other systems.[108] Hence, according to Luhman modern society is centerless, segmented, stratified, and functionally differentiated[109]. His view is antithetical to those who conceive society as fragmented and chaotic or structurally dependent on the territorial, socio-cultural, and political environments or contingencies.

Another fundamental aspect of this theory, which is here criticized and tentatively overcome, is its pessimistic stance on the capacity of societal systems to mutually understand, coordinate, assist, and open up to one another. The distinct logic, media, and truth would hinder cooperation between functionally differentiated systems.

The governance of the platform to be designed is premised on the opposite assumption that different societal systems as all complex systems are open

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[107] For an interesting review of complexity theories and the application of evolutionary complexity to management studies: Mitleton-Kelly E, Complex systems and evolutionary perspectives on organizations: the application of complexity theory to organizations (2003).

[108] Lee D, The Society of Society: The Grand Finale of Niklas Luhmann (Sociological Theory, 18(2), 2000), pp. 320-330.

[109] Luhmann N, The Differentiation of Society (New York: Columbia University Press, 1982), pp. 232-238.

systems that cannot be reduced to a single closed model that, by its nature, is incomplete and needs to cooperate, adapt, integrate and even evolve to survive and generate new ecosystems where multiple micro-systems help one another.

A legal approach to complexity is given by the theories of sociology of law, institutionalism, and legal pluralism that challenged the traditional understanding of law as an emanation from the State[110]. The German socio-legal school of Gunther Teubner contributed by theorizing a "*global law without a state*", and global private regimes claiming their autonomy *vis-à-vis* the State[111]. Subsequently, the concept of societal constitutions[112] explained the coexistence of self-referential normative societal sub-systems that may interplay.

In the face of the inadequacy of the law to guarantee the stability of expectations and conflict resolution, sectoral actors have self-created norms independently of state mechanisms. *Lex mercatoria* epitomizes this process. In medieval Europe, merchants and traders responded with their own bequeathed customs and practices to the inadequacies of local and feudal laws to regulate international trade and commerce. Over centuries this self-regulation flew into national and international commercial codifications, written laws, and regulations[113]. Yet today most international commercial and financial binding and non-binding, though persuasive, transnational rules and procedures sprung up from international

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[110] Berman PS, The Oxford Handbook of Global Legal Pluralism, online edn (Oxford Academic 2020); Teubner G, "Global Bukowina": Legal Pluralism in the World Society (Global Law Without a State 3, 1997).

[111] Teubner G, Global Private Regimes: Neo-Spontaneous Law and Dual Constitution of Autonomous Sectors? Public governance in the age of globalization, Karl-Heinz Ladeur, ed (Ashgate, Aldershot 2004), pp. 71-87.

[112] Teubner G, Golia A Jr., Societal Constitutionalism in the Digital World: An Introduction, Max Planck Institute for Comparative Public Law & International Law (MPIL) Research Paper No. 2023-11.

[113] Malaguti MC, Mazzoni A, Diritto del commercio internazionale, Fondamenti e prospettive (Giappichelli Editore 2019).

negotiation participated by private operators, applied by transnational adjudicators with a preference over national laws.

Another case in point is the scientific system, which is the central societal system in the platform. Over the history of its development, it enjoyed a wide range of organizational autonomy and freedom from the central authority of the political sovereigns. Depending on the contextual public regime, or form of government, the scientific community has been either in a privileged advisory position, censored, or left in an ivory tower. From the guilds[114] through the academies of science to the free and autonomous universities, the self-reliance of the Republic of Science[115] is carved in most liberal democratic constitutions and laws. The scientific system has for long created its own normative systems of conduct and ethical rules[116], stating its autonomy from coercive mechanisms and forms of authority other than knowledge itself, free discussion, and mutual validation among scientists, while standing above the public and the rest of society.

As much as the other societal systems of rules, these rules altogether constitute a governance system that may interlace to communicate and cooperate with and within other governance systems.

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[114] Madison MJ, The Republic of Letters and the Origins of Scientific Knowledge Commons, U. of Pittsburgh Legal Studies Research Paper No. 2020-10, Governing Privacy in Knowledge Commons, M. Sanfilippo, B.M. Frischmann and K.J. Strandburg, eds. (Cambridge University Press 2021).

[115] Polanyi M, The Republic of Science: Its Political and Economic Theory (Minerva 1962) pp. 54-74.

[116] Such as the Mertonian norms: Universalism, Communality, Disinterestedness, and Organized Skepticism. Merton M, The Normative Structure of Science in The Sociology of Science Theoretical and Empirical Investigations (The University of Chicago 1942), pp. 267-278.
For a quick understanding see Berkeley Initiative for Transparency in the Social Sciences: https://www.bitss.org/education/mooc-parent-page/week-1/introduction-to-research-transparency-and-the-scientific-ethos/mertons-norms-and-the-scientific-ethos/.

*1.5 A good democratic governance. Closing the gap between Society and Science*

To enhance global governance, at the beginning of the millennium, the European Commission proposed to make the first step to reform the Union's governance "*to drive forward a wide-ranging democratic process*"[117]. The White Paper on Europen Governance set the objective "*to bring citizens closer to the European institutions*"[118] through regional and local democracy[119]. The closer to the people, the better, the more democratic the governance is. In conjunction, the Better Regulation framework acknowledged and formalized the need to flank the classic 'command and control' model with intergovernmental and non-governmental regulatory approaches to involve civil society to the maximum extent[120][121][122].

The White Paper identified the principles of openness in decision-making, participation of citizens in policies, accountability of the parties in accordance with assigned roles, and effectiveness and coherence of policies. The principles underpin a European notion of 'good governance' that is more accessible to civil

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[117] European Commission Communication of 25 July 2001 European governance - A white paper COM(2001) 428 final.

[118] *id.*

[119] *ibid.*

[120] Senden L, Soft Law, Self-Regulation and Co-Regulation in European Law: Where do they meet? (European Journal of Comparative Law, V. 9 2005).

[121] Interinstitutional Agreement on Better Law-Making (2003) OJ C 321, para 22. It officially integrated the so-called self-regulatory mode, which typifies the governance structure of "*economic operators, the social partners, non-governmental organizations or associations*" who "*adopt amongst themselves and for themselves common guidelines at European level (particularly codes of practice or sectoral agreements)*".

[122] The lemma 'good governance' appears also in the EU partnership agreements as a conditionality requirement for third countries to enter relations (associations and trade agreements) with the democratic standard-setter. For instance, the Cotonou Agreement defines it as: "*the transparent and accountable management of human, natural, economic and financial resources for the purposes of equitable and sustainable development. It entails clear decision-making procedures at the level of public authorities, transparent and accountable institutions, the primacy of law in the management and distribution of resources and capacity building for elaborating and implementing measures aiming in particular at preventing and combating corruption.*". It results therefrom that transparency, accountability, equitable and sustainable development, the primacy of law are the main tenets of the European good governance; acts of corruption constitute the main violation of its fundamental element of good governance.

society through participatory normative processes such as stakeholder consultation, *ex ante* and *ex post* policy reform assessments, and co-regulation.

In this context, and relevant to this research, the role of the scientific system has been particularly emphasized by the European regulator, asserting the need for democratization of the scientific system. The assumption is that science serves to inform public decisions and aid in defining and resolving issues linked to comprehensive political evaluations. Acquiring expertise should then logically adhere to democratic values of transparency and access to information by the public at large. This is central to the actual policies of open research based on the so-called rights of scientific citizenship, which grant citizens the role to legitimize knowledge for policymaking and make policymakers accountable[123]. These range from the entitlement to access evidence-based information, extending to the entitlement of accessing open data, as well as to participation rights in decisions concerning novel technologies and involvement in Citizen Science endeavors. All these initiatives advance the goal of public oversight over scientific knowledge for good governance.

### *1.5 Good governance on the global stage. An a-democratic myth*

On the global stage, good governance came under the spotlight with the so-called Third World development policy instituted by the Washington Consensus in the early 90s, i.e. the group of international economic development organizations set up with the Bretton Woods Conference (the International Monetary Fund and the Group of the World Bank). In this proto-global governance scenario,

[123] Soneryd L, Sundqvist G, Scientific Citizenship, Science and Democracy: A Science and Technology Studies Approach (OUP 2023).

governance is "*the exercise of political power to manage a nation's affair*"[124], including "*an efficient public service; an independent judicial system and legal framework to enforce contracts; the accountable administration of public funds; an independent public auditor, responsible to a representative legislature; respect for the law and human rights at all levels of government; a pluralistic institutional structure, and a free press*"[125]. The good governance paradigm was still clearly entrenched in state-centricity.

The Bretton Woods institutions statutorily entrusted with the supervision of State Parties' state of socio-economic affairs anchor the eligibility of candidate States for financial and technical assistance programs to the attainment of good governance. This was understood as the efficient management of public resources, encompassing reforms within the public sector and administrative procedures, and the presence of a predictable regulatory framework for investments and the private sector. Along with macroeconomic stability and balance of payments, good governance informed the purpose and constituted an overarching conditionality criterion to access the programs. But history reminds us that the Bretton Woods conditionality policy required the implementation of systemic reforms involving massive privatizations and liberalizations of public services at the expense of people's fundamental rights, actual democratic representation in decisions, and institutional accountability. As noted by global governance scholars, global governance of international organizations, informal governmental networks, public/private initiatives, and private bodies, albeit indispensable for resolving regulatory coordination and cooperation problems

[124] World Bank, Sub-Saharan Africa: From crisis to sustainable growth (The World Bank: Washington, DC 1989). World Bank, Governance and Development (The World Bank: Washington, DC 1992).

[125] Leftwich A, Governance, democracy and development in the Third World (Third World Quarterly, 14(3): 1993), pp. 605-624.

and promoting global welfare, is doomed with an intrinsic democratic[126] and legitimacy deficit[127].

Over the years, the said international financial institutions began to stick to the good governance paradigm to assess their internal operations and functions, paving the way for widespread use among other international organizations and acceptance as a principle of law in national, regional, and international courts and institutions[128]. In the wake of various financial crises, corruption scandals, and governance failures, there was a heightened awareness of the critical role that governance plays in ensuring stability and prosperity. This led to a push for the creation of governance frameworks such as those proposed by the OECD in several dedicated declarations of principles[129]. The OECD put forward the principles of transparency, ensuring that decision-making processes are open and information is accessible to the public; accountability with a focus on making institutions and their leaders responsible for their actions and decisions, supported by mechanisms for regular reporting and evaluation; effectiveness and efficiency, highlighting the need for resource management that achieves the best possible outcomes and implementing performance measurement systems to continuously improve institutional effectiveness. These principles call for responsiveness in governance, engaging citizens and stakeholders in the decision-making process, and ensuring that public services are attuned to the

[126] Benvenisti E, The Law of Global Governance (Brill 2014).

[127] Zürn M, Governance globale e problemi di legittimità. In Antonino Palumbo, Salvo Vaccaro (a cura di), Governance. Teorie, principi, modelli, pratiche nell'età globale (Mimesis 2007).

[128] Addink H, Implementation of the Good Governance Principles on the International Level in Good Governance: Concept and Context, online edn (Oxford Academic 2019).

[129] OECD Principles of Corporate Governance (1999; 2005, 2015; 2023); OECD Principles of Regulatory Quality and Performance (2005); OECD Principles for Integrity in Public Procurement (2009); OECD Recommendation on Public Integrity (2017); OECD Principles on Artificial Intelligence (2019).

needs and expectations of the population. Further, this framework includes the principle of integrity and ethical conduct to combat corruption; the rule of law to ensure that public actions are based on laws that are publicly promulgated, equally enforced, and independently adjudicated, with a strong emphasis on judicial independence to ensure fair and impartial administration of justice; and the principles of equity and inclusiveness to promote fair treatment for all individuals, social inclusion and equitable distribution of benefits. Lastly, the principles advocate for a strategic vision in governance, in view of long-term planning and adaptability to respond to changing circumstances and emerging challenges.

*1.7 Good governance as a balancing principle in the Council of Europe legal system*

The principle of good governance has gained significant traction in the case law of the European Court of Human Rights (ECtHR) over the last two decades. The ECtHR employs this principle as a benchmark to evaluate the conduct of State parties' national authorities and adjust it to the constitutional commitment to democracy constitutive of the legal system of the Council of Europe. It bears recalling that the Council of Europe has unified a wide variety of different constitutional traditions encompassing ex-socialist states, emerging democracies, and jurisdictions with different degrees of democratic maturity.

The principle of good governance has become crucial in assessing the proportionality of actions that interfere with individual rights, within the scrutiny of fundamental rights, and mainly property rights (Article 1 of the First Protocol to the European Convention on Human Rights - ECHR)[130] as fundamental tenets

[130] In the case of Czaja v. Poland, the Court reiterates "[..] *the particular importance of the principle of good governance. It requires that where an issue pertaining to the general interest is at stake, especially when it affects fundamental human rights, including property rights, the public authorities must*

of democratic systems. In this legal framework, good governance, on the one hand, is a validity criterion for public administrative conduct that compels public authorities to act promptly, appropriately, and consistently when dealing with matters that may significantly impinge on individual rights.

The adoption of the good governance principle by the ECtHR coincided with the constitutionalization of the 'right to good administration' at the EU level with the adoption of the Charter of Fundamental Rights of the European Union. The ECtHR chose a different term for reasons not explicitly clear in its case law. This may be explained in terms of extension of the ECtHR's scrutiny beyond administrative conduct, often dealing with regulatory conduct and defective legal provisions that violate individual rights[131], which would expand the purview of 'good governance' as a more encompassing term than 'good administration'.

Unlike the European Union courts, the ECtHR has avoided establishing precise procedural yardsticks in balancing individual rights and public interest according to the good governance principle, i.e. the right to be heard or the duty to state reasons. Generally, the ECtHR expects promptness, clarity, consistency, and competence from public authorities interacting with individuals acting in good faith. States must coordinate effectively and cannot use financial or technical issues as excuses to disregard ECHR rights. Moreover, wrongs attributable to the State must be adequately compensated. In this legal system, governance lies in a more dynamic, outcome-based dimension, and a guarantee of the primary

*act promptly and in an appropriate and above all consistent manner*". Czaja v. Poland no. 5744/05 (ECtHR, 2 October 2012).

[131] See, *e.g.* Hutten-Czapska v. Poland No. 35014/97 (ECtHR 19 June 200).

responsibility of national authorities to secure the rights and freedoms defined in the ECHR.

*1.8 Territorial governance*

*Ratione loci*, when the territorial element is considered, governance is located in global, regional, national, and local contexts. What interests the present study is the axis between the local and the global levels, premised on the assumption that while, with the digitalization of knowledge and information, societal issues are globally felt and shared, democratic good governance is best attained, the closest to the people. This view is inspired by the rationale, and not the actual application, of the subsidiarity principle. Notoriously, according to the principle of subsidiarity, decision-making should be decentralized to the lowest appropriate level of governance, allowing for more efficient and effective decision-making processes[132]. Decisions are made as close as possible to the involved/affected individuals or communities, and governance structures can be held more easily accountable and responsive to local needs. Democratic governance operates through the legal device of representative democracy, i.e. voting political representatives who make choices on behalf of their electorate; direct democracy, i.e. through referenda and civic initiatives, mobilization, activism, and collaboration with other community members.

For years, the debate on local development has focused on strategies aimed at administrative decentralization and establishing territorial governance. This stance is in line with the European Council of Lisbon in 2005 to relaunch the Lisbon Strategy, which called for regional and local authorities, social partners, and civil society to

[132] Schütze R, From Dual to Cooperative Federalism: The Changing Structure of European Law (OUP 2012), pp. 243-264.

participate in the achievement of the development goals. The then-new governance model relied on intermediate bodies tasked with coordinating between the public and the private spheres and the engagement of all territorial stakeholders in all the phases of the policy lifecycle (development, application, and implementation)[133]. This approach moves beyond the linear model to implement a virtuous circle based on feedback, networks, and participation at all involved levels. In this regard, public-private or public-private-community partnerships[134] involving tangible and intangible resource management represent a valuable institutional and contractual governance framework often pivoting around a public or hybrid actor, widely used in integrated programs, particularly in the so-called Territorial Pacts. However, the model is not devoid of limits and open issues that emerged in creating local governance, such as the lack of high professionalism and competencies and the focus on individual leadership rather than stewardship of community participants. Intangible and tangible cultural heritage has been identified as a unifying asset for residents to stimulate their spontaneous active involvement, learning capabilities, and propensity to drive change[135].

Discourse on institutional and organizational networks is recursive in local governance. Already in the '90s, Rhodes described the shift in the UK's traditional local government structures to a broader system of collaborative local governance as a "*self-organizing inter-organizational network*"[136], encompassing public autonomous bodies, private actors and voluntary organizations. He referred to the multiple, interdependent and

[133] Rizziato E, Lo sviluppo locale: un approccio sistemico e generativo con la leadership orizzontale (Centro Nazionale delle Ricerche 2002).

[134] Boniotti C, The public–private–people partnership (P4) for cultural heritage management purposes (J. Cult. Herit. Manage. Sustain. Develop. 21, 256, 2021); Iaione C, De Nictolis E, Santagati ME, Participatory Governance of Culture and Cultural Heritage: Policy, Legal, Economic Insights From Italy (Frontiers in Sustainable Cities, 4, 777708, 2022).

[135] Sacco PL, Ferilli P, Tavano Blessi G, Cultura e sviluppo locale. Verso il distretto culturale evoluto (Il Mulino 2015).

[136] *ibid.* Rhodes n. 89.

autonomous entities committed to public service provision on the local level and public local resource management[137].

The commons-based model is an approach to local governance alternative to public-private governance. Elinor Ostrom and her colleagues conducted a comprehensive empirical inquiry into the self-governance arrangements of various local communities across diverse settings worldwide. This alternative approach involved the management, use and conservation of common pool resources (CPRs) through communal practices, common rules and collective decision-making processes[138]. The analysis revealed that self-organization and self-governance could offer a more sustainable alternative to public and private ownership and regulation, provided eight key *design principles* were adhered to[139]. Through clearly delineated community boundaries, a set of internally established rules tailored to the needs and circumstances of the commons, mechanisms for monitoring and enforcement, and the presence of appropriate incentives, commons management emerged as the most sustainable and equitable model for resource stewardship. Initially, the analysis focused on tangible natural resources such as water basins, lobster fisheries and forests. Subsequently, attention shifted towards intangible common pool resources, particularly the knowledge commons, encompassing scientific resources and resource management[140].

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[137] Sørensen E, Torfing J, The democratic anchorage of governance networks (Scandinavian Political Studies 28(3) 2005).

[138] The CPRs are natural or constructed (human-made, e.g. culture, information, knowledge, infrastructures) resource systems that are sufficiently large as to make it costly to exclude beneficiaries from benefitting therefrom.

[139] Ostrom E, Governing the Commons: The Evolution of Institutions for Collective Action (Cambridge University Press 1990); Ostrom E, Coping with tragedies of the commons (Annu. Rev. Political Sci. 1999), pp. 493-535.

[140] Hess C, Mapping the new commons, Paper presented at the Governing Shared Resources: Connecting Local Experience to Global Challenges (12th Biennial Conference of the International Association for the Study of the Commons, University of Gloucestershire, Cheltenham 2008).

The commoners illustrated that collaborative governance frameworks steered by local communities ensure effective and sustainable preservation and management of CPRs and contribute to the prosperity of communities sharing those resources. Additionally, the theory of the commons empowers the single individual who feels part of a well-defined community of interests and peers. The peer governance aspect underlines that value creation and distribution come out of processes between peers, where markets and States play little or no role at all. A specific, well-bounded community in a well-defined conditioned environment responds to its needs and social dilemmas through commoning. Commoning is thus the generative combination of social practices, acts of provisioning and forms of peer governance that create and sustain wealth and value[141].

*1.9 Polycentric governance and blockchain governance*

Peer governance can manifest in an aterritorial setting such as a virtual and digital well-bounded environment. A nuanced characterization of this peculiar type of localized governance is polycentric governance[142]. From its original nexus with local, territorial, urban and metropolitan governance, polycentric governance

[141] Bollier D, Helfrich S, Free, Fair and Alive: The Insurgent Power of the Commons (New Society Publishers 2019).

[142] Tiebout C, Ostrom V, Warren R, The Organization of Government in Metropolitan Areas: A Theoretical Inquiry (The American Political Science Review, 1961), p. 831: "*The traditional pattern of government in a metropolitan area with its multiplicity of political jurisdictions may more appropriately be conceived as polycentric political system*". Ostrom E, Beyond Markets and States: Polycentric Governance of Complex Economic Systems (Transnational Corporations Review, Vol. 2, No. 2, 2010); Ostrom E, Polycentric Systems for Coping with Collective Action and Global Environmental Change (Global Environmental Change 550 2010). "*Polycentric systems are characterized by multiple governing authorities at differing scales rather than a monocentric unit. Each unit within a polycentric system exercises considerable independence to make norms and rules within a specific domain (such as a family, a firm, a local government, a network of local governments, a state or province, a region, a national government, or an international regime*".

once indicated the multitude of political jurisdictions and decentralized government levels. This meaning also relates to global law and governance[143].

In recent years, supporters of distributed ledger technology (DLT) borrowed the notion and applied it to its better-known specification: blockchain technology.[144] The transposition of the legal-political language in the technological domain signals the current de-territorialization and shift of governance mechanisms in the realm of technology. By the very features of blockchain technology[145], much of the socio-economic activities involving an exchange of value and

[143] Baker LC, The Structure of Global Law: Fracture, Fluidity, Permeability, and Polycentricity (CPE Working Paper No. 2012-7, Penn State Law Research Paper No. 15-2012), p. 119."*Polycentricity is the foundation of global law*" … *"Polycentricity in its emerging form was at the center of recent efforts to develop an international framework for the management of business and human rights. These efforts focus on the simultaneous obligations of states and corporations, separate, simultaneous and separately founded. It is well evidenced in the operations of the system of soft law regulation administered through the Organization for Economic Cooperation and Development under the Guidelines for Multinational Enterprises.*" ; McGinnis MD, Legal Pluralism, Polycentricity, and Faith-Based Organizations in Global Governance, in The Struggle to Constitute and Sustain Productive Orders (Lanham, MD: Lexington Books, 2008), pp. 45-64.

[144] Blockchain technology is a distributed digital ledger that operates on a peer-to-peer network and allows for secure, transparent and tamper-proof transactions without the need for a central authority. Participants can transact directly with one another with guaranteed data integrity, protection and security. See Finck M, Blockchain Regulation and Governance in Europe (Cambridge University Press 2018); De Filippi P, Wright A, Blockchain and the Law: The Rule of Code (Harvard University Press 2018).

[145] Bassan F, Digital Platforms and Blockchains The Age of Participatory Regulation (European Business Law Review 34, 7 2022), pp. 1103-1132. "*Blockchains implement a distributed ledger holding transactions and user balances. A set of network nodes stores, broadcasts and replicates the ledger. A transaction can modify the ledger only if approved by all the nodes in the network (usually called validators), which verify its legitimacy, certify that it originates from an authorized subject, and agree on the set of changes to be applied (consensus). Hence the characteristic of decentralization (the network does not have a center and therefore a clearing house is not needed), security (the underlying cryptographic algorithms prevent forging transactions or modifying the ledger history), transparency (the governance of the blockchain is shared and each new block is visible from every node), immutability (of the data), confidentiality (the 'wallet keys' guarantee user pseudo-anonymization, a necessary counterpart to the transparency of the operations), reduction of costs (operational, transactional, counterparty).*".

transactions[146] can be carried out in socio-technical environments, capable of substituting[147] and complementing analog governance institutions[148].

Polycentric governance refers to a given system anchored in the overarching principles of decentralization and distribution, which originally posited the refusal of a central authority and intermediaries and the presence of multiple inter-independent and coordinated centers of decision. DLT/blockchain, by its very technological functioning, decentralizes processes, rules, and procedures, involves fewer intermediaries, automates repetitive business processes, and eliminates transaction costs. The community of users gets directly involved in maintaining the blockchain protocol, performing transactions, and making decisions concerning network and system modifications.[149]. However, not all users enjoy the same prerogatives. Power imbalances are proportional to the computational capacities and technological skills possessed by the participants with a concentration of powers in the hands of the core developers, who can

[146] Next to the classic example of decentralized financial services, DLT/blockchain blockchain use-cases cover supply chain management and transparency, value chain traceability, tamper-proof notarization of official documents, digital identity, health, public records, e-voting, registration of (intellectual) property rights, data management and integrity, ticketing, pre-determination (thus potentially also negotiation) and automated performance of contractual value transactions via smart contracts, where the legal and factual conditions in real-world contractual perfromance are met and communicated to the blockchain via the so-called 'oracles'. Oracles in turn are software or hardware entities that enable blockchains to interact with external data sources and serve as intermediaries providing the necessary data to the blockchain, allowing smart contracts to execute based on real-world inputs. Oracles can pull data from APIs, databases, IoT devices or other external services. Antonopoulos AM, Wood G Mastering Ethereum: Building Smart Contracts and Dapps (O'Reilly Media 2018).

[147] This was the original intention of the inventor of BitCoin and the supporting community of peer-to-peer blockchain transactions. See the most emblematic manifestos: Nakamoto S, Bitcoin: a peer-to-peer electronic cash system (2008); Szabo N, Smart Contracts (1994).

[148] This is particularly true for financial, insurance, payment and banking services. At the time of writing, numerous central banks and commercial operators are in the process of designing and implementing DLT/blockchain solutions. The Bank of Italy has been one of the first central banks to acknowledge and explore the advantages of DLT/blockchain technology in the public sector. It identified the features that blockchain should have to be widely adopted: security, scalability, decentralization, environmental sustainability, upgradability, operational continuity, no forks, interoperability, simultaneity of unmediated bilateral exchanges. Bank of Italy, Communication by the Bank of Italy on Decentralized Technology in Finance and Crypto-assets (June 2022), para. 1, p. 3.

[149] *id.*

unilaterally intervene in modifying protocols[150][151]. The protocols specify the cryptographic algorithms, data structures, network communication and consensus mechanisms that define how transactions are validated and added to the blockchain and how decisions are made on any items relevant to the community. Hence, behind the ledgers, there are human and institutional processes; this is to say blockchain governance is ultimately human governance facilitated by technology that requires normative checks and balances to be put in place.

*2.0 Ad interim remarks*

From the above discussion, it is evident that governance is an inherently complex notion that is not entirely susceptible to being encapsulated in a one-size-fits-all reductionist and 'compartimentalist' model definition. Models and schematizations lead to closed systems that can never contain the entropy of reality or the secret of durable truth. Even the parable of scientific processes and discoveries reveals that.

It bears resuming the above results and attempts to find an open-ended, complex-friendly definition of governance.

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[150] Walch A, Deconstructing 'Decentralization': Exploring the Core Claim of Crypto Systems, in Crypto assets: legal, regulatory and monetary perspectives, ed. Chris Brummer (Oxford University Press 2019).Walch analysises episodes of concentration of power in blockchain networks. In Bitcoin, such instances include emergency interventions by a small group of developers in the fall of 2018, when a critical software bug was discovered, and in March 2013, during an unintended hard fork of the blockchain. Similarly, in Ethereum, significant moments of power concentration occurred during the invite-only meetings held by key software developers in the fall of 2018, and the actions taken by these developers during the July 2016 hard fork in response to the DAO hack. Furthermore, the substantial portions of hashing power controlled by mining pools in both networks reveal power concentrations that challenge claims of decentralization.

[151] Decision-making on different issues is attributed to different actors (core developers, developers, nodes, validators, coin holders and users) on different layers (network and application layers) according to differing consensus mechanisms. Actors may exercise their decision power independently from one another but in a coordinated way, asynchronously, or synchronically. Moreover, certain blockchains allow for more inclusive off-chain decision-making mechanisms to be then implemented on-chain by the developers. One such example is the governance framework of the Algorand blockchain: https://governance.algorand.foundation/ .

From the above, one can assert that governance exists independently of/or co-dependently with a central public government. It flourishes across public, private, corporate, community and technological contexts, spanning local, national, regional and global landscapes. Governance can thus unravel on a multi-level and a multi-layer basis with ramifications and stratifications within the same organizational, territorial or technological environment. While not strictly a legal concept, governance intersects with legal structures and encompasses legal principles, rules and procedures. Its rationale lies in explaining why and how entities and agents other than the public administrative State and its organs exercise social ordering, governing and regulatory functions and how this occurs in practice.

Governance involves balancing and distributing powers and resources, organizing decision-making and resolving conflicts. It embodies a system of values, principles and rules that confer powers and rights and impose obligations. It recognizes the interests, roles and socio-cultural meanings of diverse societal systems and actors and lays out procedures and remedies based on values and principles from diverse normative sources. Governance navigates the complexity of governing processes, structures, and mechanisms of value propositions and statements, as well as the allocation and management of resources, stakes, rights, obligations and conflict resolution involving a plurality of agents. Governance is an open system *à-la-Morin* that adapts to changing circumstances, evolving societies, and technologies while embracing all legitimate normative discourse semantics.

## 4. PLATFORMS

Once the different manifestations of governance have been explored, it is necessary to define the context in which the governance model unfolds: the platform. The platform is another popular and polysemic term. Its meaning varies from context, audience and discourse. In the physical world, a platform is a flat surface on which something else lays[152], is placed and supported. For example, a railway platform is the elevated area on which the railway is placed. On an offshore platform may lie the infrastructure for oil drilling or a silent vertical shovel axis wind. Platforms offer a support plane. The platform governance to be designed embraces this basic, general and literal meaning of what constitutes the minimum trait of a platform: the ability to sustain (the sustain-ability of digitized processes).

A figurative use of the term emerged. A platform is "*the ground, foundation, or basis of an action, event, calculation, condition*" or "*a position achieved, or situation brought about which forms the basis for further achievement*"[153]. Platforms open new opportunities to those who create and benefit from the platform. This meaning reminds us of the original positive function that a platform is set to discharge.

In the political context, the term shifted from denoting the physical platform for a speaker to engage with an audience during political addresses to the stage of its ideas and beliefs[154]. In this sense, a platform indicates a forum or a *locus* for public and community discussion and the foundation for political deliberation and action. The figurative and the political meanings are relevant to this study, as the

[152] So reads the first definition provided by the Oxford English Dictionary: "*A surface or area on which something may stand, esp. a raized level surface*".

[153] Oxford English Dictionary: 'Platform' (2006).

[154] Gillepsie T, The Politics of 'Platforms' (SAGE, new media & society 12(3), 2010), pp. 347–364.

platform governance to be designed creates a virtual ecosystem based on an inter-institutional and -societal knowledge-sharing mechanism to inform evidence-based decision-making.

Besides, the platform is set in the cyberspace and digital world. Therein, a platform can be described in different ways depending on the disciplinary lens worn by the observer. For computer scientists, a platform is a technological soft- or hardware infrastructure upon which networks, applications (social media, mobile apps, email, clouds, peer-to-peer file sharing, and others), and other platforms are built and run[155][156]. Most technological platforms[157] rely on the open Internet architecture, the most standardized and purely global communications medium, i.e. the 'network of control' built on the Internet Protocol. Platforms can be programmed in different coding languages, translated into natural language interfaces, and perform various functions. Beyond communication, platforms provide a potentially open-ended, non-typified set of services, according to differing business models that developed throughout the eras of Web development.

*2.1 Web development and platform models*

A brief introduction to Web development is necessary to understand how platforms, their business models, and services have evolved over the years.

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[155] Tanenbaum AS, Modern Operating Systems, 4th ed. (Pearson, 2014). In this book the author discusses operating systems as the software layer that manages hardware resources and provides common services for computer programs. Through this lens, a platform can be inferred as the combination of an operating system and the computer hardware it manages, which creates an environment where applications can be executed.

[156] *ibid.* Solum n. 104 "*Internet governance is about the ordering of whatever technical systems enable the operation of the global network of networks as a platform for applications*".

[157] Information communication systems trading floors, postal systems and telephone networks are non-Internet-based platforms for communication, commerce and exchange.

During the Web1 era (1990-2000), the initial phase of the World Wide Web, web pages were static and hosted on web servers operated by internet service providers (ISP) or free web hosting services. There was a spare number of content creators, no advertising, and a decentralized content delivery network (CDN) using open protocols[158]. Digital platforms were e-commerce providing information on products and services on sale or free peer-to-peer blogs, content sharing, and communication forums.

The real turn to service-oriented applications came with the Web2 (2000-2020) that inaugurated the social era of websites featuring user-generated content, application services, and enhanced interoperability for end-users[159]. This phase saw a centralization of the business model based on collection, extraction, aggregation, capture, and monetization of user data[160], appropriation of technology, revenue distribution to managers and shareholders, and centralized decision-making. Platforms became highly specialized service providers and intermediaries created to satisfy specific human and societal needs and purposes through the provision and capture of data and information[161].

By contrast, Web3 (2020-present) represents a qualitative paradigm shift. The Web evolves into a database integrated with DLTs. This transformation entails

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[158] Bassan F, Web in Transition and Participatory Regulation (Antitrust Chronicle 2023), pp. 1-9.

[159] *id.*

[160] The enormous amount of data collected and processed serves a variety of purposes, from the customization of the offers to tailored marketing and advertising strategies, monitoring users' activities, profiling and predictive behavioral analysis.

[161] A public consultation on the regulatory environment for platforms conducted in 2016 by the European Commision provided the following taxonomy of platform services: general search engines, specialized search tools, location-based business directories or maps, lews aggregators, online market places, audio-visual and music platform, video sharing platforms, payment systems, social networks, app stores, collaborative economy platforms. European Commission, 'Public Consultation on the regulatory environment for platforms, online intermediaries, data and cloud computing and the collaborative economy' (September 2015).
Added to these, many others can be identified such as ridesharing, transportation, food delivery, accommodation and hospitality, job networking and recruiting, financial and investment services, tele-medicine, e-government, scientific knowledge sharing, wikis.

partially or fully decentralized business models and enables a wide range of applications[162]. Web3 applications adhere to open standards and protocols, platforms distribute control, self-executing smart contracts automate transactions, the community shares values, and revenues are returned to creators and users with token-based reward mechanisms.

*2.2 Companies, knowledge communities, political actors, and legal orders*

Precisely concerning their functions and the multiple roles they 'play' in society, legislators and commentators conceived of platforms as companies, information hosts, political actors, or – by functional analogy and extension of the legal categories – private legal orders[163] or transnational law regimes of the digital environment[164].

*2.2.1 Platform as companies and their business model*

Platforms as companies are data-driven online intermediaries and facilitators of product exchange, service delivery, and content provision[165]. Following decades of de-regulation and self-regulation, the transformative effects on the markets, society, and democracy have put them at the center of the doctrinal and legislative discourses as objects and co-subjects of regulation. In a public consultation

[162] *ibid.* 157.

[163] Bassan F, Digital Platforms and Global Law (Edward Elgar Publishing 2021).

[164] Teubner G, Constitutional Fragments: Societal Constitutionalism and Globalization, Oxford Constitutional Theory (OUP 2012); Poncibò C, Blockchain Regulation and Governance, B. Cappiello, C. Carullo (eds.) (Springer Nature Switzerland AG, 2021). "*We observe the elevation of technology [..] to the rank of global authority, producer of its own rules intended to favor the efficiency of international commerce and capable of orienting (rectius determining) the economic and social policy of states towards affirmation of special interests.*".

[165] Obergefell EI, Thamer A, (Non-) Regulation of Online Platforms and Internet Intermediaries: The Facts: Context and Overview on State of Play (Gewerblicher Rechtsschutz und Urheberrecht, Internationaler Teil 2017).

launched in 2015 meant to prepare the ground for the Digital Market Strategy, the European Commission defined an online platform as an "*undertaking operating in two (or multi)-sided markets, which uses the Internet to enable interactions between two or more distinct but interdependent groups of users so as to generate value for at least one of the groups*"[166] [167]. Platforms were considered in their socio-economic function as market players reshaping market dynamics and inventing new business models.

As extensively studied by business management scholars, platforms created new business models that possess peculiarities that distinguish them from the previous dominant linear or pipeline business models, where inputs are processed sequentially, or step by step, to create a final product or service. Digital platforms introduced bespoke platform business models, that interconnect, engage, and reward multiple participants, even the traditional consumer who became a "*prosumer*", in the value chain.

Despite employing various business strategies and offering a wide range of services, platforms as intermediaries exhibit consistent patterns. Srnicek isolates the platform business model as dominant in a self-standing economic model that he calls '*platform capitalism*'[168], an economic model characterized by the data-driven

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[166] European Commission, Public consultation on the regulatory environment for platforms, online intermediaries, data and cloud computing and the collaborative economy (24 September 2015). Building on this definition, the OECD: "*An online platform is a digital service that facilitates interactions between two or more distinct but interdependent sets of users (whether firms or individuals) who interact through the service via the Internet*" in An Introduction to Online Platforms and Their Role in the Digital Transformation (OECD Publishing, Paris 2019).

[167] The Commission aimed to subject platforms to regulation in the most sensitive sectors falling under its legislative authority (competition, consumer, data and copyright protection) and collaborative economy in multiple sectors (e.g. transport services, ridesharing, accommodation and professional services). According to the EC, collaborative economy platforms are those which "*link individuals and/or legal persons through online platforms (collaborative economy platforms) allowing them to provide services and/or exchange assets, resources, time, skills, or capital, sometimes for a temporary period and without transferring ownership rights. Typical examples are transport services including the use of domestic vehicles for passenger transport and ride-sharing, accommodation or professional services*".

[168] Srnicek N, Platform Capitalism (Polity 2017); Parker G, Van Alstyne MW, Choudary SP, Platform Revolution, How Network Markets Are Transforming the Econoomy and How to Make Them Work for You (Business, Economics, Computer Science 2016).

intermediation via digital technologies, between different groups or 'sides' of users (consumers, producers, service providers, or advertisers; hence two- or multi-sided markets) in *scalable* markets producing *network effects* and different *monetization strategies* (charging fees for transactions, subscription models, advertising revenue, or leveraging user data and time). Furthermore, they often create business activities and opportunities that exist '*solely because of the platform and without which they would have no sense*'.[169]

From this perspective, a digital platform is seen only as a firm that operates under capitalistic logic and conditions to offer and co-create products and services to the market, strategically maximize profit, and dominate markets by their knowledge and algorithmic advantage.

### *2.2.2 Information hosts*

The recent positive legal definition of online platforms sheds light on another essential feature of digital platforms. According to Art. 3 of the recent Digital Services Act: "'*online platform' means a hosting service that, at the request of a recipient of the service, stores and disseminates information to the public"*. This definition aligns with/is functional to the overarching purpose of the DSA, which is to promote diligent and responsible conduct among platforms that host information. The DSA requires these platforms to take proactive measures to address the presence of illegal content, online disinformation,, and other types of risky and abusive content uploaded by users[170]. The DSA marks a regulatory turn in comparison

[169] Advocate General Szpunar, case C-434/15, Opinion of 11 May 2017, EU:C:2017:364, par. 56.

[170] The Digital Services Act (DSA) mandates that online platforms enhance transparency and accountability by disclosing their content moderation practices, including algorithms for content curation. Platforms are required to clearly outline terms and conditions and maintain detailed reports on content removal actions and user complaint handling. In terms of user rights and protections, the DSA introduces mechanisms enabling users to challenge content moderation

with the decade-long tradition of the safe harbor (liability exemption of platforms) for content uploaded by users.

Yet, while the business character (or the platform business model) is a distinctive feature of many digital platforms, the capacity to host and convey information (to be information hosts) is common to all digital platforms. This factor is independent of the type of information hosted and whether the platform adopts any business model at all.

Before the massive digital re-location of traditional media outlets like newspapers, radio, and TV broadcasts, and the ascent of social media, native and purely information-hosting platforms saw the light and continued to operate inspired by an entirely non-business-oriented ethos. These represent the 'competing' forces to hugely market capitalized 'digital giants', i.e. the critical mass of platform communities of contributors, volunteers, and donors, and a few employees providing free access to culture and knowledge. It is the world of the non-profit platforms for information co-creation and sharing exemplified by the Wikimedia Foundation and all the other wikis existing worldwide[171]. In the United States, local and city wikis have blossomed, sparked community-generated content on

decisions. Platforms must establish an internal complaint-handling system and engage with out-of-court dispute resolution bodies to ensure fair treatment of users. As for illegal content and harmful activities, platforms shall promptly remove or disable access to illegal content. Additionally, platforms must implement measures to mitigate risks associated with the dissemination of harmful activities, such as the spread of disinformation and other online harms. The so-called very large online platforms with over 45 million monthly active users in the EU (VLOPs) are subject to additional obligations linked to systemic risk and adversting revenues. Regulation (EU) 2022/2065 of the European Parliament and of the Council of 19 October 2022 on a Single Market for Digital Services (Digital Services Act) and amending Directive 2000/31/EC [2022] OJ L 277/1.

[171] Wikis are "*freely expandable collection of interlinked web pages, a hypertext system for storing and modifying information – a database, where each page is easily edited by any user with a forms-capable Web browser client*". From Leuf B, Cunningham W, The wiki way: Quick collaboration on the web (Addison-Wesley Longman 2001), p. 14.

local knowledge, history, heritage, events, and businesses[172], and serve as collaborative learning venues in higher education[173].

*2.2.3 Platforms as political arenas, targets and actors*

Coherently with their role as information conveyors and hosts, platforms are political arenas, targets, and actors for several reasons. They provide spaces for freedom of expression as they host public expression[174], information dissemination, and transformation of ideas and opinions. As well, platforms are political actors in that they supervise, filter and censor manifestations of free speech. Whether platforms discharge these tasks in accordance with public laws and regulations (e.g. the DSA or US California content moderation statute), some scholars agree on attributing them the role of "*private governors of public speech*"[175]. Content moderation policies and actions, terms of service, filtering algorithms, and interfaces constitute governance choices and instruments that influence, restrict, or augment users' exercise of fundamental rights and freedoms and shape their political and legal education.

Another perspective considers platforms as political actors highlighting the influential role of the biggest platforms in proactively participating in the global tech-regulatory arena as lobbyists or standard-setters. For more than a decade, digital platforms have entered into an interinstitutional dialogue with EU

[172] https://localwiki.org/ .

[173] Zheng B, Niiya M, Warschauer M, Wikis and collaborative learning in higher education (Technology, Pedagogy and Education, 24(3), 2015), pp. 357–374.

[174] Gillespie T, Regulation of and by platforms, in J. Burgess, eds A. Marwick, & T. Poell (The SAGE handbook of social media, 2018), pp. 254–278. "*By platforms, I mean sites and services that host public expression, store it on and serve it up from the cloud, organize access to it through search and recommendation, or install it onto mobile devices*".

[175] Klonick K, The new governors: The people, rules, and processes governing online speech (Harvard Law Review, 131(6), 2018), pp. 1598–1670.

institutions and Member States for the implementation of public policy objectives such as tackling hate speech, online discrimination, fake news, tax avoidance, etc., e.g. with the formulation of the European Code of conduct on countering illegal hate speech online (2016) and the EU Code of Practice on Disinformation (2018).

Co-regulatory processes, such as consultations and regulatory sandboxes, and public hearings to ensure public accountability in sensitive policy areas have become standard practice in the European [176] and US legal systems. In these governance processes, platforms govern and are simultaneously governed [177].

*2.2.4 Platforms as socio-legal institutions*

Platforms are also socio-legal institutions, interpreted through the lenses of legal institutionalism, hence legal regimes. According to the institutional theory, the concept of legal order tallies with that of the institution, in light of the Roman maxim *ubi societas, ibi jus*[178]. Any social body that imposes and conforms to objective rules forms a legal order. The order is based on the society that composes it, establishes objective rules and abides by them. Societal phenomena as organizational, structured, and positioned unities, pre-date legal norms.

[176] The recently approved DLT Pilot and AI Act envision a regulatory sandbox approach for the European Single Market. The Pilot provides firms with certain exemptions from EU financial law to test distributed ledger technologies (DLTs) in trading, clearing, and settlement processes. In addition to facilitating experimentation, the Regulation aims to educate EU regulators about DLTs within this context, laying the groundwork for fundamental revisions to EU law. The AI Act

[177] Gorwa R, What is platform governance? (Information, Communication & Society, 22:6, 2019), pp. 854-871.

[178] Romano S, L'ordinamento giuridico (Quodlibet 2018), pp. 37-39.

In a similar vein, global legal scholars qualified platforms as 'private transnational legal orders'[179] performing public functions[180] traditionally entrusted to nation-states and international organizations. Platforms set their terms of service, content moderation policies, other governance codes and instruments, and conflict resolution bodies. These law-making and law enforcement powers determine and limit the exercise of fundamental rights and freedoms in cyberspace (e.g. freedom of expression, assembly, self-determination, privacy, human dignity, and the right to information and knowledge). Scholars contended that these actions are taken absent constitutional constraints and procedures, raising substantial concerns about their legitimacy and accountability[181]. Other scholars[182] described the reality that it has been up to judicial activism and subsequent regulatory follow-up to put constitutional constraints or counteractions[183] to platform juridical expansionism.

A legal institutionalist point of contention hinges on the legitimacy basis of the platform ordering power. Most platforms have continued to regulate their ecosystems based on the acquiescence of users rather than an *ab origine* genuine informed and expressed consent. Social acceptance of a system of rules cannot be derived from acceptance blinded by informational asymmetry and obedience to unilateral boilerplate conditions. It goes deeper into the intention to be bound

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[179] *ibid.* n. 163.

[180] Brousseau E, Marzouki M, Méadel C, Governance, networks and digital technologies: societal, political and organizational innovations, in Brousseau E, Marzouki M, Méadel C, eds. Governance, Regulation and Powers on the Internet (Cambridge University Press 2012), pp. 3-36.

[181] DeNardis L, Musiani F, Governance by Infrastructure in The Turn to Infrastructure in Internet Governance, Information Technology and Global Governance (Palgrave Macmillan 2016).

[182] For an overview of ECJEU case-law that prepared the ground for regulatory activism: De Gregorio G, The rise of digital constitutionalism in the European Union (International Journal of Constitutional Law, Volume 19, Issue 1, January 2021), pp. 41-70.

[183] Celeste E, Digital constitutionalism: a new systematic theorization (Taylor & Francis in the International Review of Law, Computers & Technology 2019), pp. 76-99.

by the rules and a democratic belief to participate indirectly or directly in rules-forming.

*2.4 Platforms govern society. Can societies and communities govern platforms?*

The extensive integration of platforms into society has gained momentum, to the point that scholars across different disciplines have coined expressions like '*platform society*'[184] or '*platformization*'[185] to conceptualize the domination of platform-based actors in all socio-economic sectors of society and industries. These actors act as gatekeepers not just into markets, but to almost all social, economic, and cultural activities. They interfere with personal and emotional spheres as well as human daily routines and psychology.

The shared concern addressed by most scholars is whether such domination results in technocratic control, administration and surveillance of society by digital platforms, and commodification of *quality* knowledge/information. Scholars, judges and regulators shed light on the informational[186] algorithmic opacity, unveiled platform business secrecy, and advocated for accountability and

[184] Van Dijck J, Poell T, de Waal's M, The Platform Society: Public Values in a Connective World (OUP 2018).

[185] Andersson Schwarz J, Larsson S, A Platform Society, in S. Larsson, & J. Andersson Schwarz eds., Developing Platform Economies: A European Policy Landscape (European Liberal Forum 2018), pp. 114-140; Nieborg DB, Poell T, The Platformization of Cultural Production: Theorizing the Contingent Cultural Commodity, 20 (11) (New Media & Society 2018).

[186] For example, an early stage analysis tracked respondent's browsing behaviour while users navigate platforms' community guidelines, by measure of the amount of time users take, the level of uncertainty they report, and the consistency with which they assess content. "*Preliminary results suggest that platforms with longer community guidelines that require more clicks tend to take more time for users and result in less consistent answers across respondents [..] these findings highlight the broader implications for transparency in content moderation, as they indicate that shorter, more user-friendly guidelines may be able to enhance user comprehension*". Online Talk Series Behind the Scenes – Conversations on Empirical Platform Governance Research: Does the Community Understand the Community Guidelines? Friederike Quint, Yannis Theocharis, Mia Nahrgang, Margaret E. Roberts, Nils Weidmann, Department of Governance, Technical University of Munich (9th July 2024).

transparency frameworks for explainable algorithms and fair machine learning[187]. Algorithmic discrimination is perpetrated and concealed by the intrinsic opacity of black boxes or dysfunctions (e.g. biases and hallucinations) of unsupervised systems, industrial secrecy, lack of skills, or errors made by those responsible for predefining, supervising, and interpreting algorithmic decisions.[188] Added to this, platform operators are in the position to disclose information on users' rights or algorithmic systems selectively, even where required by the law (for instance the European AI Act[189]) and contractual promises in their terms of services.

This big picture compels a reflection on whether this informational and algorithmic asymmetry should be settled with democratic mechanisms of social and community participatory platform governance capable of ensuring that basis of social acceptance that hails from within social and community texture. Diffused 'rules-forming'[190] could be termed the process of co-adapting and -altering the current dominant platform environment, which aseptically treats people as users, consumers, or prosumers, to make it habitable to people as strong, empowered citizens, aware of the vulnerable conditions as humans, in democratic, plural and complex societies.

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[187] Ananny M, Crawford K, Seeing without knowing: Limitations of the transparency ideal and its application to algorithmic accountability (New Media & Society, 20(3) 2018), pp. 973–989. For a critique to the right to explain in the GDPR: Edwards L, Veale M, Slave to the algorithm: Why a right to an explanation is probably not the remedy you are looking for (Duke Law & Technology Review, 16, 2017), pp. 18–84.

[188] Zuiderveen Borgesius FJ, Strengthening Legal Protection agaist Discrimination by Algorithms and Artificial Intelligence (International Journal of Human Rights 2020).

[189] The recently approved (in May 2024) Regulation laying down harmonized rules on artificial intelligence sets out transparency obligations upon providers, deployers and users of certain AI systems. See, for example, Chapter V, Article 50 of the Regulation and Annex III on transparency information to flow into the technical documentation for providers of general-purpose AI models to downstream providers that integrate the model into their AI system.
Regulation of the European Parliament and of the Council laying down harmonized rules on artificial intelligence (Artificial Intelligence Act) and amending certain Union legislative acts, COM(2021) 206 final.

[190] Hinting at 'terraforming', the process of environmental alteration of a planet, satellite or other celestial body to make it habitable for living beings on Earth.

*2.5 Platform governance types*

Platform governance is a stand-alone interdisciplinary strand of academic literature spanning the fields of social sciences, internet studies, and computational science. Three main macro-types of platform governance mechanisms are discernable from the platform governance literature[191]:

- Type 1 is endogenous to the platform ecosystem, i.e. governance by platforms.
- Type 2 is exogenous to the platform, i.e. platform governance by regulation.
- Type 3 is endo-exogenous, i.e. platform co-regulation/co-governance or by platforms and regulation[192].

Type 1 relies on the built-in technological and algorithmic architecture and internal content moderation policies, terms of service, and practices. Type 2 governance hails from public and private regulators on a global, regional, and domestic level that treat platforms as economic operators, actors, guardians of public speech, and market shapers. Type 3 involves forms of cooperation between regulators, platforms, civil society, and, in limited instances, single individuals as in the case of regulatory sandboxes, lobbying and consultations processes prodromic to legislative interventions, voluntary compliance mechanisms, such as the Global Network Initiative principles, industrial partnerships on content moderation, engagement in international governance bodies like the UN High-Level Advisory Body on Artificial Intelligence and similar initiatives.

A type 4 of platform governance is democratic platform governance agreed upon by the wider platform community.

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[191] *ibid.* Gillespie n. 173; Gorwa n. 177; Caplan n. 103.

[192] Albeit regulation and governance do not semantically overlap, the scholarly debate often use them interchangeably.

*2.6 Platforms in Science*

On closer inspection, online platforms are products of collaborative science. Informatic engineers, computer scientists, data scientists, graphic designers, copywriters, content creators and managers, philosophers, lawyers, and users all contribute to their realization. To different degrees, all participants in a platform ecosystem deploy their scientific background in a process of constant upskilling. In this sense, platforms result from combinations of scientifically acquired competencies and practical non-scientific experience.

Members of the scientific system play a central role in conceiving, coding, and developing platforms. Often platforms and the underlying software come out of the ingenuity of research teams in universities and research centers commissioned by public institutions and/or private firms. Even a single or few researchers came up with programming breakthrough platforms for the scientific sector. Facebook originated as a university network coded by Harvard University students to connect university students. Academia.eu was coded by a PhD in Philosophy at Oxford University to offer other academics a personal webpage to upload and share their papers. Open AI was founded by a consortium of researchers, scientists, and entrepreneurs, originally as a non-profit organization dedicated to conducting research on/and advancing artificial intelligence. CORE, the most popular global aggregator of open-access repositories and journals was invented by a then PhD student at the Knowledge Media Institute at the Open University, who devised a tool to harvest both metadata and full text from all research repositories worldwide and enable unrestricted access to all content.

Digital platforms are widely used in the scientific system and serve as collaborative ecosystems. In these ecosystems, scientific data, outputs, and results can be shared, ranked, evaluated, and co-created.

'Platforms in Science' can be distinguished by whether they are online-native or serve as the digital extensions of established print publishing entities. Native platforms can be divided into several categories depending on the services they offer, which sometimes merge into one platform: pre-prints, free access networks, open access libraries, aggregators of open access repositories and journals, data repositories, protocols or code sharing repositories, bibliometrics, and data analysis platforms. Some are independent outlets, others are affiliated with institutions or created in the framework of research and innovation partnerships and consortia gathering several educational institutions, foundations, and private and public entities.

Pre-prints serve the purpose of accelerating the pace of publication and evaluation of early, non-definitive, negative, or otherwise controversial results. In addition, they provide records for priority and attribution of a given scientific result with digital object identifiers (DOIs), and store data and results that may be lost in the reviewing and publishing processes. Pre-prints can be disciplinary, e.g. SSRN Social Science Research Network in social sciences, bioRxiv, and medRxiv respectively for medicine and biology, or multidisciplinary, e.g. Pre-prints.org; institutional, e.g. eScholarship from the University of California or the European Commission's CORDIS - Community Research and Development Information

Service[193], inter-institutional, e.g. SocArXiv, ArXiv[194]; or format repositories, e.g. CORE, BASE, OER Commons.

Amongst the most famous free access networks, Sci-Hub and LibGen stand out. These entities have been engaged in ongoing legal battles across multiple jurisdictions, confronting publishers and publishing consortia who assert intellectual property claims over academic knowledge. The disputes center on the fundamental tension between free access to scholarly work and the commodification of research outputs. The legal debate in courts and papers has therefore centered around the balance between the human right to access knowledge, information, and participation in scientific knowledge, and the copyright of publishers and eventually interested authors. Free access and the different categories of open access libraries will be dealt with more in-depth *infra sub § 3.5.2.*

A type of service that is proving to be critical is the one offered by data repositories for digital objects (digital entities described by metadata and referenced by a persistent identifier)[195] curation and integration. These foundational and critical core resources are widespread in the life sciences (*e.g.* Genbank and Worldwide Protein Data Bank) and in the space sciences (Space Physics Data Facility, Set of Identifications, Measurements, and Bibliography for Astronomical Data)[196].

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[193] The Community Research and Development Information Service (CORDIS) is the European Commission's primary public repository and portal to disseminate information on all EU-funded research projects and their outcomes. CORDIS is designed to facilitate access to and exploit the results of research funded by the European Union.

[194] Since 2016, SocArXiv is an online paper server for the social sciences founded by sociologist Philip N. Cohen in partnership with the non-profit Center for Open Science.

[195] Schwardmann U, Digital Objects – FAIR Digital Objects: Which Services Are Required? (Data Science Journal, 19(1) 2020), p. 15.

[196] Wilkinson MD et al. The FAIR Guiding Principles for scientific data management and stewardship, Scientific Data, 3, 160018 (Nature 2016).

These repositories curate and capture high-value reference datasets, fine-tuning them to enhance scholarly output, support both human and mechanical users, and provide extensive tools for dynamic access to their content. However, not all datasets or data types can be captured by/or submitted to these repositories. Important datasets from traditional, low-throughput bench science do not fit the data models of these specialized repositories, yet they are equally significant for integrative research, reproducibility, and general reuse. In response, numerous general-purpose data repositories have emerged, ranging from institutional scales (e.g. from single universities) to global repositories such as Dataverse, FigShare, Dryad, Mendeley Data, Zenodo, DataHub, DANS, and EUDat. These repositories accept a wide variety of data types and formats, generally do not attempt to integrate or harmonize the deposited data and place few restrictions or requirements on data descriptors. Consequently, the data ecosystem appears to be moving away from centralization, becoming more diverse and less integrated, exacerbating already existing discovery and reusability challenges faced by both human and computational stakeholders.

Even non-purely scientific platforms provide avenues for open science practices. Most scholars regularly publicize their initiatives and outputs on social media, such as Twitter, Facebook, Instagram, and even WeChat or WhatsApp. In conjunction, professional networking and career development platforms like LinkedIn have become the preferred venues for scientific post-publication communication. The existence of such unconventional outlets supports the argument for conceiving of a platform ecosystem for open public and easy-to-read scientific engagement, evaluation and dissemination.

## 5. THE PARADIGMS OF THE OPEN RESEARCH AND INNOVATION ECOSYSTEM

The platform is set to host an open research and innovation ecosystem.

Ecosystem is a scientific term gleaned from biology that refers to "*prototypical examples of complex adaptive systems, in which patterns at higher levels emerge from localized interactions and selection processes acting at lower levels*"[197]. Essential aspects of systems are non-linearity, which leads to historical dependency, multiple possible outcomes of dynamics, and diversity of organisms and species.

From a socio-legal perspective, an open research and innovation ecosystem can be regarded as a complex adaptive system encompassing a multiplicity of normative systems, as if the latter were the organisms constituting the ecosystem's bio-societal diversity, acting at a lower, i.e. local level. Institutional, societal, and individual agents co-evolve, interact, influence, and adapt with one another as organisms do in biological ecosystems[198]. They may choose to cooperate, to compete, or to ignore. All choices, including inaction/inertia, impact one or the other system or over the entire ecosystem's (co-)evolution, affecting and changing the equilibria. This happens in real life. For instance, if prestigious publishers decide to raise the costs of their subscription fees and APC (authors processing charges upon institutions and researchers to publish open access) in

[197] Levin S, Ecosystems and the Biosphere as Complex Adaptive Systems (Ecosystems 1, 1998), pp. 431-436.

[198] The recurrent semantical choice 'eco-system' is drawn from evolutionary biology. Kauffman S, The Origins of Order: Self-organization and Selection in Evolution (OUP 1993), p. 242: "*Ecosystems are not totally connected. Typically each species interacts with a subset of the total number of other species, hence the system has some extended web structure*". "*Each kind of organism has, as parts of its environment, other organisms of the same and of different kinds ... adaptation by one kind of organism alters both the fitness and the fitness landscape of the other organisms*".

transformative agreements[199], universities will federate to increase their bargaining power and lower the costs or may choose to terminate contracts with the publishers. In case contractual negotiations fail, the system will change and be affected in terms of fragmented or decreased knowledge dissemination and access to knowledge inequalities based on the institutional financial capacity. Institutions and researchers may choose to switch to green open-access journals or free-ride and resort to free-riding and - sometimes - copyright-infringing shadow libraries.

The co-evolving normative systems of an open research and innovation ecosystem co-create, co-evolve, transfer, capture, or share the common value generated by their interactions. The normative systems that participate in the ecosystem are the scientific system, in its guise of the primary producer of pure and applied research; the public governmental system; the private institutional-organizational system; the organized civil societal system and the individual-subjective system of a natural person. Added to these, there is a technological normative system that – if interpreted in harmony with Azimov's

[199] Pievatolo MC, Accordi trasformativi: un'offerta che non si può rifiutare? (AISA 2020).

laws of robotics[200] – is susceptible and should be subject to human governance, agency[201], and ethics.

From a legal institutionalist perspective, each of the normative systems may be regarded as legal institutions themselves dominated by a 'super-structure'[202] on which the agents and the interrelations among them depend. In the polity governing and governed by the platform, these superstructures and their agents cooperate to engender innovative policies through open research and innovation practices. This definitional section accounts for the evolution of the *openness paradigm* in its 6 Os manifestations: open innovation; open government; open data; open source; open research; and open society.

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[200] Asimov I, Laws of Robotics (Voyger GB 2018).
Isaac Asimov's Laws of Robotics are a set of three fictional rules that the science fiction author introduced in his 1942 short story 'Runaround' as part of the 'I, Robot' collection. These laws built a moral and operational framework to govern the behaviour of robots within Asimov's stories to ensure ethical and safe behavior of robots towards humans and their environment.
The laws are:
1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.
Asimov's Laws of Robotics have been influential beyond literature, in the fields of ethics, robotics, artificial intelligence and law about how to ensure that increasingly autonomous and intelligent machines act in ways that are safe and beneficial to humanity.

[201] Just like the most authoritative soft law instruments on the Ethics of Artificial Intelligence advance. *Ex multis*, High-Level Expert Group on Artificial Intelligence (AI-HLEG), Ethics Guidelines for Trustworthy AI (April 2019); OECD, The OECD Recommendation on Artificial Intelligence (2019); European Commission, White Paper on Artificial Intelligence – A European Approach to Excellence and Trust COM(2020) 65 final; European Commission, Joint Research center, Glossary of Human-Centric Artificial Intelligence (Publications Office of the European Union, 2022) 32 and Future of Life, General Purpose AI and the AI Act; European Declaration on Digital Rights and Principles for the Digital Decade [2023] OJ C23/1. The 2022 European Declaration on Digital Rights and Principles for the Digital Decade further emphasises the human-centerd approach to digital transformation and data governance.

[202] *ibid.* Romano n 178.

*3.1 The Open Innovation Paradigm*

Since the inception of this millennium, the *open innovation paradigm*[203] has disrupted and dominated the economics and business management academic debate and practice, as a business model based on the circulation of knowledge as an economic resource. The paradigm is expressive of the *Zeitgeist* and economic culture of the contemporary digital epoch. Digital technologies and human digital skills provide basic and advanced tools to augment and disseminate knowledge for innovation. Notably, knowledge is a cumulative good: existing knowledge combined with new knowledge creates value. Hence, knowledge development takes the form of innovative ideas, discoveries, techniques, methods, designs, products, services, technologies, infrastructures *et cetera*. Innovation requires knowledge to proliferate, and innovation propels new knowledge. The knowledge-innovation development movement is non-linear but circular and subject to a continuing trial-and-error process. With his experience in Silicon Valley, Henry Chesbrough - the mastermind of open innovation - brought to the fore the advantageous outcomes resulting from the strategic collaboration between enterprises, including alliances, partnerships, and joint ventures. This collaborative approach is instrumental in the joint creation and development of innovative products, services, and technologies from the supply side of private firms. The kernel of the model is the coupling of so-called 'outside-in' and 'inside-out' open innovation processes to fasten the pace and diversity of innovation, reduce, share, optimize costs and gains, and access new markets and distribution channels. Leveraging external ideas into the company's internal

[203] *Ex multis* Chesbrough H, Open innovation: The new imperative for creating and profiting from technology (Harvard Business School Pres 2003).

innovation processes (outside-in innovation processes) expands the knowledge resources and technology base while accelerating in-company innovation. Channeling internal ideas and technologies to the market through licensing, joint ventures, and spin-offs in turn allows companies to monetize their technology and spur business relations. The openness paradigm stands in opposition to the traditional vertical integration business model where internal research and development activities lead to inwardly developed products distributed by the firm[204]. This model operates mostly in the private organizational system. Along with other actors, including universities and public bodies, private firms trigger "*purposive inflows and outflows of knowledge*" according to capture-oriented business models.

The model rests on the appropriation of knowledge through private and intellectual property rights over the knowledge and technical resources needed to innovate and the final products of innovation to gain the necessary resources to reinvest. Upstream and downstream knowledge is treated as commodities.

Open innovation entails *dominium*, control, and ownership of innovative products and services. Knowledge is captured in know-how, patents, trademarks,, and copyright. In this paradigm, openness is conditioned upon financial and capital capacity and availability, profit-making business models, and competitive or co-op strategies.

From a market-based perspective, the open innovation ecosystem is walled within entry barriers represented by the go-to-market ability of the firms and their capacity to survive in the markets. Once in the market, technological start-ups

[204] Chesbrough brings the examples of AT&T Bell as a closed innovation ecosystem and IBM, Intel, Procter-and-Gamble as open innovation models.

and new entrants are exposed to 'killer acquisitions'[205] from the part of big players. From a holistic societal perspective, open innovation is paradoxically a closed system in that its accessibility is dependent upon the financial capacity to enter the open innovation market dominated by incumbents.

*3.2 Open Government*

Open Government reflects the narrative of evolving democratic ideals of civic engagement accompanied by the progressive acquisition of civil rights and liberties. The historical-philosophical root can be traced to the Enlightenment era permeated by Kant's thoughts on the nexus between publicity (which equates to openness) of power and the formation of public opinion. According to his thought, the visibility of power is a political and moral imperative to enlighten human minds and free them from the "*yoke of immaturity*"[206] that makes them depend on others and passive receivers of commands. Simply put, every concealed exercise of power amounts to injustice, as its publicity would trigger scandal and reaction from those who dissent from the content of the exercise of power.

Even the theories of social contracts lay the foundation of openness in public government, as they are predicated on the ideas of the accountability of the rulers to the governed and the involvement of the 'public' in politics, albeit far from manifesting in the exercise of contemporary democratic rights. That was the era leading to the acquisition of freedom of speech, press, and information in liberal

[205] Cunningham C, Ederer F, Ma S, Killer Acquisitions (Journal of Political Economy, Vol. 129, No. 3 2020), pp. 649–702.

[206] Kant I, An Answer to the Question: What is Enlightenment?, translated by Ted Humphrey (Hackett Publishing 1992).

democracies between 18th and 19th centuries and placed the first stones of what today constitutes the open government architecture.

In hindsight, Open government refers to a contemporary response of governments to increasing demands for transparency and accountability in governance. The fundamental concept originated from the principal-agent theory[207], which posits that legislators and bureaucrats (agents) are unlikely to be answerable to voters (principals) unless the latter possess sufficient information regarding the conduct of the former. This theory presupposes that ordinary voters, particularly those from lower socio-economic backgrounds, harbor a distaste for public corruption and desire impartial service delivery.

The concept of Open Government was popularised by the Obama administration's Open Government Directive in 2009, which was designed to implement "*the principles of transparency, participation, and collaboration*" that underpin his administration. In practice, the directive ordered the executive branch agencies to "*publish information online in an open format [..] that is platform independent, machine-readable, and made available to the public without restrictions that would impede the reuse of that information*."

A more generic and political definition of open government is offered by the OECD[208], which framed it as "*a culture of governance based on innovative and sustainable public policies and practices inspired by the principles of transparency, accountability, and participation that fosters democracy and inclusive growth*.". The focus is on the same

[207] Brandsma GJ, Adriaensen J, The Principal–Agent Model, Accountability and Democratic Legitimacy, in Delreux, T., Adriaensen, J. (eds) The Principal Agent Model and the European Union (Palgrave Studies in European Union Politics 2017).

[208] OECD, Open government. The Global Context and the Way Forward (OECD Publishing 2016).

principles with an emphasis on institutional participatory democracy on the assumption that civil and civic societies should contribute to public policy[209].

As suggested by Yu and Robinson[210] , the political and institutional principles and practices of open government and its technological profile should be neatly separated. The latter shall be more accurately named *open government data*. Governments can be transparent and accountable without necessarily having adopted new technologies and offering open data. Conversely, they can open up machine-readable data, while lacking transparency and accountability in highly sensitive political issues, i.e. corruption and press freedom[211]. Open government has thus two-fold nuanced consequences. Openness on the one hand addresses participation in/transparency and accountability of government action. On the other hand, information may be open without serving actionable democratic policies.

In the European continent, an open government model was early adopted by Scandinavian countries and Denmark, where access to official documents was qualified as a natural right in all "*civilized societies*"[212]. To align with that tradition and respond to a lack of accountability and democratic deficit perceived by the Member States, between the 90's and the 00's, the European institutions took openness and transparency of decision-making and access to official documents

[209] Open Government has emerged as a global transformative governance model with the establishment of the Open Government Partnership and the Extractive industries transparency initiative.

[210] Yu H, Robinson DG, The New Ambiguity of "Open Government" (University of California La Review Discourse 178, 2012).

[211] *id.* The authors provide an example: "*The Hungarian cities of Budapest and Szeged, for example, both provide online, machine-readable transit schedules, allowing Google Maps to route users on local trips. Such data is both open and governmental, but has no bearing on the Hungarian government's troubling lack of accountability. The data may be opening up, but the country itself is "sliding into authoritarianism.*"

[212] Curtin D, Meijers H, The principle of open government in Schengen and the European Union (Comm. Market Law Rev. 32, 1995), pp. 391–442; Grønbech-Jensen C, The Scandinavian tradition of open government and the European Union: problems of compatibility? (Journal of European Public Policy, 5, 1998), pp. 185-189.

on board, adopting a code of conduct and a series of binding decisions and regulations.[213]

In the last two decades, the European Union has interpreted open government as synonymous with 'open government data' and has been proactive in releasing data with public sector entities. At first, the European Commission set a precedent by adopting policies on the reuse of data accrued from its activities and initiated the open data agenda with the Communication from the Commission 'Open data: An engine for innovation, growth, and transparent governance'[214].

*3.3. Open data*

The old continent boasts a record of publicly led open data initiatives and an evolving regulatory framework that is gradually expanding to encompass cross-sectoral, cross-institutional, and cross-societal open data flows.

Even before the launch of the EU Open Data Agenda, the EU institutions had established foundational guidelines for public sector information (PSI) reuse across Member States with the PSI Directive[215]. This piece of legislation was revised in 2013 and centered around the '*open by default principle*', according to which public sector data should be made accessible for public reuse, except in cases contrary to legitimate justifications. In addition, the revised PSI reduced

[213] Driessen B, Transparency in EU institutional law. A practitioner's handbook (Kluwer Law International 2012).

[214] European Commission, Open data: An engine for innovation, growth, and transparent governance, COM(2011) 882 final.

[215] Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the reuse of public sector information [2019], OJ L 172. "*Public sector information, sometimes also referred to as government data, refers to all the information that public bodies produce, collect or pay for. Examples are geographical information, statistics, weather data, data from publicly funded research projects and digitized books from libraries*". (Commission, Digital Agenda for Europe, 2013). Like today, the policies rested on the premise that the reuse of this type of data generates value on the economy and society.

fees for access and reuse, extended the scope of application to cultural institutions, and identified five priority domains for release (geospatial data, earth observation, environmental, transport, statistical, and company data)[216].

The primary outcome of the project was the establishment of governmental open-source data portals. European public administrations set up cross-domain and horizontal open data portals to the foundation of a European open data ecosystem[217]. However, several limitations emerged due to Europe's political and cultural diversity, multilingualism, and choice of different standards for semantics, data formats, licenses, metadata, and quality standards. Diversity, while being the wealth of the European cultural *humus*, complicated the development of coordinated and interoperable portals and resulted in operational fragmentation, duplication of information, inconsistencies, and limited dataset discovery.[218]

As a part of the EU Open Data policy, the Open Data Directive[219] updated the PSI framework as concerns the conditions under which public sector data should be made available for reuse, with a particular focus on the increasing amounts of

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[216] Carrara W, Dekkers M, Dittwald B, Dutkowski S, Glikman Y, Loutas N, Peristera V, Wyns B, Towards an open government data ecosystem in Europe using common standards, European Data Portal (ISA program 2017).

[217] *id.* "*Open data portals are online platforms which maintain a data catalogue including a collection of datasets made available by data publishers. Data portals make the description metadata of the datasets in their collection freely available to third parties. In addition, data portals may also make collections of relevant datasets of other data portals searchable via their user interface.*". An EU-wide open data portal is data.europa.eu, the official portal for European data, providing access to public data resources from European Union institutions, agencies, and bodies. It combines the functionalities of the European Data Portal and the EU Open Data Portal to offer a comprehensive data service. To monitor the state-of-the-art, every year the European Commission's Directorate General for Communications Networks, Content and Technlogy prepares the Open Data Maturity Report in which assesses the level of open data maturity across European countries, provides insights and benchmarks.
CROWD4SD is an EU project focusing on the use of citizen science and open data to achieve the Sustainable Development Goals (SDGs), that encourages citizen participation in data collection and analysis to address local and global challenges.

[218] *ibid.* 219.

[219] Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the reuse of public sector information, OJ L 172. The Open Data Directive entered into force on 16 July 2019 and the Member States will have to transpose it by 16 July 2021.

high-value data that is now available. According to the Open Data Directive, open data is "*data in an open format that can be freely used, reused and shared by anyone for any purpose*", "*for private or commercial purposes, with minimal or no legal, technical or financial constraints, and which promote the circulation of information not only for economic operators but primarily for the public*"[220]. Open data spans from anonymized personal data (in full compliance with the GDPR) on household energy use to information on national education or digital literacy. The Directive sets forth a positive obligation upon Member States to make all existing documents held by public sector bodies, public undertakings, and all data hailing from publicly-funded research '*as open as possible as closed as necessary*'. This means that public data shall be accessible and re-usable, unless *proportional* restrictions or exclusion from access are justified under national laws on documentary disclosure or subject to public interest exceptions, such as public security reasons, including sensitive critical infrastructure information. Public authorities may restrict the availability of public data by including conditions in standard licenses related to the reuse by the licensee. These conditions address issues such as liability, protection of personal data, proper use of documents, and ensuring non-alteration and acknowledgment of the source. Article 8 of the Open Data Directive stipulates that such conditions must be "*objective, proportionate, non-discriminatory, and justified on grounds of a public interest objective*". The Directive applies only to public sector bodies and public undertakings.

As the global economy began to pivot towards a data economy and a data-driven society, European institutions saw data flows and exchanges as the boons for competitiveness in the single market. In the framework of the European Strategy

[220] Recital 16.

for Data launched in 2020[221], the Commission proposed the creation of common European Data Spaces, collaborative and interoperable data-sharing ecosystems in strategic sectors and domains of public interest (Industries, Green Deals, Health, Mobility Finance, Energy, Agriculture, Public Administration, European skills). To this end, the European co-legislators have recently approved two milestone regulations: the Data Governance Act and the Data Act.

#### *3.3.3.1 The Data Governance Act*

The Data Governance Act[222], in force since September 2023, will become effective in December 2024 to give Member States and operators time to adapt their internal laws and practices to its complex architecture. For the purposes of this study, it is worth highlighting the data governance structure and actors, and those aspects that are most relevant to an open research and innovation ecosystem, such as the platform to be designed.

The Regulation promotes a dual model for data sharing which envisages both commercial (data in exchange for fees) and altruistic exchanges (voluntary data donation). It establishes different legal regimes depending on whether the data is publicly or privately held, commercially or altruistically offered.

As for the reuse of publicly held data, this shall be protected data, as it would otherwise fall within the purview of the Open Data Directive. Protected data covers personal data, intellectual and industrial property rights, as well as commercial, professional, and statistical confidentiality rights. This data may well

[221] *ibid.* 24.

[222] Regulation (EU) 2022/868 of the European Parliament and of the Council of 30 May 2022 on European data governance and amending Regulation (EU) 2018/1724 (Data Governance Act), OJ L152/1.

be beneficial for research purposes, more informed, evidence-based policymaking, and open innovation in the private sector.

Public sector bodies are not exempt from GPDR compliance requirements. They will have to warrant data privacy and confidentiality safeguards through the now standard technological and legal solutions such as anonymization, pseudonymization, secure data rooms to access data, and confidentiality agreements concluded with the reuser.

To hamper the possibility of entering exclusive data reuse agreements with a data user, e.g. a company, the DGA foresees public interest objectives, critiqued for terminological vagueness[223]. While fees are regularly charged in public data reuse agreements, in case the data user or reuser pursues non-commercial purposes, i.e. scientific research or business development of SMEs and start-ups, public sector bodies may make data available at a discounted fee or free of charge. This marks an important achievement for the encouragement of open research practices.

When it comes to private data, the Regulation introduces the most significant novelties. It creates new actors entrusted with a neutral intermediation role between individuals, companies, and data users. These are the so-called data intermediation services that provide "*a service which aims to establish commercial relationships for the purposes of data sharing*". These providers will be authorized and supervised by national competent authorities (NCAs), and operate in an extended platform ecosystem relying on databases for the exchange and joint use of data and an infrastructure to interconnect data holders with operators and users. The NCAs will be responsible for ensuring that exchanges are subordinate to consent

[223] Casolari F, Buttaboni C, Floridi L, The EU Data Act in context: a legal assessment (International Journal of Law and Information Technology 2024).

by data subjects and rights holders, and technical measures such as anonymization, pseudonymization, secure storage, curation, and security of data and systems in interoperable formats.

To avoid abusive conduct and conflicts of interest, data intermediation services must guarantee full independence even where they are incorporated within an organization. They cannot make adherence to commercial contractual terms for their services dependent on the use of other services from related entities.

Next to the commercial approach, the EU Data Governance Act embraces a non-profit model embodied by the new figure of data altruism organizations. Like the data intermediaries, they will be registered, authorized, and supervised by the NCAs. They should be non-profit organizations that might be part of a wider organization as functionally separated entities. Such organizations collect and share data voluntarily offered by data subjects and holders who decide to make their data available for altruistic purposes and objectives of general interest. The latter amounts to any research and policy objectives such as improving traffic and mobility, air quality, and environmental and public health. This novelty has been pushed for and applauded by activists and scientists, especially those engaged in the bio-medical field. In certain instances, the impossibility of voluntary donations of medical data had been contested as such data holds immense value for advancing scientific research, and individual private autonomy contributing to science shall be prior.[224]

From a technological standpoint, the Regulation envisages the creation of data altruism pools for data analytics and machine learning, organizational and

[224] Krutzinna J, Floridi L, 'Ethical Medical Data Donation: A Pressing Issue' in Jenny Krutzinna and Luciano Floridi (eds), The Ethics of Medical Data Donation (Springer 2019).

technical arrangements to ensure consent of rights holders and structured data exchange between public authorities for public policy design. For standardization, interoperability, and exchange of national best practices and oversight of implementation, the Regulation sets up an EU-wide body of representatives, named the EU Data Innovation Board, tasked with providing interoperability standards, promoting the exchange of national best practices, and overseeing the consistent implementation of the Regulation.

The European Data Innovation Board has several key responsibilities in supporting data innovation across Europe, ranging from coordinating national policies and practices related to data regulation, supporting cross-sector data usage through standardization and interoperability frameworks, developing technical and legal standards for data transmission between processing environments, working with sectoral organizations on data reuse, helping develop consent forms for data altruism initiatives, and creating guidelines for European data spaces to strengthen the European data economy (Recital 54 of the DGA).

The Board will operate within existing frameworks like the European Interoperability Framework and collaborate with various standardization platforms and stakeholders, including the European Data Protection Board.

*3.3.1.2 The Data Act*

In January 2024, the EU Data Act (DA) entered into force and will be applicable from September 2025. This Regulation establishes a harmonized contractual framework for fair IoT-generated data access and use, and a cloud standardization and interoperability framework, including so-called cloud contracts. Data sharing contractual schemes will apply to business-to-business

(B2B), business-to-consumer (B2C), and, subject to the pursuit of specific objectives of public interest, business-to-government data transactions (B2G, with the "G" to be indented as indicating the public sector at large). These rules clarify fair and non-discriminatory data usage and sharing conditions, empower users of IoT products to access the data they generate, e.g. from vehicles or domotic devices, and make this available to other societal actors for all possible uses in business and research contexts. In some cases, B2B data sharing is mandatory; [225] data holders may request reasonable compensation except when the data recipient is a non-profit research organization, micro-companies and SMEs. The regulation introduces legal certainty through safeguards against/and a list of unfair contractual terms to protect businesses, especially small ones. When there is an exceptional public interest, e.g. research purposes, official statistics, and a public emergency (e.g. floods, major cybersecurity incidents), private entities are compelled to share both non-personal and personal data without undue delay, provided consent and data sanitization techniques are warranted. If data is needed to discharge a public task, public entities may request access to privately held IoT-generated data. Research funding and research-performing organizations amount to public bodies in B2G data-sharing schemes.

Data processing services customers, including currently monopolized cloud and edge services, will be able to switch providers for free and swiftly by 2027, avoiding vendor lock-in. To this end, the DA contains provisions on contractual transparency to balance the negotiating power between providers and customers

[225] Users, both individual and business, of connected devices are entitled to access and share data generated from their use of these devices (e.g., vehicles, home equipment) and associated services. Manufacturers are obligated to design these connected devices and related services in a manner that facilitates the exercise of these rights. Data holders (i.e., manufacturers) may withhold or suspend data sharing if it threatens the confidentiality of trade secrets. Additionally, they may refuse access to their data on a case-by-case basis.

and mandates that data providers comply with essential requirements, which may be crucial to operationalizing interoperable European Common Data Spaces for research and innovation purposes (Art. 33 of the DA on interoperability). For example, descriptions of data structures, formats, and semantics will have to be made public. Data-sharing techniques will become interoperable through data-sharing agreements, including in the form and efficiency of smart contracts[226]. In this specific regard, it establishes requirements for vendors of smart contracts to automate the execution of data-sharing agreements, ensuring that they accurately fulfill the provisions of the agreements and resist third-party manipulation. The Commission is evaluating obstacles to interoperability, and prioritizing standardization needs in delegated acts. Based on this evaluation, it may request European standardization bodies to develop harmonized standards that meet the specified requirements. Standards and interoperability are essential to enable the use of data from various sources within and between Common European Data Spaces. This integration facilitates research and the development of new products or services. The Data Act further safeguards against unlawful international data transfers.

*3.4 Open source*

Between the late '80s and the early 1990s, the Internet emerged as a platform for collaborative efforts for informatic developers. In 1991, a Finnish developer established an Internet newsgroup dedicated to software development open to

[226] Defined in the Data Act as "*computer programs on electronic ledgers that execute and settle transactions based on pre-determined conditions. They have the potential to provide data holders and data recipients with guarantees that conditions for sharing data are respected.*".

all: Linux. Then, integrated with the preceding work of the free software GNU[227], Linux was the first entirely non-proprietary operating system created by a virtual community of developers. In parallel, a deluge of development and distribution communities mushroomed[228]. Development communities flourished with free and open software gaining significant popularity among digital native generations. Today's internet software infrastructure is based on Free/Libre and Open-Source Software (FLOSS)[229] collectively shared and improved on GitHub[230][231] and other platforms for version control and collaborative coding rules and practices. A global open collaborative AI developing community is growing within GitHub and other AI model hosting intermediaries known as model marketplaces[232] (e.g. the New York-based start-up Hugging Face). While using open-source licenses, they are tainted by serious content moderation scandals and regulatory uncertainty on liability for content[233].

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[227] The GNU project was founded in 1984 by Richard Stallman, a programr from the Artificial Intelligence Lab of the MIT to counter the process of privatization of software which considered as a threat on freedom of expression. It resulted in the creation operating system made entirely of free software.

[228] For instance, the Debian community in 1993, which adhered to a 'social contract' to guide their methodologies.

[229] Weber S, The success of open source (Harvard University Press 2004). As Fuster Morell explains "*The distinction between free and open software is [..] of two different ideological approaches. Whereas free software emphasizes the liberty free softwares give users, open instead emphasizes productive efficiency and business models based on open collaboration*". See Fuster Morell M, Governance of online creation communities: Provision of infrastructure for the building of digital Commons (Dphil thesis, European University Institute 2010); Stallman RM, The free software definition, 1996. Retrieved from http://www.gnu.org/philosophy/free-sw.html.

[230] GitHub enables users to host code repositories, 'fork' and modify others' repositories, and facilitate project collaboration through version control tools. Launched in 2008, it quickly gained popularity for source code management and software development. Microsoft acquired it in 2018.

[231] GitHub is widely used for teaching and research purposes in the academia. It serves as a valuable tool for code management in scientific research, transparency and reproducibility of results. It has become part of educational curricula in the field of computer science and engineering.

[232] "*Model marketplaces are a new form of user-generated content platform, where users can upload AI systems and AI-related datasets, which in turn can be downloaded, and depending on the business model, queried, tweaked, or built upon by other users.*". See Gorwa R, Vaele M, 'Moderating Model Marketplaces: Platform Governance Puzzles for AI Intermediaries' 16(2) (Law Innovation and Technology 2024), p. 4.

[233] On the incompatibility between the DSA, AI ACT and AI model intermediaries liability, *id.* pp. 17-19.

Out of these open-source communities grew a transnational normative entity, the Open-Source Initiative, a Californian public benefit non-profit corporation founded in 1998, that acts as a standard-setting and rules-making body. The Open-Source Initiative approved a license trademark and program that traced a nexus of trust for cooperation between developers, users, corporations, and governments.[234]

The open-source movement highlighted what academics called the digital commons movement[235], a social, collective, bottom-up, then institutionalized movement governing the (re)production of resources on the Web: data, information, culture, and knowledge co-created and/or maintained online[236]. Linked to this is the counteraction movement promoted by a group of American legal academics during the 1980s and 1990s to express concern over the growing influence of Intellectual Property (IP) in a neoliberal knowledge marketplace. Motivated by the desire to safeguard creativity and the public domain, these

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[234] https://opensource.org/osd. A summary of the requirements additional to accessibility of the source code of an open source software follows. Free Redistribution: The license must allow anyone to sell or give away the software as part of a larger distribution without charging royalties. Source Code: The software must include source code and allow for its distribution. If not included, there must be a way to obtain it for no more than a reasonable reproduction cost, preferably free via the Internet. The source code must be the preferred form for making modifications. Derived Works: The license must permit modifications and derived works, allowing them to be distributed under the same terms as the original software. Integrity of The Author's Source Code: The license can restrict modified source-code distribution only if it permits patch files for modification. It must allow distribution of software built from modified source code and may require derived works to have different names or version numbers. No Discrimination Against Persons or Groups: The license must not discriminate against any individual or group. No Discrimination Against Fields of Endeavor: The license must not restrict the use of the program in any field, such as business or genetic research. Distribution of License: The rights attached to the program must apply to all recipients without needing additional licenses. License Must Not Be Specific to a Product: The rights must not depend on the program being part of a specific software distribution and should be applicable even if the program is extracted and distributed independently. License Must Not Restrict Other Software: The license must not impose restrictions on other software that is distributed alongside the licensed software. License Must Be Technology-Neutral: The license must not be dependent on any specific technology or interface style.

[235] Stalder F, Digital Commons in Hart, Keith, Laville, Jean-Louis, Cattani, Antonio David (eds). The Human Economy: A World Citizen's Guide (Polity Press 2010).

[236] Dulong de Rosnay M, Stalder F, Digital commons (Internet Policy Review, 9(4) 2020).

scholars led the development of the Creative Commons (CC) licenses. Creative Commons licenses facilitate the sharing and adaptation of creative works and promote online collaboration and innovation.

Currently, two phenomena threaten the open source movement: enclosure of originally open-source software and tools, and barriers posed to open source by protectionist states in international trade. As for the first issue, open-source software languages and protocols haling from collaborative research work can fall in the lure of enclosure and be trapped in proprietary business models. An emblematic example is the start-up that has launched the most advanced and lucrative generative AI language models: Chat GPT (Generative Pretrained Transformer) from OpenAI. In origin, OpenAI offered its codes and protocols to the public open-source to involve developers and researchers in AI systems growth, in line with its initial non-profit and research-oriented vocation. As the research and the business advanced, OpenAI reserved access and development of codes and training models to its technological asset for its team and selected collaborators under restrictive licenses or controlled API access to ensure alignment with the company's values and safety concerns.

In international trade, recent trade agreements[237] incorporate specific provisions related to source code, namely the lines of code behind every software product and service[238]. These provisions prohibit governments and their agencies from requiring the transfer of, or access to, source code. Software is becoming

[237] e.g. the US–Japan Digital Trade Agreement (US–Japan) (2019)32; the United States–Mexico–Canada Agreement (USMCA) (2018)33; the EU–Japan Economic Partnership Agreement (EU–Japan) (2018)34; the EU–UK Trade and Cooperation Agreement (EU–UK) (2020)35; the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) (2018).

[238] Dorobantu C, Ostmann F, Hitrova C, Source code disclosure: A primer for trade negotiators, in I. Borchert & L. A. Winters (Eds.), Addressing Impediments to Digital Trade (CEPR Press 2021), pp. 105-140.

increasingly important in addressing questions of regulatory compliance and legality, as its use spans virtually all sectors and, as real-life cases testify, may impair fundamental rights and even threaten human lives (e.g. computer-controlled medical devices). As software usage expands in products and services, regulatory and judicial authorities in various countries are frequently required to determine whether the software meets regulatory or legal standards. Thorough assessments often necessitate source code analysis, and accessing the source code may be more cost-effective and straightforward than other techniques. Consequently, governments might establish rules and frameworks to ensure relevant authorities and associated actors can access source code for compliance and legality assessments. Requirements for *ex-ante* regulatory approval or independent conformity assessments for certain products, services, projects, or processes are well-established in many jurisdictions. For instance, medical devices and vehicles must undergo independent assessments and obtain regulatory approval before entering the market. Depending on the context, these assessments and approvals may be conducted by regulatory authorities themselves or through delegated certification schemes administered by accredited organizations. Software may be subject to *ex-ante* regulatory approvals or conformity assessment requirements when it is part of products, services, or processes that are themselves subject to regulatory approvals or conformity requirements, such as cars, medical devices, or voting machines, or where software is a standalone product or tool that requires regulatory approvals or assessments on its own, such as software for interpreting CT scans or models used by financial institutions to calculate capital requirements.[239]

[239] *id.* Dorobantu et al.

*3.5 Open Research*

Open research is a broad term that encompasses open scientific practices and policies (*3.5.1*), the bottom-up mobilization movement and institutionalization of Open Access (OA) (*3.5.2*), and the new transnational regulatory domain known as Open Science, which originated in recent years (*3.5.3*).

*3.5.1 Early open access scientific practices and policies*

Some retrace the introduction of open scientific data in the public discourse to the open data policy adopted by NASA in its 1970s satellite programs. NASA exported its open scientific data standards by requiring partners in international scientific collaborations to adhere to its open data policy. NASA's international agreements with international partners required the sharing of data in a NASA-predefined format.

In a report published in 1995 by the National Academy of Sciences (NAS) titled 'On the Full and Open Exchange of Scientific Data', the academy elaborated on the idea of sharing data from environmental monitoring satellites. "*International programs for global change research and environmental monitoring crucially depend on the principle of full and open exchange. [..] Experience has shown that increased access to scientific data, information, and related products has often led to significant scientific discoveries and the opportunity for educational enhancement.*"[240].

Another case in point concerns the field of international genetic research, where the principle of open scientific data has been a precursor of subsequent applications in the life sciences. The case of the Human Genome Project, the

[240] US NATIONAL RESEARCH COUNCIL, On the Full and Open Exchange of Scientific Data (Apr. 3, 1995).

international public research project (1990-2003), identified the sequence of nucleotide base pairs that make up human DNA and mapped over 20,000 genes of the human genome. The results of this breakthrough project and the ensuing open international sharing have been crucial to studying genetic predisposition to diseases and advanced subsequent biotechnological and pharmaceutical research for therapies and treatments. Open academic conferences, open-source programming, and the development and sharing of data analysis tools were central to achieving the completion of the project before private-sector competitors.

On the other side of the Atlantic, years before, in 1953, the founding Convention of the European Organization for Nuclear Research (commonly known by its French acronym, CERN) set clear the purpose of collaborative and open research in the nuclear research field. Its Article 2 ("Purposes") reads: "*The organization shall provide for collaboration among the European States in nuclear research of a pure scientific and fundamental character, and in research essentially related thereto. [..] the results of its experimental and theoretical work shall be published or made generally available.".*

CERN is also the institution that developed the World Wide Web (WWW) software and put it in the public domain in 1989. The WWW project provided clear indications of its commitment to open science, as evidenced by the definition of the World Wide Web on the first webpage: "*a wide-area hypermedia information retrieval initiative aiming to give universal access to a large universe of documents*"[241].

In particular, the Web "*was originally conceived and developed to meet the demand for automated information-sharing between scientists in universities and institutes around the*

[241] https://info.cern.ch/hypertext/WWW/TheProject.html

*world*" explains CERN's website[242]. Open access to knowledge hailed from a scientific initiative to make the products of science universally accessible. The birth of the Web coincides with the first attempt to spread open scientific practices by exploiting the intrinsic advantages of distributed technology. The 'donation of the Internet' was the first act of open science in an institutional setting liaising the scientific, the public inter-governmental, and, by extension, all other societal systems. From that moment on, the Internet hosted the evolution of open science practices. The very existence of a place-not place to share bits of information, documents, and data without borders paved the way for the emergence of bottom-up digital collective action both from within and outside the scientific system.

*3.5.2 From the shadow libraries up to the institutionalization of OA*

Within the scientific system, free and open access movements relating to the open access limb of open science emerged. Among many revolutions, the union of science and technology made the access revolution possible[243]. Free access unfolded in the so-called 'shadow libraries' which represent the ultra-legal, radical, and potent collective reaction by intellectuals around the globe to the inequalities of scientific knowledge access and circulation against commercial paywalls and

[242] https://home.web.cern.ch/science/computing/birth-web .

[243] "*Digital technologies have created more than one revolution. Let's call this one the access revolution*". Suber P, Open Access (MIT Press 2012).

copyright enclosure.[244][245] Rather than open access advocacy, their mission leans toward attaining a common good identified in the free access to scientific and non-scientific cultural resources. Empirical studies showed that, despite the ecumenical vocation, the users of shadow libraries are highly educated and proficient online users from high-income countries[246].

With their anti-conformist, fringe, and rebellious aesthetics, they operate on the edge of legality but do not always break the law. Emerging from the underground of the scientific system and operating independently from the existence of a legally registered entity, a shadow library complies with IP laws, when it indexes and distributes papers and databases authored by the uploader(s), under a Creative Commons license or any other license that implies consent of the author(s)[247]. *Vice versa*, failing similar licenses and consent of the authors or where shadow libraries adopt commercial business models making profit out of advertisement or subscription fees, there is no room for doubts about their illegality.

Despite the substantial differences, shadow libraries share common features. They are built on digital decentralized infrastructures: digital archives and

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[244] Karagianis J, Bodó B, Shadow Libraries: Access to Knowledge in Global Higher Education (MIT Press 2018).

[245] The issue with the scientific publishing translates into a bundle of paradoxes. Prestigious scientific publishers raise financial barriers in the form of subscription fees (paywalls), where access is given only to those institutions and researchers that can afford unilaterally imposed stiff prices (pay to access, to read). Open access journals charge article processing fees on the shoulders of researchers and their institutions of affiliation (pay to publish) with embargo periods for publication. Both costs can be imposed such as in hybrid journals (double-dipping). In other words, those who create science bear the financial burden to access it and open the access to others in a system that does not reward the endeavors made behind and throughout the editing and publication processes (drafting, reviewing and editing).

[246] Bodó B, Antal D, Puha Z, Can scholarly pirate libraries bridge the knowledge access gap? An empirical study on the structural conditions of book piracy in global and European academia (PLoS ONE, 15(12), 2020).

[247] Dulong de Rosnay M, Open Access Models, Pirate Libraries and Advocacy Repertoires: Policy Options for Academics to Construct and Govern Knowledge Commons (Westminster Papers in Communication and Culture 16(1) 2021), pp. 46-64.

databases, created, maintained, and used by members of the wide global scientific community. The services provided range from free access to journal articles and books (Sci-Hub approximately 88 million products), peer-to-peer file-sharing of academic and non-academic book articles (e.g. LibGen 3.2 million), audiovisual materials, artworks, fiction and poetry (e.g. UbuWeb); collaborative platforms similar to Wikipedia with an encyclopaedical and indexical-curational mission (e.g. Monoskop).

Common to this decentralized database infrastructure is the accessibility from different domains, the so-called 'mirror websites' and protocols (e.g. InterPlanetary File System and BitTorrent). They do not have a sophisticated organizational structure and rather constitute forms of librarianship. Developers and contributing users manage, index, curate, and share content[248]. While they are widely used by researchers, academics, and intellectuals worldwide, their survival is undermined by the proliferation of lawsuits brought against them by guilds and representatives of publishers and authors. The most recent legal cases concern Z-Library and Sci-Hub. Following a complaint on counterfeiting and piracy charges to the US Trade Representative office from the US Authors Guild, Z-Library has been subject to investigation, and its domains seised US FBI and US Attorney's Office for the Eastern District of New York, leading to its shutdown by the US Department of Justice in November 2022. Sci-Hub has been involved in several lawsuits in the US jurisdiction over the years and recently in India.

[248] Mars M, Medak T, Against innovation: Compromized institutional agency and acts of custodianship (Ephemera Theory and Politics in Organizations 2019).

In parallel to the shadow library phenomenon and for the same sake of opening access to scientific knowledge to the public, the open access movement originated from spontaneous initiatives of members of the scientific system. The bottom-up movement that led to the institutionalization of Open Access from a set of practices to a fully-fledge policy saw the light in the early '00s in North American and European universities, with the Budapest[249] and Berlin[250] declarations as well as the Bethesda Statement on biomedical research. It grew as a web of coalitions and partnerships between the social actors of the scientific system (single researchers and academics, research institutions, universities, libraries *et similia*). Vocationally integrated with the open culture, wiki-culture, and open-source software movement, the open access movement has been extensively studied by commoners, where scientific knowledge is conceived as a common pool resource, whose production, use, management, and preservation follows "*an institutional approach"*. To do so, national research agencies, universities, and other organizations created their own institutional or interinstitutional repositories for pre-prints, scientific data, definitive publications, and, more rarely, other research results (negative and partial) that may add building blocks to the research project they are part of or create synergies with other projects.

A different kind of open access initiative sprung up from single researchers who devised platforms such as Academia.eu, originally conceived as a platform to offer a one-click way of creating a researcher homepage or profile to upload papers. Today it hosts several free and premium services and has become a commercial business (hence enclosed). The open access movement resulted in

[249] Budapest Open Access Initiative (2002).

[250] Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities. Max-Planck-Gesellschaft (2003).

the emergence of several repositories and journals organized in centralized online platforms and the partial adaptation and transitioning of conventional journals to open access.

The social dilemma of unequal and inequitable access to/and production and circulation processes of scientific knowledge is due to the dominating exclusionary and proprietary editing and publishing commercial business model[251], enclosing the research cycle. The open access movement has long focused on access to definitive (e.g. journals, monographs, books) and quasi-definitive (pre-prints) *products* and neglected the wealth of research data (including surveys, questionnaires, statistics, methods, bibliographies) that, if made open from the outset, speed up research processes and make them more efficient and transparent, allowing for reproduction and quality and impact control. The quality crisis in scientific research manifests in data unreliability, experimental results irreproducibility, fraud, conflicts of interest, and the failure of the peer-review system[252]. Studies on data falsification and scientific results irreproducibility highlighted that up to 80% of articles published in scientific journals are affected[253].

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[251] Larivière V, Haustein S, Mongeon P, The Oligopoly of Academic Publishers in the Digital Era (PLoS One 10 2015).

[252] Funtowicz SO, Ravetz JR, Peer Review and Quality Control, in James D. Wright (editor-in-chief), International Encyclopedia of the Social & Behavioral Sciences, 2nd edition, Vol 17 (Elsevier 2015), pp. 680–684.

[253] Ioannidis JPA, Why Most published Research Findings Are False (PLoS Medicine 2005), p. 8; Hardwicke, TE, Wallach JD, Kidwell MC, Bendixen T, Crüwell S, Ioannidis JPA, An empirical assessment of transparency and reproducibility-related research practices in the social sciences (2014–2017) (Royal Society Open Science 2020). "*Our empirical assessment of a random sample of articles published between 2014 and 2017 suggests a serious neglect of transparency and reproducibility in the social sciences. Most research resources, such as materials, protocols, raw data and analysis scripts, were not explicitly available, no studies were pre-registered, disclosure of funding sources and conflicts of interest was modest, and replication or evidence synthesis via meta-analysis or systematic review was rare.*".

### *3.5.3 Open Science: a set of socio-technical practices and a multi-level regulatory framework*

Open Science is simultaneously a set of practices enabled by technological instruments to democratize scientific conduct and a brand-new global policy framework. In this first sense, open science represents the expansion of open access beyond the dissemination processes towards data-driven scientific knowledge co-creation, stewardship, transparent evaluation and collaboration, wider societal participation in scientific projects, and improved quality and social impact of science. On the other hand, it refers to the corpus of international, supranational, and national regulations on scientific conduct that have emerged in the last two decades.

#### *3.5.3.1 A set of socio-technical practices*

Open Science as a set of socio-technical practices[254] is enabled by the interaction between scientists, technologists, and any interested parties with Web-based data-driven technologies that make scientific research results and processes universally accessible, available, reusable, reproducible throughout the entire research cycle, and beneficial to everyone in society.

The wide range of practices can be systematized in groups in light of their purpose.

The first group encompasses those open-access practices sharing the purpose of granting *everyone* the substantial right to have access to scientific outputs at any

[254] The expression "sociotechnical practices" refer to the interplay between social phenomena (human behavior, organizational culture, societal norms) and technological components (machines, networks, systems) in various settings. These practices recognize that technical systems and social systems are deeply intertwined and that changes or developments in one aspect invariably affect the other.
The term has been coined by the academic strand of science, society and technology studies that explore how technological developments influence societal structures and relationships, and *vice versa*, emphasizing that technology and society cannot be understood in isolation from each other.

stage of the research cycle. This presupposes the existence and persistence of economic, legal, and cultural barriers. The barriers range from sky-rocketing scientific journal subscriptions to access/and fees to publish research products, restrictive intellectual property licenses attributing ownership to publishers, and the absence of an *ad hoc*, clear, predictable and harmonized regulatory framework guaranteeing data sharing for research purposes. Tearing those barriers means offering research products, including data (raw, metadata, images, graphs, tables, *etc.*), and other often neglected outputs, such as partial, negative, or non-definitive research results,[255] for analysis, verification, reuse, and reproduction by other researchers, but also actors other than cognitive ones, e.g. public bodies, start-ups, non-profits, and citizens.

Scientific resources are cumulative, and the production of scientific resources is incremental and dependent upon the production of previous outputs[256]. As such, open educational resources (OER) and processes constitute other building blocks of new avenues for innovation and development, evidence-based policymaking, and public discourse-making.

Another group of practices aims to open evaluation processes through open peer review and qualitative evaluation metrics. The former makes scientific debate publicly available and transparent while providing clear evidence material on the reviewers' work and efforts. This in turn facilitates the implementation of rewarding mechanisms and reduces cases of conflicts of interest, thereby increasing accountability and transparency. The second aspect of open evaluation

[255] If shared, partial, negative and non-definitive results allow other researchers to avoid repetitions, underpin their research in previous trials and errors and increase accuracy of their results.

[256] Giglia E, Open Science, la Scienza Aperta fa bene alla ricerca (e alla società) (Valu.news, 14, dicembre 2020).

concerns the introduction of new parameters to assess research quality which is instrumental to determine researchers' career advancement. Today's research assessment parameters center around the number of publications and citations, and the prestige of the publication venues. The elaboration of new metrics has advanced in recent years[257] and has been incorporated in national research and open science plans, which are now in the phase of concrete implementation by research institutions and national research assessment competent bodies. Quantity-based metrics such as the impact factor, the h-index, or the citation index will be accompanied by qualitative criteria: open access publishing, collaboration in multi-auctorial and inter-, multi- or trans-disciplinary projects, contributions to conferences, workshops, papers, even as research assistants, open communication such as social media sharing and measured social impact of scientific projects[258].

[257] Several interinstitutional initiatives have been taken so far. In July 2022, the COalition for Research Assessment (COARA) has signed the Agreement on Reforming Research Assessment, following suit the San Francisco Declaration on Research Assessment (DORA), the principles proposed by the Leiden Manifesto for research metrics, and the Hong Kong Principles for assessing researcher. According to the Agreement: "*Coordinated action now is needed to build on this and gather sufficient mass to enable systemic reform of research assessment practices.*" The Agreement emphasizes the importance of "*recognizing and rewarding a wide range of research outputs and practices, including early sharing, open collaboration, and diverse forms of scientific contributions beyond traditional publications* [..] the value of various research roles, tasks like peer review, mentoring, training, leadership, science communication, and industry-academia cooperation. It calls for assessment criteria that respect the diversity of scientific disciplines, research types, and career stages, promoting multi-disciplinary and inter-sectoral approaches. Additionally, it stresses the importance of acknowledging and valuing the diversity in research roles and careers, both within and outside academia, and ensuring gender equality and inclusiveness in research teams and content.

[258] Other open evaluation criteria are, for instance: sharing posters and presentations, e.g. on FigShare; using open licenses; self-archiving in archives; using open peer review, e.g. at PubPeer o F1000; sharing pre-prints (OSFpreprint, arXiv o biorXiv; using actionable formats, e.g. with Jupyter or CoCalc; open XML-drafting, e.g. Overleaf or Authorea); sharing protocol and workflows, e.f. at Protocl.io; sharing notebooks, e.g. at OpenLabNotebook; sharing code, e.g. GitHub licensing GNU/MIT; sharing data, e.g. Dryad, Zenodo, Dataverse; pre-registering, e.g. at OSFregistry o AsPredicted; commenting openly, e.g. with Hypthes.is o Pund.it; using shared reference Libraries, e.g. with Zotero; sharing (grant) proposals, e.g. with RIO journal (Bianca Kramer & Jeroen Bosman). Source: Giglia E, De Luca M, Open Science why and how + FAIR data management / Theoretical and Applied Neuroscience National PhD school retreat, Bertinoro (October 18, 2023).

3.5.3.2 *A multi-level regulatory framework*

Open Science today is a widely recognized multi-level public policy for regulating scientific conduct. It is a fully-fledged public policy endorsed and promoted by public institutions, pursuing the public interest enshrined in the universal human right to science[259] - essential for societal and individual welfare - of a constitutional rank[260]. Its multi-level character lies in its endorsement by multiple levels of governance, i.e. international, supranational, regional, national, subnational, and community. Most rules are incorporated in soft legal instruments of a non-binding force. This non-bindingness is typical of that complex of rules arising out of societal and bottom-up normative phenomena, such as the *lex mercatoria* or *lex cryptographica*, i.e. self-regulation that prompted the reaction of hard legislators and regulators in their respective domains. Today a growing number of national and supranational legislative frameworks have enacted legally binding mandates to open science and open data sharing. In the international arena, the legal landscape of Open Science is dotted with soft normative standards and guidelines (for States and all the relevant involved actors). The 2021 UNESCO Recommendation on Open Science[261]

[259] Andorno R, The Right to Science and the Evolution of Scientific Integrity. In H. Porsdam & S. Porsdam Mann (Eds.),The Right to Science: Then and Now (Cambridge University Press 2021), pp. 91-104.

[260] Romano CPR, Boggio A, The Right to Benefit from Progress in Science and Technology in World Constitutions. An entry in Max Plank Encyclopedia of Comparative Constitutional Law (forthcoming), Loyola Law School (Los Angeles Legal Studies Research Paper No. 2020-17).

[261] The UNESCO Recommendation on Open Science emphasises the following values:

1. Quality and Integrity: Encouraging scientific rigor, reproducibility, and integrity in research.
2. Collective Benefit: Promoting science for the benefit of all, supporting global scientific collaboration and solidarity.
3. Equity and Fairness: Ensuring that all can participate in and benefit from science.
4. Diversity and Inclusiveness: Respecting diverse knowledge systems and cultures, including indigenous and local knowledge.
5. Transparency: Making scientific processes more transparent and accountable.
6. Openness: Providing access to scientific information and data to a broader audience.

institutionalized the policy domain, emerging out of a long process of wide multistakeholder consultation and consensus from 193 States and representatives of open science coalitions. To guarantee enforcement, it requires States to report on their progress in advancing open science practices and provides guidance on actions to be taken by the States and open science participants (e.g. on how to set up open research infrastructures). Several regional projects have been activated under the auspices of the UNESCO Open Science which monitors the state of implementation subject to scrutiny by academics.[262] At the end of the day, it is up to the goodwill and compliance of researchers, research institutions, governments, and even private organizations to translate this body of rules into enforceable rights and duties.

Among the numerous regulatory infrastructures taken worldwide, it bears briefly displaying three approaches to Open Science: the European Union multi-layered governance approach, the African Open Science Platform (*infra sub* Chapter III), and the Open Science and Open Government commitment of the Biden-Harris administration.

7. Adaptability and Sustainability: Ensuring that open science practices are adaptable and contribute to sustainability.

8. Collaboration: Encouraging cooperation and sharing among scientists and other stakeholders.

[262] Camkin J, Neto S, Bhattarai B, Ojha H, Khan S, Sugiura A, Lin J, Nurritasari FA and Karanja JM Open Science for Accelerating the Sustainable Development Goals: Status and Prospects in Asia and the Pacific (Front. Polit. Sci. 2022).

In the European Union, Open Science stands out as a significant and consolidated policy priority since 2016[263][264]. The EU *aquis* consists of a hard legal framework enacted by the co-legislative bodies along with already operational open research infrastructures. Open Science is integrated as a standard approach in the European Research Agenda (ERA) 2022-2024, the constitutionally recognized (Art. 179 TFUE) EU policy action to pursue the free movement of researchers, scientific knowledge and technologies, and its research and innovation funding programs implemented with multiannual frameworks adopted by the ordinary legislative procedure. *Inter alia* Horizon Europe, the former Horizon2020, and the European Research Council foresee an explicit obligation for beneficiaries to publish open access with no embargo periods (timeframe between approval of a manuscript by the journal and open publication), no funding coverage for hybrid[265] open access journals, copyright retention by the authors in contrast to a long-lasting tradition of copyright transfer to

[263] The Open Science Agenda has been at the core of the co-regulatory work of the European Union since the first public consultation held in 2014 to gather stakeholders' views. Since 2016, the European Union has intervened with the Amsterdam Call for Action (April 2016) for a research environment based on data sharing and stewardship default approach for all publicly funded research, European Cloud Initiative Communication (April 2016), the European Council Conclusions on the transition towards an Open Science system (27 May 2016), the Plan S and cOAlition S, the European Open Science Cloud (EOSC) and the EOSC Strategic Research and Innovation Agenda, the European Open Science Policy Platform, the Communication 'A new ERA for Research and Innovation', the 2019 EU Directive on Open Data and the reuse of public sector information and the Report 'Towards a 2030 Vision on the Future of Universities in Europe'.

[264] Burgelman JC, Pascu C, Szkuta K, Von Schomberg R, Karalopoulos A, Repanas K, Schouppe M. Open Science, Open Data, and Open Scholarship: European Policies to Make Science Fit for the Twenty-First Century (Front Big Data. 2019).

[265] Hybrid open access journals are traditional subscription-based journals that offer authors the option to publish articles open access upon payment of a fee, often referred to as an Article Processing Charge (APC). This model allows authors to publish open access in journals that also contain subscription-based articles. It provides a way for researchers to comply with open access mandates from funders or institutions while publishing in established journals. However, this model has been subject to criticism, particularly around the issue of "double dipping", where publishers receive income from both subscriptions and APCs for the same content.

conventional publishers (copyright retention), involvement of citizens and civil society organizations in research and adherence to open science practices.

From the broader science policy perspective, Art. 10 of the 2019 Open Data Directive[266] requires the EU Member States to implement open science policies addressed to research-performing organizations and research funding organizations to make research data from publicly funded research available, open-by-default and compatible with the so-called FAIR principles[267]. The European Open Science Cloud (EOSC) pursues this aim by building an open science infrastructure *par excellence* launched in 2018 to provide European researchers, innovators, companies and citizens with a federated and multi-disciplinary platform environment to publish, find and reuse data, tools, and services for research, innovation and educational purposes. The idea is to weave a 'Web of FAIR Data and services' for science in Europe, from

[266] Art. 10 reads: "*Member States shall support the availability of research data by adopting national policies and relevant actions aiming at making publicly funded research data openly available ('open access policies'), following the principle of 'open by default' and compatible with the FAIR principles. In that context, concerns relating to intellectual property rights, personal data protection and confidentiality, security and legitimate commercial interests, shall be taken into account in accordance with the principle of 'as open as possible, as closed as necessary'. Those open access policies shall be addressed to research performing organizations and research funding organizations.*"

[267] The acronym stands for Findability Accessibility Interoperability Reusability. Thus, the FAIR principles are a set of guidelines to ensure that:

1. Findable: Data should be easy to find for both humans and computers. Machine-readable metadata are essential for the discovery of datasets and should include a globally unique and persistent identifier.
2. Accessible: Once found, the data should be accessible with well-defined access conditions, whether open or restricted. Metadata should always be accessible even when data is no longer available.
3. Interoperable: The data should be presented in a structured form so that it can be automatically combined with other data. In addition, metadata should use shared standards to add value to the data.
4. Re-usable: Data should be well-described so that they can be replicated and/or combined in different settings. Metadata and data should be understandable to humans and computers, and data should be associated with detailed provenance.

Art. 10 reads: "*Member States shall support the availability of research data by adopting national policies and relevant actions aiming at making publicly funded research data openly available ('open access policies'), following the principle of 'open by default' and compatible with the FAIR principles. In that context, concerns relating to intellectual property rights, personal data protection and confidentiality, security and legitimate commercial interests, shall be taken into account in accordance with the principle of 'as open as possible, as closed as necessary'. Those open access policies shall be addressed to research performing organizations and research funding organizations.*".

visualization and analytics to long-term information preservation and monitoring of the uptake of open science practices (more *infra sub* Chapter III).

Another EU open science infrastructure is the European Strategy Forum on Research Infrastructures, where open science translates into policy-making concerning research infrastructures: national delegates from EU Member States and affiliated countries and representatives of the European Commission set objectives, strategies, and activities over 10/20-year span. As research is a shared competence, the European Member States have each formulated National Research Plans and Open Science Plans aimed at implementing the EU framework as part of the National Recovery and Resiliency Plans. On a micro-level, national research centers, universities, affiliated entities, and publishing outlets have followed suit with institutional open science policies and codes of conduct, let alone that their commitment to open access and open science often anticipated the institutional momentum witnessed today.

The other two benchmark models for institutional open science governance are the African Open Science Platform, which will be dealt with in Chapter III, and the US 2023 Year of Open Science, a cross-agency federal *funding* initiative involving all sectors of society, including private, civil society organizations and interested single individuals. The US-American is a centralized and bureaucratic model in line with its primary goals of setting common open science standards on all governance levels and its focus on public funding programs. This model is orchestrated through a collaborative framework involving federal agencies, coordinated by the White House Office of Science and Technology Policy (OSTP) and the National Science and Technology Council (NSTC) with its subcommittees and working groups. In 2023, the OSTP launched the 'Year of

Open Science' to foster an open science culture across the federal government and increase transparency and public trust in science. The OSTP's actions address the issues of updating public access plans, developing new open science curricula nationwide, and engaging historically underrepresented communities in scientific research. NASA, the National Institute of Health (NIH), and the Department of Energy (DOE) are actively implementing policies and programs to support open science.

### *3.5.5 The Open Science Paradigm*

The Open Science paradigm could be interpreted as a paradigm of scientific revolution *à la* Kuhn[268]. While it does not mark a fundamental change in scientific 'understanding' on the merits of a specific research field that breaks from past theories and accomplishments, it turns the perspective on the methods, methodologies, and standards for legitimate contributions to science. It does change the scientific understanding of how scientific creation, evaluation, and communication genuinely contribute to all scientific fields and societal well-being. It is thus a revolution in standards of scientific conduct and continuous co-development of digital instruments and human competencies to facilitate this revolution. Open science marks a 'paradigm shift' in scientific conduct by opening it from the scientific value creation, through evaluation, to its distribution through participatory, responsible, transparent, and accountable techniques that accelerate good science and may create a science-society-polity interface.

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[268] Kuhn T, The The Structure of Scientific Revolutions, Second Edition, Enlarged (International Encyclopedia of Unified Science 1970).

*3.6 Open society*

The lemma 'Open society' leads the mind to Karl Popper's seminal work 'The Open Society and its Enemies'[269]. An open society counters ideological totalitarianism and embraces humanism and critical rationalism, underpinned by a scientific approach to problem-solving and a commitment to critical discourse. It contrasts with closed societies governed by authoritative ideologies that claim possession of ultimate truths and often suppress dissenting views. Popper posits that the open society is perpetually provisional and falsifiable. Human knowledge is fallible and truths are never absolute but subject to revision and refutation. This acknowledgment of the potential for error in human knowledge forms the bedrock of democratic structures that allow for the peaceful resolution of conflicts and the fluidity of power through democratic opinion shaping and electoral processes. Critical rationality facilitates an environment where policies and ideas are scrutinized and debated rather than accepted based on tradition, formality, or authority. This approach protects against the rise of dogmatic or tyrannical rule. Another fundamental tenet of Popper's open society is 'piecemeal social engineering' that is "*the introduction of scientific method into planning and politics*"[270]. In analogy with scientific experiments, social engineering can only be rationally justified by being small-scale, incremental, and constantly revised in light of experience, trials and errors. In Popper's words: "*We make progress if, and only if, we are prepared to learn from our mistakes: to recognize our errors and to utilize them critically instead of persevering in them dogmatically*"[271]. Trial and error processes are thus

[269] Popper K, The Open Society and its Enemies, Vol. I (Routledge and Kegan Paul, 4th ed. 1962).
[270] Piecemeal engineering in The Oxford Companion to Philosophy, 2nd ed. T. Honderich (OUP 2005).
[271] Popper K, The Poverty of Historicism (Art Paperback 1957), p. 57.

connatural to constructing open societies and letting them unfold on a progressively evolving, open-minded, and non-predestined storyline.

## 4. THE COMMON GOOD AND THE POLITY

The common good has been the object of continuous contemplation, reflection, and discussion in the human and social sciences. It can be intended either as an ideal end of human behaviors and actions of a social group or a political community[272] or, in legal and economic terms, as objects, things, or infrastructures that serve a purpose and may be subject to appropriation, hence property rights, rival or nonrival, exclusive or inclusive use. In the first meaning, the common good is the symbolic place of convergence of individuals as members of a community and their needs as common needs. In the second meaning, the common good is a *tertium* in respect of the public and the private goods.

### *4.1 Common good as an ideal*

A quote from Thomas Aquinas explains the common good as an ideal: "*The Law of its very nature is an ordinance of reason for the common good, which is made by the person who has care of the community, and this rule is promulgated*". Aquinas' thought is widely recognized for articulating Christian morality expressed in the human virtues of prudence, justice, fortitude, and temperance guided by reason and faith. It belongs to a bygone age and therefore contemporary interpretations and

[272] Mele R, Farano A, Oltre l'individualismo proprietario? Note giusfilosofiche per uno studio sui beni comuni, Benessere e felicità: uscire dalla crisi globale (Diogene Edizioni 2013).

de-contextualizations inevitably lead to fallacies. Yet, his words represent a milestone of common good thought in human history. The ideal common good appears as the end of the law as ordered and ordering reason and emphasizes the element of individual care of the community. This quote has been recently used as the theoretical foundation of a reactionary legal doctrine denominated 'common-good constitutionalism', whose formulation has pushed so far as to affirm that "*the central aim of the constitutional order is to promote good rule, not to 'protect liberty' as an end in itself*"[273]. In practice, the theory would lay support to an extensive array of jus-political conservative objectives such as bans on abortion, censorship, and increased pre-eminence of an old-fashioned common good ideal to the detriment of individual fundamental rights.

This research adopts an entirely different approach to the common good as an ideal that is rather closer to John Rawls' conception, who defined the common good as "*certain general conditions that are ... equally to everyone's advantage*". John Rawls' conception of the common good[274] revolves around a fair and just society where social cooperation benefits everyone and, in particular, the least advantaged. According to his principles of justice, the system must ensure the protection of fundamental rights and liberties, fair distribution of opportunities, and socio-economic inequalities must be arranged to improve the well-being of the least fortunate. This framework aims to establish conditions that are advantageous to all members of society, fostering a sense of justice and mutual benefit.

[273] Vermeule A, Beyond Originalism (The Atlantic 2020).

[274] Rawls J, A Theory of Justice (Belknap Press of Harvard University 2005).

*4.2 Public, private and common goods*

When considered in a material sense, a good is a thing or facility susceptible to appropriation and consumption. In modern economic literature, the concept of public good owes its introduction to Paul Samuelson in his discussion of public expenditure. According to Samuelson, a public good is characterized by non-excludability and non-rivalry. This means that, once provided, it should be impossible or costly to exclude individuals from its use. For example, once a lighthouse is constructed, it is challenging to prevent ships from glimpsing its light. Additionally, the lighthouse is non-rivalrous: one person's use does not reduce the availability of the good for others. The use of light by one ship does not diminish the light available for another. Governments typically (while not exclusively) provide or oversee the provision of public goods.

Along with rivalry and excludability, goods can be categorized based on their depletability. Depending on these characteristics, they can be classified as public, private or common. Common goods are resources that are accessible to all but can be depleted through overuse. Their non-excludable but rivalrous nature often leads to the "*tragedy of the commons*"[275], where individuals, acting in their self-interest, overuse and deplete the resource. Effective management of common goods typically requires collective action, regulation, or community-based management to ensure sustainability and equitable access. Common goods are thus non-rivalrous but depletable consumption goods, such as rivers, lakes, air, beaches, natural parks, forests, environmental goods, and wildlife, but also immaterial cultural goods, such as information and knowledge, when they are artificially enclosed.

[275] Hardin G, The tragedy of the common (Science 1968).

A counterpoint to depletability is Rose's theory of the "*comedy of the commons*"[276] which suggests that certain shared resources become more valuable and beneficial, the more consumption is collective. One such example is open access to information and recreational spaces, for the more people participate in open-source software or knowledge collaborative projects like Wikipedia, the richer, valuable, and comprehensive the produced resources become in a positive feedback loop.

Regardless of their public or private ownership, these goods are essential for the exercise of fundamental rights and the free development of individuals. Therefore, the law must guarantee the collective and direct enjoyment of these goods by everyone, especially from an intergenerational perspective.

More than ten years ago, a group of Italian jurists summoned in the Rodotà Commission made efforts to incorporate the category of '*beni comuni*' into the Italian Constitution, having in mind the essential function of certain material and immaterial goods to afford the exercise of fundamental rights[277], such as knowledge[278]. The notion of common goods used in the doctrinal debate intercepts a new conception that illuminates the concreteness of human needs that can be met by linking fundamental rights to essential goods through a right to access.

In the legislative project for the reform of the Italian Civil Code, the Commission purported to align with the objectives of subsidiarity of the public administration and administrative activity as embraced by the Italian Constitution. The proposed

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[276] Rose C,The Comedy of the Commons: Commerce, Custom, and Inherently Public Property (Faculty Scholarship Series, Yale Law School 1986)

[277] Rodotà S, Il diritto di avere diritti (Laterza 2015).

[278] Mattei U, Beni comuni. Un manifesto (Laterza 2012).

rules envisioned that the public destination of goods could be maintained irrespective of their formal ownership, thereby establishing a notion of a 'public good in an objective sense'. This concept implies that a good remains public in its use and function due to a destination constraint, even if it is privatized and traded through private transactions. Such goods, despite not necessarily being publicly owned, continue to be non-excludable from their institutional purposes except in case of natural or fortuitous events and are regulated by public authorities, with specific administrative powers ensuring their protection and access.

The Rodotà Commission sought to transcend the categorization of goods codified in 1942 putting forward a never-approved legislative draft providing for the abolition of the categories of state property and unavailable assets, redistributing these into new categories, including 'common goods'.

However, the recognition of the category of common goods in the Italian legal system has gone through the judgment of the highest judicial authority of the Italian Supreme Court of Cassazione[279]. The Supreme Court interpreted the common good as an inherently public good managed by private parties based on the constitutional principle of protecting 'human personality' and its proper development within the framework of the welfare State (Artt. 2, 9, 42 Italian Constitution). This protection applies not only to public goods but also to those goods which, by their intrinsic nature or purpose, serve community interests. Common goods are deemed so regardless of ownership and are deemed essential for the welfare state. Therefore, functionality relating to community interests takes precedence over the aspect of public or private ownership.

[279] Supreme Court of Cassation, Joint Civil Sections, Judgment of February 14, 2010, No. 3665.

The Court also observed that a common good entails governance responsibilities for the entity that holds the ownership title, aimed at making effective the various forms of enjoyment and common use of the good. In other words, within the category of public goods, as identified by positive law, there is a specific subset of goods, i.e. common goods, that require organizational frameworks and operational mechanisms to ensure full and effective access and enjoyment by the community of users. The demand for affirming the common nature of certain goods, ranging from water to scientific works through the urban space to institutions such as the university or health, stands in stark contrast with the exclusive market logic of global capitalism as well as the exclusive public management of such assets.

*4.3 Administrative law instruments to govern common goods in the Italian legal system*

The organizational and operational mechanisms for caring for the common goods have emerged in the Italian administrative socio-legal landscape over the years of real-life experiences in local communities. The paradigm of the *homo curans* has spontaneously emerged in the practices of governance of the common goods. The parable of the common goods and *shared administration*[280] in Italy represents a paradigmatic case confirming the inextricable link between the spontaneous forces of societal expressions of order, and the 'elastic' values, principles, and rights of the Republican and Democratic Constitution written by the 'constituent fathers' in their role of interpreters of societal needs.

[280] Arena G, Introduzione all'amministrazione condivisa (Studi parlamentari e pol. cost., 1997), pp. 117-118.

Article 118 of the Constitution of the Italian Republic affirms the right of every individual to act for the general interest. This constitutional provision grants citizens a right to take care and share with all levels of the public administration the management of activities of general interest in light of the principle of horizontal and circular subsidiarity therein enshrined. Citizens can promote such caring activities by autonomous initiatives both individually and in association. The concrete application of this constitutional mandate has been and still are the Regulations for the Shared Administration of Common Goods establishing a legal relationship of collaboration between local public administrations and citizens for the care and shared management of urban commons. As clarified by the initial articles, the regulations directly apply the Article 118, last paragraph, of the Constitution, and Articles 114 and 117, paragraph 6, on local autonomy. Since its inauguration in the city of Bologna in 2014, the Regulation for the Shared Administration of Common Goods has been a reference point for numerous municipalities and other local administrative bodies for ten years, along with the instrument of the 'collaboration pact' to promote the care of material, immaterial and even digital goods. Collaboration pacts identify the general interest to be protected, the actions to care for it, the duration of the pact, the responsibilities shared, and the capacities, skills, and resources of the signatories (including public entities)[281].

The consolidation of this model has reached the legislative level with two regions producing the essential features of municipal regulations on a broader scale.

[281] For further details, *ex multis* Chirulli P, Sussidiarietà e collaborazione «amministrata» nei beni comuni urbani, in P. Chirulli, C. Iaione (a cura di), La co-città, Jovene, Napoli, 2018, p. 55 ss.; Iaione C, La collaborazione civica per l'amministrazione, la Governance e l'economia dei beni comuni, in G. Arena, C. Iaione (a cura di), L'età della condivisione. La collaborazione fra cittadini e amministrazione per i beni comuni, Carocci, Roma, 2015, pp. 51-55.

Lazio's Law No. 10 of 2019[282] and Tuscany's Law No. 71 of 2020, despite the differing approaches, have advanced the experimental process, extending collaboration and support for citizens' civic initiatives to regional administrations (which is crucial given the potential for collaboration in areas like management of parks, healthcare or public housing). In complex urban contexts, regional laws allow intra-municipal organizational units to adopt collaboration pacts even without a general regulatory framework from the municipality[283].

An additional legislative development has been reached with the Third Sector Code with its Ministerial Guidelines 72/2021, which outlines the tools for collaboration between public administrations and Third Sector entities (non-profit)[284]. The instruments provided in Article 55-57 of the Code, i.e. co-programming, co-design and accreditation, attribute planning, and organizational functions to pursue civic, solidarity, and social utility purposes. The law also mandates third-sector entities to foresee democratic decision-making and civic participation which indirectly guarantees a framework for citizens' engagement in identifying the needs for the delivery of civic and solidarity services, including those of a cultural and educational nature.

According to the Italian Constitutional Court[285], these instruments represent the concretization of the principle of shared administration. In recent rulings, the Court was asked to verify the constitutional legitimacy of regional regulations concerning third-sector entities. On this occasion, it interpreted the principle of

[282] For further comments, see Grigorut I, L'amministrazione in trasformazione. Il modello dell'amministrazione condivisa della Regione Lazio (Reg., 2020), pp. 1209 and following.

[283] Giglioni F, Consolidamento e futuro dell'amministrazione condivisa, Focus – Territorio e istituzioni n. 20 (federalismi.it 2022).

[284] Third sector entities include voluntary organizations, social promotion associations, philanthropic entities, social enterprises and other non-profit organizations.

[285] Constitutional Court Rulings no. 131/2020 and no. 52/2021.

shared administration as an expression of normative provisions supporting entities that contribute to the social and civil development of communities. Regarding co-programming and co-design, the judge made clear that rather than focussing on a fee-to-service exchange, they are based "*on the convergence of objectives and the aggregation of public and private resources for the joint planning and design of services and interventions aimed at raising levels of active citizenship, social cohesion, and social protection, according to a relational sphere that goes beyond mere utilitarian exchange*".[286]

The principle of shared administration has the legal power to catalyze a recognizable system of rules based on the collaboration between public administrations and citizens. This cultural advancement links the principle of horizontal subsidiarity to a new governance model distinct from traditional authoritative performance-based governance and competitive regulation.

*4.4 The Polity*

According to the Black's Law Dictionary - the Free Online Legal Dictionary - a polity is "*the form of government*" or "*civil constitution*". Polity translates ancient Greek πολιτεία derived from πολίτης, i.e. citizen, in the historical-political language used as an equivalent of Latin *res publica*, to denote the organization as the common good of all citizens and, consequently, the optimal political constitution. The hypostatization of polity and constitution is due to the historical and anthropological context of the ancient Greek city-state. Plato in The Republic and Aristotle in his Politics explored the nature of political constitutions as the ideal forms of organization within the polis. Plato proposed his theoretical model of the ideal polity ruled by philosopher-kings, and Aristotle classified different

[286] Constitutional Court Ruling no. 131 of 2020.

forms of government (democracy, aristocracy, and monarchy), examining their strengths and weaknesses. The concept of polity has influenced subsequent political thought and laid the foundation for studying political systems and institutions in various historical and cultural contexts. For instance, in his theory of communicative action and deliberative democracy, Habermas[287] intended the polity as encompassing both the formal statal institutions (the legislature, the executive, and the judiciary) and the informal arenas where public debate takes stage (the media, civil society organizations, and grassroots movements). In Teubner's interpretation, a polity is part of the substrate of '*pouvoir constituant*', i.e. the social phenomenon and foundational basis of a nation-state political constitution and, in his opinion, a societal subsystem's constitution (e.g. the globalized constitutions of the economy, science, religion, and other private constitutional orders). The people would constitute the polity as a pre-constitutional community[288].

The current historical context and the specific socio-political and cultural context in which the platform should operate are pivotal to identifying and circumscribing the polity of the platform.

The reference polity of the platform whose governance is to be designed - with a discrete level of approximation - is located in continental Europe, due to the acquired standard of societal, technological, and digital openness elucidated above, as well as its embeddedness in democratic spirit and constitutionalism.

The polity is local in size. The local size may tally with the size of regional or municipal administrative territorialities. In legal terms, this is mandated by the

[287] *ibid. n.* 34 Habermas.
[288] *ibid. n.* 163 Teubner.

substantial rationale of the European principle of subsidiarity, which presupposes that the most effective and efficient governing intervention stems from the institutions closer to the territory, the citizens, and other inhabitants (temporary residents or invisible ones).

The polity is local in size and global in perspective. As the transnational anthropologist Arjan Appadurai aptly observed, globalization arises from the interplay of global and local forces. The movement of people, communities, ideas, technology, money, and media creates and recreates both spatial and virtual localities and neighborhoods[289].

The more popular expression of 'glocalization' fits with this worldview. A portmanteau of global and local, glocal refers to the reciprocal influence of global and local occurrences and trends and their interactions. Societies think and act globally, even those who proclaim themselves as anti-globalists[290]. Local conditions shape the reception and implementation of global socioeconomic, cultural, and political evolutions; *vice versa*. Globalization does not always produce homogeneity according to the global legal standardization mantra proposed by international and supranational intergovernmental bodies and associations. In a more nuanced way, it accentuates local differences and hybridizes global and local traditions, identities, imaginaries, and inventions. For instance, with glocal business strategies companies adapt products, marketing, and business models to fit local markets, preferences, regulations, and cultural norms. Also, urban planning and community cultural life are influenced by global phenomena such as

[289] Appadurai A, The Production of Locality, in Modernity at Large (Cultural Dimension of Globalization, University of Minnesota 1996)

[290] Robertson R, Glocalization: self-referential, remembrances, glocalism (Journal of Culture, Politics and Innovation 2020).

climate change, migration, information and technological transfer, global agendas on climate neutrality, migration, or digital governance and transition.

This contemporary historical context is characterized by political and informational polarization[291] and fragmented discourse pluralism that is not always situated in the mainstream media and political fora. A platform for a local knowledge polity creates a virtual space where knowledge and information flow more openly and transparently and opportunities for inter-societal synergies emerge and scale.

[291] The threats of climate change, its denialism, and fossil fuel investments, armed conflicts and steady rearmament, technological dual-use, protectionism and competition, economic stagnation, to name a few.

# CHAPTER II: A PLATFORM GOVERNANCE FRAMEWORK

## PART I THE GOVERNANCE FORMANTS

This dissertation takes platform governance 'multi-perspectively', thus combining legal, ethical, institutional, and technological considerations. As clarified, governance is not only made of pure legal matter. It rather unfolds in an ordering exercise whereby three different sources of normativity – the law, the ethics, and technology – establish and facilitate interaction and relationships between several actors and management of multiple resources and activities in the open research and innovation ecosystem to be created.

To this aim, the governance model, on the one hand, necessarily relies on legal sources and avails itself of legal principles, rights, and institutions recognized in existing democratic[292] legal systems and legal theory applicable to the legal situations at play. On the other hand, in harmony with the evolution of the debate on the ethics of technologies, and the embeddedness of ethics and the law, ethical norms shape the requisite axiological foundation of the model. Technology enables and operationalizes actions and interactions between actors. Digital, smart, legal contracts allow interested parties to conduct accountable, transparent well-informed negotiations and stipulations, and monitor the performance of agreements in the platform ecosystem. Automation can be 'tamed' by encoding human communication and transactional processes in technology (human in the

[292] The attribute is here devoid of the political connotation.

loop approach). In contrast, technology can smoothen those processes and make them more transparent, accountable, efficient, and enforceable.

Law, ethics, and technology constitute the 'governance formants' in the contemporary complex and plural normative universe. This draws from the theory of legal formants. The no lesser complex and plural juridical universe is dotted with legal formants, i.e. the various elements and sources that contribute to the formation, interpretation, and evolution of legal rules within a legal system. Legal formants encompass formal sources such as laws, regulations, judicial and administrative practice, and informal ones such as doctrinal opinions, legal education, and societal values that sway the interpretation and application of legal norms[293]. While legal formants encompass the myriads of elements that collectively shape the law within a legal system, the governance formants perform the same function as regards the even more complex universe of more spontaneous and less formalized governance frameworks.

Postmodern complex societal systems that tend to fragmented self-regulation can find unity in the platform ecosystem, based on a network of rules that considers both juridical and non-juridical formants. The ecosystem is oriented towards the common good of its developers, participants, and the public good.

This chapter aims to design a generalizable governance model for platform ecosystems that provide open research and innovation services for local polities through the democratization of science and technology.

[293] Sacco R, Legal Formants: A Dynamic Approach to Comparative Law (Instalment I of II) (The American Journal of Comparative Law 39, no. 1 1991), pp. 1-34; Sacco R, Legal Formants: A Dynamic Approach to Comparative Law (Installment II of II) (The American Journal of Comparative Law 39, no. 2 1991), pp. 343-401.

### *1.1 The legal formant of the governance model*

We learned from Hart that the law consists of primary and secondary rules[294]. Jurists commonly call the first group of rules 'substantive rules'. These rules accord parties rights and duties, i.e. substantive legal positions of advantage or disadvantage. Primary norms impose duties and prohibitions, foresee sanctions in case of breach, and speculatively grant rights. The secondary norms are procedural rules that recognize, modify primary rules and confer powers. In other words, primary rules deal with institutionalizing legislative, adjudicative, and executive processes. Secondary norms thus legitimate the exercise of the three public powers of traditional legal doctrine and, likewise, private powers, i.e. powers exercised by private institutions. For instance, national civil and commercial codes confer the power to associations and companies to establish their organizational structures, purposes, and procedures in articles and by-laws. As shown in the following, while digital platforms enjoy a high degree of normative autonomy, they have not equipped themselves with a predictable set of primary and secondary norms. The secondary norms of attribution of the platform allow for modifying primary rules. While implicitly recognizing the latter, the former confer powers and tasks to the actors engaging in platform governance.

According to Habermas, secondary procedural norms institutionalize the legal discourse in deliberative democracy. Legal discourse derives its validity from

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[294] Hart HLA, The concept of Law (Oxford 1961), pp. 81-ff. "*Under rules of the one type, which may well be considered the basic or primary type, human beings are required to do or abstain from certain actions, whether they wish to or not. Rules of the other type are in a sense parasitic upon or secondary to the first; for they provide that human beings may by doing or saying certain things introduce new rules of the primary type, extinguish or modify old ones, or in various ways determine their incidence or control their operations. Rules of the first type impose duties; rules of the second type confer powers, public or private. Rules of the first type concern actions involving physical movement or changes; rules of the second type provide for operations which lead not merely to physical movement or change, but to the creation or variation of duties or obligations.*".

rational communication, argumentation, justification, and consent of the concerned parties. It operates '*not only under the external constraints of legal procedure but also under the internal constraints of a logic of argumentation for producing good reasons*'[295]. In this research context, legal procedures allow legal and non-legal reasons and rationalities to enter negotiations, decisions, and operations on the platform. In conjunction, the platform shall foresee open, inclusive, and participatory procedures that give voice and space to plural differing rationalities expressed by different stakeholders. For instance, in the context of the purely scientific services of the platform, '*the ontological commitments of groups other than scientists*' may motivate and enhance the scientific endeavor of universities, academies, and other research institutions and feed in scientific quality assurance in a configuration that has been termed "*postnormal science*"[296]. Also, on-platform participatory procedures may entail proposal, elaboration, and choice of the themes on which the platform's science-society-polity interface may focus. Multiple, selected stakeholders and individuals, who may or may not be familiar with a specific issue of common concern, should be entitled to propose and vote on new items of discussion, inquiry, requests for clarification, and analysis by the actors who hold expert knowledge in the field.

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[295] Habermas J, Law and Morality (Translation of Recht und Moral, 1988b by K. Baynes, in: S.M. McMurrin (Ed.), The Tanner lectures on human values, Vol. 8 (University of Utah Press), pp. 217-279.

[296] *ibid.* n. 257 Funtowicz. Post-normal science is a scientific approach focused on problem-solving which involves multiple voices in situations where empirical facts and even scientific methods are uncertain, values in dispute, stakes high and decisions urgent. Such situations typically of complex and challenging issues like climate change, health hazards, biodiversity loss and technological risks. Open non-peer review forums may be a concretization of this approach.

*1.2 Overview of the state-of-the-art platform governance models*

Numerous digital platforms have drafted 'governance documents' establishing primitive forms of both primary and secondary normative frameworks. At the same time, digital platforms are subject to constitutional checks and balances that compel continuous integration and modification of policies, as public legislators and adjudicators constantly scrutinize their conduct. The attention of legal scholars, ascribed to the strand of 'digital constitutionalism'[297], has centered on the public and/or private legal nature of the commitments expressed in these documents. As well, scholars focused on the tensions and convergences between digital state-centric constitutionalism (i.e. human-rights-based technology regulation and adjudication), and private transnational platform constitutionalism (internet bill of rights, in-platform governance instruments, decisions of the ICANN dispute settlement body concerning fundamental rights[298]).

These preliminary legal issues are paramount to understanding the legal relationships between platforms and States, platforms and users, and other actors of the platform ecosystem with different implications on the legal parameters (principles, rules, interpretative canons, etc.) to apply to solve legal issues and conflicts. For digital ecosystems provide space to augment the possibility to exercise fundamental rights and freedoms (e.g. expression, assembly, privacy, business), platforms are in control of how these rights are exercised in their spaces (digital territories) and may intervene in a way that impinges on/

[297] For a systematic overview of digital constitutionalism, its different conceptual meanings and consequences see *ibid.* Celeste n. 183.

[298] Karavas V, Teubner G, 'Www.CompanyNameSucks.Com: The Horizontal Effect of Fundamental Rights on "Private Parties" within Autonomous Internet Law' (Constellations 12 (2) 2005), pp. 262-82.

fundamental, civil and political rights of users (citizens, consumers, human beings, organizations, and firms).

The following pages endeavor to establish a descriptive taxonomy of the three main platform governance models (the centralized, the decentralized, and the hybrid). This investigation seeks to identify and systematically categorize the fundamental juridical, technological, and ethical formants that underpin contemporary platform governance structures.

### *1.2.1 The Centralized Governance Model*

Para. 2.1 Chapter I briefly introduced the currently still dominating centralized business model of Web2 of social media. The second-generation internet platforms extract, monetize, and exchange users' data and attention[299], thus generating revenue through exclusively owned big data analysis and artificial intelligence techniques. When the business model is centralized, the governance model will also tend to centralize, encompassing the normative, organizational, and decision-making processes and frameworks supporting major platform infrastructures.

This centralized governance model is rooted in the platform's technological-architectural arrangements and explainable by the historical and evolutionary trajectories of centralized platform governance.

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[299] Wu T, The Attention Merchants (Penguin Book 2016). "*Ours is often called an information economy, but at a moment when access to information is virtually unlimited, our attention has become the ultimate commodity. In nearly every moment of our waking lives, we face a barrage of efforts to harvest our attention. This condition is not simply the byproduct of recent technological innovations but the result of more than a century's growth and expansion in the industries that feed on human attention.*".

As for the technological arrangements, the APIs (application programming interfaces) serve as instruments of 'infrastructural'[300] governance for most of the platforms. The most used and efficient APIs are concentrated in the hands of the few most powerful platform corporations with 'developing power'. These actors typically retain ownership and control over their APIs and eventually license use by third parties. But what are APIs and why do they constitute governance arrangements?

APIs are sets of informatic rules and protocols that allow software applications to communicate and exchange data and make services interoperable, posing the material conditions for app development. Platforms that own APIs exert control over who can access data and services within their ecosystems and how this data is accessed, used, and shared with authorized application providers. They also define the operations that can be performed on the platform and set limitations on data modification and application. This control implies charging other developers for access, use, and implementation of APIs on a subscription basis according to platform-developer contracts. Developers must adhere to contracts to build applications that interact with the platform. Although open-source APIs exist, most centralized platforms exert technical digital governance by concentrating access to/and control over technology used by other players.

During the COVID-19 outbreak, Google and Apple launched an API to develop contact tracing applications allowing smartphones to exchange anonymous identifiers with nearby devices to track potential COVID-19 exposures (the GAEN – Google and Apple Exposure Notification – API). National

[300] Van der Vlist FN, Helmond A, Burkhardt M, Seitz, T, API Governance: The Case of Facebook's Evolution (Social Media + Society, 8(2) 2022).

governments across Europe deployed apps using the GAEN API. Two months after its release, the European Commission created the European Federation Gateway Service (EFGS) to make national contact tracing systems interoperable using the GAEN API. This case marked the victory of centralized platform governance through their technological dominance while signaling a state of consolidated technocratic imbalance in favor of the Northern American big tech firms.

Two main phases can be distinguished regarding the history of centralized platform governance. Between the 1990s and the second half of the 2010s, platforms were left free to design their governance arrangements. This is the time of the *laissez-faire* attitude by the US and the EU legislators with the 'safe-harbor provisions' of the US Communication Decency Act and the EU e-commerce directive respectively. The 2016 European GDPR kick-started the second phase, the notorious overarching personal data protection regulation, and the siblings data laws. From then, public powers inaugurated a comprehensive human rights-based regulatory approach, mirrored in the freshly approved Artificial Intelligence Act. The proactive regulatory attitude of the EU legislators set the scene for the subsequent collaboration between digital platforms and public regulators in sector-specific initiatives (e.g. competition, content moderation, financial and payments services, networks, product liability, etc.). The *desiderata* of public, private, and bottom-up regulators converged throughout these two phases.

The governance arrangements through which centralized platforms self-regulated their ecosystems are first and foremost the 'terms of service', which are

progressively influenced by international, regional, and national regulatory pressure.

Gillespie explains that terms of service "*spell out the terms under which users and platforms interact, the obligations users must accept as a condition of their participation, and the proper means of resolving a dispute should one arise*" and address "*not just appropriate content and behavior but also liability, intellectual property, arbitration, and other disclaimers.*"[301]. The terminological choice reflects the contractual imbalance and juridical subordination of users *vis-à-vis* the platform. The latter stands as a superior entity towards which users cannot but accept unilateral obligations as conditions of participation and action in the platform 'community' ecosystem.

Attempts to subject modifications and updates of terms of service to democratic procedures entailing users' involvement failed, as exemplified by the Facebook saga[302]. Scholars elaborated on the unfitness of reviewed terms of services to conform with the requirements of the rule of law and procedural fairness in terms of limits to the power conferred to platforms, transparency, clarity, and equity of rules-making, and enforcement[303].

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[301] Gillespie T, Custodians of the Internet: Platforms, Content Moderation, and the Hidden Decisions that shape Social Media, 46 (2018).

[302] Suzor N, Digital Constitutionalism: Using the Rule of Law to Evaluate the Legitimacy of Governance by Platforms, (Social Media + Society, 4(3), 2018). "I*n 2009, Facebook suffered a backlash for proposing to change its terms of service without adequately consulting its community. Mark Zuckerberg (2009) pledged that from then on, Facebook users would have direct input on the site's terms of service: 'Our terms aren't just a document that protects our rights; it's the governing document for how the service is used by everyone across the world. Given its importance, we need to make sure the terms reflect the principles and values of the people using the service. Since this will be the governing document that we'll all live by, Facebook users will have a lot of input in crafting these terms'. Facebook never really lived up to its promise of direct democratic participation. In May 2009, Facebook renamed its 'Terms of Use' to a 'Statement of Rights and Responsibilities' that included a mechanism for Facebook's users to vote on proposed changes to the terms of service. The vote would be binding on Facebook if more than 30% of its active user base participated. This turned out to be an unrealistically high threshold. By the end of 2012, Facebook had rolled back its commitment to binding votes, as well as introducing controversial changes to its privacy policy, in a process opposed by 88% of the 668,872 people who voted – a group that represented less than 1% of the more than one billion registered users at the time, much fewer than the 30% required. Some time after October 2014, an edit was made* to *Facebook's blog, and Zuckerberg's comments were disavowed, attributed instead to a former Facebook employee who left the firm in 2010*".

[303] *ibid.*

Terms of service alone do not exhaustively provide a governance framework for regulating platform-users, and user-user relationships. To this end, there are supplementary documents on the rights and duties of the parties involved. Such documents cover the platform's data policies, community guidelines, and moderation policies, outlining what is deemed as appropriate online behavior and content. They may also include additional written agreements governing other specific functionalities of the platform such as advertising policies, music guidelines, and commercial terms. This intricate web of documents forms fragmented bodies of rights and obligations, responsibilities, and exemptions for users, the platform, and third-party providers. Often unilaterally imposed boiler-plate contractual arrangements[304], they constitute the sources of rights and obligations between the platforms and third parties, the users, and between the users, complementary to the liability rules provided by the public legislators and regulators.

Added to the issue of unilateral character, the modes of communication of terms and policies corroborate structural informational and power asymmetry. Users' rights and duties are often communicated "*dynamically*"[305] during interactions through multiple forms of written and "*conduct-based communication*", i.e. following a specific action by the user. Certain rules are even embedded in the platform's code, undisclosed and protected by trademarks, outlined in equally undisclosed internal policy guidelines, expressed in internal moderation procedures, conveyed

[304] Mills G, A Contractual Approach to Social Media Governance (42 Yale Law & Policy Review, 2024) Forthcoming. This article suggests the application of contractual liability upon platforms to solve many legal issues concerning violations of users' rights.

[305] *id.*

in public announcements, official news releases detailing updated policies, or posted on the platform by its CEO[306].

This situation creates a convoluted and disjointed para-constitutional-contractual framework characterized by imbalanced relationships between platforms, users, and third parties. However, it should be noted that the content of these instruments is in a constant and progressive process of dynamic adjustment to users' claims and expectations and more decisively consonant with the demands of the judiciary[307] and soft and hard legislators[308].

### *1.2.2 The decentralized model*

The first decentralized model dates to the early days of the Internet of Web1, where platforms were webpages curated, moderated, and browsed by a few webmasters and users. There was no advertising, profiling, surveillance, or data monetization, the content delivery network was decentralized, and protocols were open. The regulatory environment, i.e. type 2 platform governance, during the

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[306] *ibid.*

[307] For a comprehensive review on the evolution of the CJEU judicial activism in shaping constitutional guarantees in platform environments see De Gregorio G, The Rise of European Digital Constitutionalism, in Digital Constitutionalism in Europe: Reframing Rights and Powers in the Algorithmic Society. Cambridge Studies in European Law and Policy (Cambridge University Press 2022), pp. 38-79.

[308] Since the first European Digital Single Market Strategy in 2015, the EU institutions have demonstrated a proactive attitude towards platform regulation that imposed constitutional values (respect for the rule of law, human rights and democracy) onto platforms. For a comprehensive overview from the GDPR to more recent regulatory interventions such as the Digital Market Act (DMA) and the Digital Service Act (DSA) see: Zenner JK, Scott M, Sekut M, A dataset on EU legislation for the digital world (Bruegel 06 June 2024).
For instance, the Digital Services Act (DSA) has imposed comprehensive obligations on digital platforms and a single set of rules for digital providers across Europe, to create a safer and more transparent digital environment. These obligations include requirements for content moderation, transparency reporting, user protection, advertising transparency, risk management and cooperation with authorities. By establishing these rules, the DSA seeks to enhance accountability and ensure that platforms operate in a manner that protects users' rights and promotes a fair and open online ecosystem. As of 17 February 2024, the DSA rules apply to all platforms. Since the end of August 2023, these rules have been applying to designated platforms with more than 45 million users in the EU (10% of the EU's population), the so-called Very large online platforms (VLOPs) or Very large online search engines (VLOSEs).

Web 1.0 era was nascent and focused on foundational issues related to internet infrastructure, domain names, and basic user rights. Besides the safe harbor provisions exempting platforms from liability linked to illegal content uploaded by users, the 'rules of the game' mostly concerned the stability and security of the technological infrastructure coming from ICANN and the standardization of protocols and technical practices by the global community of the Internet Engineering Task Force (IETF). These transnational bodies operate themselves under a decentralized governance model. Exemplarily, the ICANN embodies a bottom-up participatory rules- and decision-making framework involving governments, private sector entities, civil society, academic representatives, and technical communities. Normative development and operational decision-making relating to domain names and IP addresses roll out through open and transparent processes in working groups, public consultations, and community meetings. In line with the transnational nature of the organization, the decision rule is consensus as the rule of thumb to balance and inter-penetrate the views of all stakeholders. Public access to meetings, transcripts, policy documents, and decision-making processes warrants operational transparency and accountability.

The more recent version of the decentralized model redirects to Web3. A simple Wikipedia search clarifies its meaning as "*decentralized online ecosystem based on blockchain*", using the words attributed to Polkadot blockchain's founder and Ethereum blockchain's co-founder Gavin Wood. Web3 marks the evolution of the web into a decentralized database integrated within Distributed Ledger Technologies (DLTs). Among several types of DLTs, the much-discussed blockchain technology stands out due to its decentralized approach to value

transfer and decision-making, cryptographic methods ensuring operational integrity, and ability to support a diverse range of interconnected applications[309].

Blockchains are classified as private, permissioned, and public/permissionless depending on the degree of decentralization, accessibility to the ledger, and participation in the network. A public and permissionless blockchain is an open network with unrestricted participation, and no permissions for reading, writing, or auditing the ledger are required (e.g. Ethereum, BitCoin). A private blockchain operates as a closed network with access restricted to specific users, on different layers, typically under the control of a single organization in regulated environments, such as in the cases of Corda (widely used in the banking sector for data transfer) and Hyperledger. A permissioned blockchain represents a hybrid model that limits access to certain activities, e.g. coding transactions, while allowing public or selected entities to access the data.[310]

As only public and permissionless blockchains guarantee full decentralization, it is worth dwelling on this specific type of blockchain network. For systematization purposes, four elements of decentralization deserve attention in this discussion. The first element of decentralization in public blockchains relates to the absence[311] of intermediaries to perform value transactions, entailing economic

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[309] Blockchain applications can be intended as either the technological dApps or the use-cases of the technology. decentralized applications known as dApps run on a blockchain network connecting distributed servers controlled by multiple nodes rather than being hosted on centralized servers. See Buterin V, A Next-Generation Smart Contract and Decentralized Application Platform (2013).

[310] *ibid.* n. 143, De Filippi, pp. 13-32.

[311] Originally conceived by an imaginary inventor of the BitCoin blockchain known as Satoshi Nakamoto in 2008 to enable peer-to-peer global transfers of electronic cash, blockchain technology served the purpose to fully eliminate intermediaries. According to Nakamoto, bitcoin is a "*purely peer-to-peer version of electronic cash*" that allow "*online payments to be sent directly from one party to another without going through a financial institution*". See Nakamoto S, Bitcoin: a peer-to-peer electronic cash system (2008). However, current experimentations by central banks and other financial operators foresee the presence of the latter.

The DLT Pilot Regulation (Regulation 2022/858 of the European Parliament and of the Council on a pilot regime for market infrastructures based on distributed ledger technology, and amending

and data/informational exchange. Disintermediation cuts third-party transaction costs. Decentralized finance (DeFi) constitutes the most common use case, enabling peer-to-peer transactions of currency and other virtual assets directly on the blockchain. This process eliminates the need for traditional intermediaries such as banks, brokers, and other financial institutions.

Smart contracts represent the second element of decentralized governance[312]. Introduced in the Ethereum blockchain in 2014, smart contracts consist of computer programs that encode and self-execute binary performance relations between two events (if Y, then X). In other words, they are set to enforce contractual terms, where the factual and legal conditions pre-determined by the parties of a transaction for performance are met. While this functioning reduces and eliminates reliance on centralized and intermediary institutions for transaction verification and validation, it has been empirically proven that smart *legal* contracts[313] can be applied to enable parties to engage in negotiations, formalize agreements and execute contracts directly on the blockchain[314]. Plus, agreements formalized and executed on-chain may have any legitimate content, provided principles and rules of contract law are respected. In addition to verification, recording, and automation of transactions, the whole lifecycle of contractual arrangements may well take place on a chain, including negotiation of

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Regulations (EU) No 600/2014 and (EU) No 909/2014 and Directive 2014/65/EU), approved on May 30, 2022, and which will apply from March 23, 2023, allows the launch of experimental projects for the inclusion of DLT and blockchain in the financial markets.

[312] The notion was coined in 1994 by Nick Szabo, an American computer scientist and legal scholar known as the precursor of the Bitcoin architecture, as follows: "*a computerized transaction protocol that executes the terms of a contract. The general objectives [..] are to satisfy common contractual conditions (such as payment terms, liens, confidentiality, and even enforcement), minimize exceptions both malicious and accidental, and minimize the need for trusted intermediaries*". Szabo N, Smart contracts, 1994.

[313] The expression 'smart legal contract' can be defined as "*a specific application of technology as a complement, or substitute, for traditional contracts"*. Banca d'Italia, Università Cattolica del Sacro Cuore, Università Roma Tre, Caratteristiche degli smart legal contacts, Giugno 2023.

[314] Bassan F, Rabitti M, From Smart Legal Contracts to Contracts on Blockchain: An Empirical Investigation (November 6, 2023).

terms and clauses, performance monitoring, modifications[315], enforcement, and conflict resolution[316] .

Besides the classic financial use case, smart contracts are adaptable to several fields of application, ranging from ownership transactions, peer-to-peer trading in a decentralized energy grid (e.g. payments for energy exchange[317]), IP rights management, transparent voting systems, and patient records management, to name a few.

Asset (including data) tokenization is the third element of decentralization. Tokens digitally represent tangible and intangible assets, fractions of ownership that increase liquidity (hence the availability of resources to distribute). Tokenization of tangible ownership entails converting real-world assets, such as real estate, artwork, and precious metals, into digital tokens that can be traded, transferred, and managed securely and transparently on a blockchain network. Examples of intangible assets are native crypto-currencies, voting rights, securities, non-fungible tokens, intellectual property rights, and any data that can be incorporated into the tokens.[318]

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[315] This is possible not only technically but also legally since the entry into force of the Data Act (Article 36), which mandates a series of requirements for, among others, safe termination and interruption.

[316] An oracle functions as a script that validates the presence of necessary conditions for the intended outcome. The data transmitted by oracles triggers the execution of smart contracts, thereby supporting the overall operation of the blockchain ecosystem. Due to this pivotal role, oracles are often referred to as "bridges" that connect the real world with blockchain protocols. See Carron B, Botteron V, How smart can a contract be? in D. Kraus, T. Obrist, O. Hari (eds.), Blockchains, Smart Contract, decentralized Autonomous organizations and the Law, (Cheltenham, UK-Northampton, MA, USA 2019). The authors define oracles as "*sensors in the physical word*". Also Cardarelli G, Beyond Oracles, A Critical Look at real-world Blockchains (Future Internet 2022), p. 175 takes up the concept that "*Oracles act as a bridge that can digest external and non-deterministic information into a format that a blockchain can understand*".

[317] Kounelis I, Giuliani R, Geneiatakis, Di Gioia R, Karopoulos G, Steri G, Neisse R, Nai- Fovino I, JRC Tehcnical Reports, Blockchain in Energy Communities A proof of concept (2017 EUR 29074 EN).

[318] For the proposal of a general framework to address some of the multifactor aspects of data tokenization (technological, legal, social, economic) exploiting blockchain/distributed ledger technology (DLT) to create a decentralized market-place for data: Pithadia H, Fenoglio E,

The fourth element of decentralization in public blockchains is on-chain decision making where all the participating parties have access to the ledger and all operations recorded in the ledger. The most radical form of blockchain governance occurs in the decentralized Autonomous Organizations (DAOs)[319], whose members can propose and vote on decisions concerning changes to a protocol or the use of the funds for a project, according to several voting mechanisms, usually one person one vote or one token one vote. Sometimes decision-making functions through delegation networks, whereby a token holder must delegate their tokens to a delegate, and participation in decision-making often leads to concentration of power in delegated actors. On the one hand, this governance system resembles traditional corporate governance, where a small number of large shareholders and investors represent their interests[320]. On the other hand, on-chain decision-making implements new models of political participation, such as liquid democracy[321], provided the widest involvement of actors in the network avoids concentration of power. The potential of democratizing decentralized systems can be more fruitful by incentivizing the direct participation of actors in decision-making in highly technical digital ecosystems. Incentivization is not only a matter of economic reward (participation in governance is rewarded with tokens) but also creates the material conditions for wider participation through knowledge sharing, educational

Batrinca B, Treleaven P, Echim R, Bubutanu A, Kerrigan C, Data Assets: Tokenization and Valuation (April 2023).

[319] Guskow Cardoso A, Decentralized Autonomous Organizations, DAOs: the Convergence of Technology, Law, Governance, and Behavioral Economics (MIT Computational Law Report 2023).

[320] Fritsch R, Müller M, Wattenhofer R, Analyzing Voting Power in Decentralized Governance: Who controls DAOs? (Blockchain: Research and Applications 2024).

[321] Atzori M, Blockchain Technology and Decentralized Governance: Is the State Still Necessary? (December 1, 2015); Swan M, Blockchain. Blueprint For a New Economy (Sebastopol, CA: O'Reilly 2015).

programs, and capacity building. To solve this issue, as participation within the back-end of the blockchain network decision-making requires high computational capacities and coding skills, some blockchains have put in place off-chain natural language decision-making mechanisms. This constitutes a factor of inclusion in the governance of decentralized systems, provided that a framework of shared values coupled with transparency and accountability rules build trust and fair conduct between off-chain principals and on-chain agents.

decentralized digital ecosystems are not agnostic to written governance frameworks. A recent scientific empirical study identified and decoded the existing DAO governance documents[322], displaying titles such as manifestos, constitutions, codes of conduct, community covenants, and charters. These web-scraped foundational documents summarise the common values and goals of decentralized governance with varying levels of explicitness. According to the authors, they constitute 'performative' documents that pragmatically articulate the commitments of a group and guide participants toward a common project.

### *1.2.3 The hybrid model*

Next to these models sits the hybrid model which may display either centralized and/or decentralized characteristics. One is the 'platform cooperativism' model, i.e. a digital transposition of analog cooperative corporate governance models, coupling the rules of constitutions and bylaws of cooperatives with open-source and P2P technology[323]. This model aims to ensure shared and balanced

[322] Tan J, Langenkamp M, Weichselbraun A, Brody A, Korpas L, Constitutions of Web3 (SocArxiv, February 2024).

[323] Bauwens M, Kostakis V, Pazaitis A, PeertoPeer: eCommonsManifesto (London: University of Westminster Press 2019), pp. 1-10.

governance and co-ownership of the 'Internet levers of power', encompassing both platforms[324] and protocols, and the economic and human resources by all the participating members of the co-ops. Collective choices are taken through democratic rules and decision-making procedures involving all members who commit to the co-op with their skills, work, and economic contribution. Other main characteristics are the co-ownership of servers, data control, the nexus between contribution in investment and labor, orientation towards community growth, and the development of human and social capital.

Another hybrid model that can be drawn from the above lies in the permissioned, private, and public-private blockchain platform models. Permissioned blockchains are hosted and managed by one or more collaborating organizations, where participation in the network requires approval and authorization from the governing authorities. The ledger may be publicly accessible or not, which marks the difference between a public and a private blockchain. A public-private blockchain may consist of several layers and applications accessed and used by a limited number of participants and some by all.

*1.3 The ethical formant*

No matter the centralized, decentralized, or hybrid model, all platforms shape or adhere to a system of values rooted in human ethics, whether heteronormatively, building on existing ethical codes, or autonormatively, by making their brand-new code. Ethics *per se* is a human invention of what are righteous or wrongful, deontological, consequential, virtuous, and fair actions and ends. In the digital

[324] Scholz T, Schneider N, Ours to Hack and to Own, The Rise of Platform Cooperativism. A New Vision for the Future of Work and a Fairer Internet (OR Books 2016).

epoch, the enmeshment of human and digital entities and conduct have led legal-philosophical scholarship to coin the term 'digital ethics' to depict "*the branch of ethics that studies and evaluates moral problems relating to data and information (including generation, recording, curation, processing, dissemination, sharing, and use), algorithms (including AI, artificial agents, machine learning, and robots), and corresponding practices and infrastructures (including responsible innovation, programming, hacking, professional codes, and standards), in order to formulate and support morally good solutions (e.g., good conduct or good values)*"[325].

Digital ethics is complementary to digital governance and regulation. The former is understood as the practice of designing and implementing policies, standards, and procedures, and the latter is the system of binding legal rules requiring compliance assisted by enforcement mechanisms concerning the digital sphere. Digital ethics adds up the questions and the answers of moral righteousness and wrongfulness, and the best or the worst content and connotations for values that underpin a system of rules, rights, duties, and any legal or socio-technical rules. Ethics should intervene before, during, and after governance rules are approved, applied, and enforced in the first case.

Supranational[326] and national governments have established digital ethics committees to accompany technological evolution with ethical considerations. Likewise, platforms have attempted to follow suit by setting up advisory boards (Safety Advisory Board, Content Advisory Council, Inclusion Advisory Council, etc.). These bodies, entrusted with monitoring and supervising social behavior

[325] Floridi L, Soft Ethics and the Governance of the Digital (Philos. Technol. 31, 2018), pp. 1-8; Catanzariti M, What Role of Ethics in the Law of AI? (Springer Nature 2023).

[326] *Ex multis*, on the international level, UNESCO World Commission on the Ethics of Scientific Knowledge and Technology (COMEST).

and content safety on platforms, are composed of members of nonprofits, academics, and bottom-up organizations[327] .

In an inter-institutional and inter-societal platform ecosystem, ethical considerations specific to the types of activities, needs, and objectives of the societal actors involved give substance to the overarching ethical framework governing the platform. The existing ethical codes of conduct binding upon public servants, industrial players, professional categories, research institutions, and personnel[328] become integral parts of the ethical plasma of the platform. Building upon and cross-referencing existing codes of ethics with express citation, the platform categories of actors may also delineate easy-to-read codes of ethics tailored to the various activities and specific interactions conducted on the platform. One or more ethics committees composed of experts on ethics and technology, may oversee the activities and be asked to advise on ethical issues raising controversies.

*1.4 The evolving technological formant*

Technology itself is regulative and can be regulated.

In its regulative capacity, technology forms norms and practices, embedding rules that can be extrapolated from its functioning as the Berlin key metaphor conveys

[327] *ibid.* n. 103 Caplan, for an overview. A controversial case concerned the dissolution of Twitter's Trust and Safety Council set up in 2016 since the corporate takeover of 2022 by Elon Musk. The body had been a role model for network governance in the platform industry.

[328] For instance, the European Code of Conduct for Research Integrity provides a framework for self-regulation in the European research community, applicable across all disciplines and research environments. The 2023 Revized Edition ensures the Code remains relevant to new research areas and practices. Recognized by the European Commission, it serves as the primary standard for research integrity in EU-funded projects and increasingly influences national and institutional codes, funding guidelines, training initiatives, and discipline-specific standards. For example, it underpins guidelines for responsible Open Science and the responsible use of generative AI in research.
ALLEA, The European Code of Conduct for Research Integrity – Revized Edition 2023, Berlin.

(*supra* n. 8). For instance, blockchain networks may well be designed to encode principles of good governance such as democracy, fairness (non-discrimination), privacy, transparency, accountability, security from cyber-attacks and, in certain cases, environmental sustainability[329]. In this case, it is up to the developers to live up to this encoding task of the legal and ethical formants in technology, advised and assisted by ethics, legal, and policy experts. The development and use of blockchain solutions by the European and Italian public administrations[330] and private organizations have proven uncontroversial and successful[331].

Technology can thus defer to human agency and be deterministic, where an input brings an unequivocal output. Such is the case of smart contracts or traditional sorting algorithms (for data analysis, search, and indexing). Deterministic technology is a fully 'controllable' and malleable product of human ingenuity.

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[329] Next to energy consuming blockchains exist the so-called green or carbon-neutral blockchain. See Bassi C, Ihsanullah N, Proof of Stake Blockchain Efficiency Framework, Algorand, efficient self-sustaining blockchain (Algorand Foundation 2022). The distinction is based on the consensus mechanism applied to protocol maintenance and modification. The traditional Proof-of-Work consensus mechanism requires energy-intensive high computational capacity and mining process. Proof-of-Stake, delegated-proof-of-stake and proof-of-authority mechanisms assigns vote on the basis of the quantity of tokens held by participants.

[330] In Italy, several applications of blockchain technology have been implemented in various areas of administrative action. The Ministry of Economic Development, Fondazione Ugo Bordoni and two Italian universities have initiated applied research activities to combine the delivery of advanced services for public administration. The first output was the public "Registro delle Opposizioni" extended to all national telephone numbers, landlines and mobile phones to offer citizens the relieving choice of having unwanted telemarketing calls blocked. Another noteworthy case is a project initiated by some Italian universities (University of Cagliari, University of Milan Bicocca and University of Padua) focusing on the application of Blockchain for the authentication and recognition of academic qualifications. Lo Sapio G, Il tormentato rapporto tra blockchain e pubblica amministrazione nel prisma dei contratti pubblici (federalismi.it 2023/26).

[331] The European Union has been promoting a common approach of knowledge sharing of blockchain best practices with the 2018 Blockchain Observatory & Forum, the European Blockchain Partnership (EBP), the European Blockchain Services Infrastructure. The latter is a network involving all EU partners managing at least one node and identifying various application areas including notarization, diplomas, European digital identity and reliable data sharing. Implementation started in February 2023 with the launch of the European Blockchain Sandbox, now underway with the first 20 experimental projects. In Italy, the Ministry of Economic Development, an active member of the European Blockchain Partnership has established a group of 30 experts on Blockchain technology with the aim of developing a National Strategy. Additionally, the Ministry has announced investments for research and experimentation in Blockchain technologies and their applications.

Deterministic technology can be predicted, pre-determined, steered, and explained by humans. It can be designed and programmed according to ethical principles (ethics by design)[332] and legal rules (legally compliant by design). In a platform governance framework, clear rules on technology design and development shall be clearly defined from the outset in a language accessible to its user base.

Other technologies bring about unexpected and inexplicable consequences. This is the case of non-deterministic algorithms, where the outputs for a possible input vary randomly[333]. Scholars have highlighted that algorithmic bias results from incorrect training/design of the algorithm or model, or errors in the data collection and usage process, meaning that even the most obscure AI systems can be trained, corrected, and cautiously used[334]. The literature on algorithmic bias and discrimination is rich and has thoroughly tackled the issue of interference with the exercise of fundamental rights and access to essential products and services available to the public, such as credit or health insurance[335], or the use of AI systems and blockchain in public administration[336].

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[332] Brey P, Dainow B, Ethics by design for artificial intelligence (AI Ethics 2023).

[333] *e.g.* Deep neural networks, the so-called black boxes, are generally considered poorly explainable, because they are highly non-linear and nested models that transform data, producing a new representation as output through complex combinations of inputs.

[334] *Ex multis*, Hacker P, Teaching Fairness to Artificial Intelligence, Existing and Novel Strategies against Algorithmic Discrimination under EU Law (Common Market Law Review 55 Kluwer Law International 2018), pp. 1143-1186; Adams-Prassl J, Binns R, Kelly-Lyth A, Directly Discriminatory Algorithms (OUP Modern Law 2022).

[335] Aggarwal H, Machine Learning, Big Data and the Regulation of Consumer Credit Markets: The Case of Algorithmic Credit Scoring, in H. Aggarwal, H. Eidenmüller, L. Enriques, J. Payne, K. van Zwieten (ed.) Autonomous Systems and the Law (Beck, 2019), pp. 37-45.

[336] Corradino M, Intelligenza artificiale e pubblica amministrazione: sfide concrete e prospettive future (Rivista Diritto Amministrativo Rivista Giuridica, Anno XVI - n. 07 - Luglio 2024); Carullo G, Piattaforme digitali e interconnessione informativa nel nuovo Codice dei Contratti Pubblici (federalismi.it 19/2023). Two provisions of the Public Contracts Code specifically refer to automated decisions and distributed ledgers. Article 30, dedicated to the use of automated procedures and aimed at codifying the principles of so-called algorithmic legality developed by scholars and upheld by the the Council of State. Article 106 provides that surety guarantees must be natively digital and can be managed through the use of distributed ledger technologies.

Artificial intelligence has regulative power. Machine learning and generative AI self-train and develop without being deeply understood by proactive law-makers, who are adopting cautious risk-based and experimental approaches (e.g., EU, US, Canada, Brazil) and more cautious wait-and-see ones.

The recently approved Artificial Intelligence Act foresees the establishment of a set of advisory bodies, among which an advisory forum for stakeholders to provide technical expertise to the AI Board (the latter composed of representatives of the Member States and the Commission). The opinions of the 'technical' stakeholders, including the community of AI open source developers[337], have reached a degree of importance that has fully institutionalized their role in the decision-making processes of the EU AI future-proof legislation. The introduction of AI regulatory sandboxes makes the new regulation porous and adaptive to new experiments and innovations in the field and *evidence-based regulatory learning* which does not rule out that future evolutions in technology may produce the need for novel rights, obligations, or exemptions for users, providers and developers[338]. The role of developers is increasingly important in policy-making and, all the more so, it should be in educational programs, public offices, and private organizations.

When coding a platform governance model, it is necessary to clarify from the outset what technology forms the basis of the infrastructure and the tools, for

[337] Paradigmatic has been the participation in the discussions on the proposal for the AI Act of Eleuther AI, GitHub, Hugging Face, LAION, and Open Future, which offered suggestions for how the Act can better support open source and open science. Supporting Open Source and Open Science in the EU AI Act, July 2023, available at: https://creativecommons.org/2023/07/26/supporting-open-source-and-open-science-in-the-eu-ai-act/.

[338] Council Conclusions on Regulatory Sandboxes and Experimentation Clauses as tools for an innovation-friendly, future-proof and resilient regulatory framework that masters disruptive challenges in the digital age 2020/C 447/01, p. 1–3.

which uses and objectives, and provide an explanation or ensure - no easy task even for mathematicians - explainability of the reasonings behind its functioning. A platform that revolves around open research and innovation shall aim to communicate and enhance the understanding of the technologies in use to the participating societal actors. To this end, the platform may offer digital literacy building massive open online courses (MOOCs), experimenting on online and analogue living labs, and, if advanced, hackathons for coding development.

## PART II SKETCHING *AD INTERIM* PROPOSALS FOR THE PLATFORM GOVERNANCE MODEL

In light of Part I of this Chapter, the legal formant of a platform governance model comprises primary (rights, duties, and sanctions) and secondary (procedural) rules. The ethical formant complements these rules with moral considerations. The technological formant is instrumental to encoding ethics and the law in the platform through cross-disciplinary expertise and open knowledge sharing (computer scientists, developers, philosophers, lawyers, economists, citizens, etc)[339].

Building on these takeaways, it is worth sketching an *ad interim* proposal for platform governance to foster an open research and innovation ecosystem in a local knowledge polity. The size and type of polity have been previously fixed. The polity is local in size, juxtaposed with regional, municipal, or neighborhood

[339] In a similar vein to the Law + Technology approach proposed by Schrepel T, Law + Technology (Stanford University CodeX Research Paper Series 2022; The Journal of Law and Technology at Texas 2023).

territories and administrative entities, while simultaneously maintaining a global outlook and openness.

It is, therefore, time to identify the actors, mission, goals, processes and services, technological architecture and arrangements, the underlying organizational and business model, and finally the values and rules of the platform ecosystem to be built.

### *2.1 Actors*

The actors in the platform are the agents of the societal systems previously identified.

The scientific system is represented by universities and other research and educational institutions, which may have their physical seat either close to the polity or far from it (e.g. a foreign university or innovative firm); the public governmental system by the central and local departments of the authorities that are competent for research and innovation matters; the private-institutional-organizational system by firms, start-ups, SMEs and bigger companies adopting an open innovation model; the organized civil society by global and local NGOs and third sector entities; the individual-subjective system by citizens, temporary residents (e.g. expats, foreign students) and invisible ones (e.g. asylum seekers, applicants for a residence permit).

In the platform ecosystem, actors are classified into pro-users, members, and parties, based on the type of services available to/provided by them, and the activities performed. Pro-user is the default category of individuals and unregistered NGOs. The term identifies the active user who plays a proactive role in the platform ecosystem, which is not limited to having granted access to

on-platform content and services. For public and private institutions and organizations membership to the platform is required, as their financial capacity allows them to contribute to a common endowment fund to economically sustain the fixed costs of the platform (e.g. IT developing, fixed staff, and maintenance activities). Membership can be acquired *ab initio* from establishing the underlying legal organization or following later admission thereto.

Parties are parties in the legal contractual sense, i.e. those actors who enter into negotiation and contractual relations employing the smart legal-technological arrangements on the platform. For example, a university department negotiates and concludes a data-sharing smart agreement with the public administration and local start-ups.

### *2.2 Mission, goals, functions, processes and services*

The core mission of the platform is to promote a knowledge-based democratic polity that is local in size and global in perspective.

The platform's primary goal thus translates into creating a virtual environment that connects the actors from the scientific system with the actors of the institutional, organizational, and other societal systems, including the individual system. The latter is intended as a self-determining subjective system interested in collective action and cooperative behavior[340]. Another goal is to create a virtual environment for a local polity, i.e., a political community for active citizens and

[340] A complex open research and innovation ecosystem attracts competitive behaviours by its agents. According to Axelrod, cooperation is not just a matter of altruism or morality but a rational strategy for entities pursuing their self-interest under certain conditions. Axelrod demonstrated that cooperative behaviors could emerge and sustain themselves even in competitive ecosystems (whether biological or human), highlighting the significance of strategy, foresight and reciprocity in facilitating cooperation. Axelrod R, The Evolution of Cooperation (Basic Books Inc. New York 1984).

social inclusion for non-citizens, creating a science-society-polity interface. Having identified the main goals, the cascading purposes reverberate in the functions and services that the platform ought to provide.

To do so, the platform has two main functions:

1. Enabling open and participatory processes for scientific knowledge creation, evaluation, and communication, where the scientific system acts as the pivot for local development and voluntary engagement in science and policy.
2. Providing a forum for inter-societal and inter-institutional dialogue for science-based and common good-oriented research projects and policy proposals.

Based on the multi-level Open Science regulatory mandate and best practices, the open and collaborative scientific processes, practices, and services provided by the platform, encompass:

a) Co-production[341] and early dissemination of scientific results (including negative, partial, and early-stage results).

b) Open and transparent evaluation (scholarly peer review and 'lay' post-normal/social impact review).

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[341] Jasanoff S, States of Knowledge, Idioms of Co-production (Routledge 2004), p. 3. ".. *in broad areas of both present and past human activity, we gain explanatory power by thinking of natural and social orders as being produced together. The texture of any historical period, and perhaps modernity most of all, as well as of particular cultural and political formations, can be properly appreciated only if we take this co-production into account. Briefly stated, co-production is shorthand for the proposition that the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it. Knowledge and its material embodiments are at once products of social work and constitutive of forms of social life; society cannot function without knowledge any more than knowledge can exist without appropriate social supports. Scientific knowledge, in particular, is not a transcendent mirror of reality. It both embeds and is embedded in social practices, identities, norms, conventions, discourses, instruments and institutions – in short, in all the building blocks of what we term the social. The same can be said even more forcefully of the realities of human experience emerge as the joint achievements of scientific, technical and social enterprise: science and society, in a word, are co-produced, each underwriting the other's existence*".

c) Scientific results (data and publications) will be disseminated openly and immediately on the platform following a golden open-access model on a platform peer-reviewed journal[342].

d) Creative commons licenses as default scheme for fast and smooth knowledge sharing.

e) By-design data privacy and cryptographic security protection.

f) Open data repositories accessible to all with smart legal arrangements for data exchange and altruism in line with the recent European Union Data Governance Act and Data Act.

g) Crowd-based translation services for inclusion in increasingly multiethnic societies.

h) An interface for networking, proposing, and pitching collaborative research and innovation projects involving multiple parties (high educational institutions, public entities, private enterprises, non-profit organizations, and individuals).

i) An application layer to negotiate, conclude, perform, and monitor the performance of agreements between the actors involved. Performance shall be compliant with local administrative and private laws, with memoranda of understanding between institutions and the administrative law instruments seen, when applicable as preferred legal instruments for partnerships.

[342] The Gold Open Access model is the practice of making scientific research freely accessible to the public immediately upon publication, without any subscription or access fees. It thus represents the golden standard of open dissemination.

j) An open dashboard[343] displaying key information and data metrics to provide a quick and comprehensive overview of performance, status, or other critical data points concerning R&I projects and policy proposals or measures to all users, to monitor real-life applications and results, and to stimulate discussions.

k) A voting mechanism expressed in natural language built on a blockchain network.

l) Private rooms for ongoing projects with dashboards, notebooks, and administration tools for project participants.

Additionally, the platform provides three application-based services:

i) an application for research crowdfunding and crowd-sourcing.

ii) an application for on-platform local job offers, search, and placement (a federated non-profit LinkedIn).

iii) and a moderated forum for policy proposals and discussions to put to vote, building on the research projects and results communicated on the platform.

The platform could then serve as the central stage for effective societal and collective dialogue, engagement, action, social integration, and informed science-based policy formulation. This strand of activity would, in part, draw inspiration from existing civic engagement platforms, of which the open-source tool Decidim constitutes the most successful example of citizens' participation in municipal development plan formulation and organization[344].

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[343] Few S, Information Dashboard Design: The Effective Visual Communication of Data (O'Reilly Media 2006), 1-37.

[344] Decidim, applied by public, private organizations, universities and NGOs, enables users "*to configure spaces for participation (initiatives, assemblies, processes or consultations) and enrich them through the*

The platform's educational framework encompasses two complementary components: open-access digital literacy and skills courses, delivered through MOOCs and *gamification*[345] approaches to accommodate varying proficiency levels and collaborative technological development opportunities via coding hackathons and virtual living labs.

*2.3 Technological architecture and arrangements*

The platform lies on a technological infrastructure and relies on arrangements designed to provide the ecosystem with innovative and experimental services and tools tailored to actors, activities and objectives.

As for the infrastructure, the platform will adopt a blend of two infrastructural technologies. A hybrid multilayered blockchain[346] for digital negotiation, performance, and remedy of contractual transactions; and the cloud for swift, secure, interoperable, and cross-sectoral open data exchange, including IoT data sharing for better local policymaking and monitoring, compliant with the recently approved EU legislation on data governance and sharing.

Artificial intelligence on the platform would be an object of experimental digital literacy, rather than a decision-making instrument that substitutes human agency.

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*multiple available components (face-to-face meetings, surveys, proposals, voting, follow-up of results, comments and many more)*". https://decidim.org/features/ .

[345] Deterding S, Dixon D, Khaled R, Nacke L, From Game Design Elements to Gamefulness: Defining "Gamification" (Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments 2011).

[346] Meaning both public, accessible to anyone, thus transparent, and private where parties wish to keep contractual arrangements confidential for proportional and legitimate purposes (data protection, NDAs, contractual confidentiality, professional secret, etc.).

*2.3.1 AI on the platform and digital literacy building on the platform*

At the 'AI for Good Global Summit' organized by the International Telecommunication Union (ITU), which took place in May 2024, the UN Agency for Digital Technologies concluded with commitments to develop inclusive standards and provide capacity building to ensure all countries and communities benefit from artificial intelligence. This could translate into practical efforts to build AI-literate local communities through on-platform AI community education and development initiatives. High schools, universities, and any other educational institutions may partner to offer and receive courses to democratize both the use and coding of AI systems and basic coding languages. Some universities around the world, especially in the US, have launched similar courses (e.g. free Massive Online Open Coding Courses), living laboratories, and hackathons, not just within the faculties and departments of computer science but also in the context of inter- and multidisciplinary collaborative programs. MOOCs, or Massive Open Online Courses, is an online course format designed in the US to guarantee access to education to a large number of participants worldwide, often free or at a low cost. MOOCs cover a wide range of subjects typically delivered via video lectures and interactive exercises with forums for discussion and peer support. The actors in charge of this service would be universities, colleges, and other educational institutions (already existing platforms providing this service are Coursera, edX, and Udacity). Hackathons are intensive, time-bound events where teams of programmers, designers, and industry stakeholders collaborate to create functioning software or hardware solutions. Participants work on specific themes or challenges set by the organizers, and the event culminates in presentations of the projects developed. Hackathons are

popular in the tech industry and academia and serve as a means to quickly prototype ideas, build networks, and identify talent.

Living Labs[347] are centered on users and open innovation ecosystems, where real-life communities and environments become test beds for research and development. They may integrate research and innovation processes within a public-private-people partnership. Their goal is to create a collaborative environment where users are actively involved in the co-creation and evaluation of new technologies, products, services, and infrastructures (such as the case of the construction of the Stockholm Airport already in 2009)[348]. This approach helps ensure that the outcomes are more aligned with the needs and contexts of the end-users. A living lab often operates in urban development, smart cities, and sustainability projects.

*2.4 Values and rules*

Ethical values, rights, obligations, sanctions, and conflict resolution rules must be set out in a clear and intelligible manner, and be enforceable. Similar to digital constitutionalism that advances the idea of an 'Internet bill of rights' with the function of empowering societal institutions[349], while ensuring compliance with the relevant applicable laws, a set of values and rules could be enshrined in a 'living' constitution of the platform. This could be susceptible to amendments proposed and voted by a qualified majority of the platform participants through a

[347] Ballon P, Schuurmann D, Living Labs: Concepts, Tools and Cases (April 1, 2015). Info, Vol. 17, n° 4, Forthcoming, Available at SSRN: https://ssrn.com/abstract=2642754 or http://dx.doi.org/10.2139/ssrn.2642754

[348] Kviselius NZ, Andersson P, Living Labs as Tools for Open Innovation (COMMUNICATIONS & STRATEGIES, No. 74, 2nd quarter 2009).

[349] Redeker D, Lex G, Gasser U, 'Towards Digital Constitutionalism? Mapping Attempts to Craft an Internet Bill of Rights'. (International Communication Gazette 80 (4) 2018), pp. 302–19.

blockchain-based decentralized method. Otherwise, the platform's fundamental values and rules could be outlined in publicly available Articles of Agreement of the platform underlying organization, and recognized by explicit and specific reference[350] to the characteristics of the applicable provisions of relevant legal documents of the country where the platform organization is registered, international and European law principles, laws, case-law and standards, guidelines and best practices, and ethical codes of conduct. For instance, the principles of good governance elaborated by the European Union and OECD, the principles of open government, open science, and open data, could be incorporated into a foundational document and complemented with additional principles identified by the community or adapted to socio-legal evolutions. The texts of the relevant legal sources may be uploaded on the platform accompanied by reader-friendly summaries and factsheets (like in the platforms of the European institutions).

All users, pro-users, members and parties to the platform shall be bound by ethical and legal conduct rules, and respond to misconduct. Powers and boundaries of power must be clearly defined. Rule-making powers could be attributed to *ad hoc* assemblies to which members and pro-users may exercise or delegate their rights to propose and vote. Members, users and parties could enjoy a procedural right to claim against abuses and misconducts and resort to an on-platform impartial conflict resolution mechanism similar to the mechanism

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[350] *ibid.* Hart n. 299, p. 95. "*In a developed legal system the rules of recognition are of course more complex; instead of identifying rules exclusively by reference to a text or list they do so by reference to some general characteristic possessed by the primary rules. This may be the fact of their having been enacted by a specific body, or their long customary practice, or their relation to judicial decisions. Moreover, where more than one of such general characteristics are treated as identifying criteria, provision may be made for their possible conflict by their arrangement in an order of superiority, as by the common subordination of custom or precedent to statute, the latter being a 'superior source' of law.*".

envisaged in the Digital Services Act for content-moderation[351]. A conflict resolution clause and an oracle for redress before the judicial authorities competent under the principles of international private law and public administrative law should be provided to ensure respect for the rule of law.

*2.5 Organizational and business model*

To bring together different societal and institutional actors, the open research and innovation complex ecosystem delineated needs a unifying organizational entity that takes the form of an independent legally recognized organization. Given the public and common interest at stake and the adherence to a genuine open access and open science paradigm, the organization should follow a non-profit business model. As anticipated, formal institutions and organizations should commit to the values, goals, and rules of the platform and financially contribute to an endowment fund. The discussion on the openness paradigms showed that openness goes more coherently hand in hand with a non-profit model. Hence, the best possible legal vest seems to be the non-lucrative institution of the Foundation. In the Italian legal system, an exemplary legal organizational structure born from practice and private autonomy, recently crystallized in the Code of the Third Sector (d. lgs n. 117/2017) is embodied in the participatory foundation (*fondazione di partecipazione)*. The core distinguishing characteristics of this type of foundation from the traditional ones under the Italian Civil Code can be summarised in the presence of multiple founders and, notably, the ability for new participants to join the entity at a later stage; mechanisms aimed at

[351] Article 21 of the Digital Services Act mandates the establishment of out-of-court dispute settlement bodies (ODS). These bodies, certified by Digital Services Coordinators (DSCs), are designed to handle disputes regarding content enforcement decisions made by online platforms, ensuring that users receive effective, timely, and independent means of redress.

progressively increasing the assets, including subsequent contributions beyond the initial endowment; active involvement of participants in the administration, often through participation in an Assembly. In Italian administrative law and practice, this type of Foundation has been assigned 'cultural services' even through direct administrative award instruments. Also, the administrative law significance of these foundations arises where their capital is substantially held or where they have been directly established by public entities[352], as part of the broader and more general process of governance hybridization.

[352] Chiti MP, La presenza degli enti pubblici nelle fondazioni di partecipazione tra diritto nazionale e diritto comunitario, in AA.VV, Fondazioni di partecipazione, Quaderni della Fondazione Italiana del Notariato, 2007), p. 35. The author noted that in participatory foundations "*the presence of public entities is frequent and their role quite significant*".

# CHAPTER III THE EMPIRICAL ANALYSIS

This Chapter is dedicated to an empirical analysis of case studies concerning the governance of scientific collaborative platforms inspired by the values and principles of open science. The first set of case studies comprises developing open science digital and highly institutionalized platforms. The analysis here is descriptive and desk-based covering information and data gleaned from the web.

The descriptive case study analysis observes the governance features of techno-institutional platforms of regional reach, which create an open research and innovation digital and analog ecosystem involving multiple and diverse societal actors and adopt a collaborative working method. The governance of these platforms is a recent and underresearched topic. The analysis is, therefore, oriented towards describing and conceptualizing different models of open research and innovation platform infrastructures, highlighting their singularity. Despite the heterogeneity of the results and the wide territorial scope of the platforms, an assessment of the importability of the models in a local context will follow as a key finding of the descriptive analysis. It follows a qualitative study based on the administration of a semi-structured interview with one of the founders of a collaborative platform that aims to open up the surgical data life cycle for quality improvement and educational purposes using cloud, computer vision, and artificial intelligence. In other words, the platform endeavors to establish an interconnected digital ecosystem that facilitates global collaboration among surgeons and healthcare professionals, fostering the democratization of surgical expertise through shared knowledge repositories, standardized data collection, and collective clinical insights. This framework aims to transform

traditionally siloed surgical information into an accessible and dynamic common resource, enabling evidence-based practice advancement, and continuous professional development across geographical and institutional boundaries.

Although currently in its nascent developmental phase with restricted geographical implementation, the platform demonstrates significant potential to democratize artificial intelligence applications in surgical care delivery, thereby enhancing both clinical decision support and patients' informational autonomy and 'well-being'. This paradigm shift could facilitate equitable access to AI-driven healthcare solutions while promoting patient engagement and informed decision-making throughout the surgical care continuum.

1. *Analytical dimensions of governance*

The governance features are defined by 12 analytical dimensions that are partly inspired by previous literature on online platform communities[353], partly by the Knowledge Commons Framework[354], and partly proposed anew (See Figure I for a scheme of the dimensions of governance).

[353] For a full account *ibid.* n. 233 Fuster Morell.

[354] Frischmann BM, Madison J, Strandburg KJ, The Knowledge Commons Framework, Governing Medical Knowledge Commons (Cambridge University Press 2017).
This framework builds on the Institutional Analysis and Development (IAD) approach pioneered by Elinor Ostrom, which was initially used for studying natural resource commons. It specifically seeks to inform the design of institutional arrangements and improve understanding of intellectual property law and policy. The dimensions of the framework are the background environment: legal, cultural, and social context of the commons; the attributes: characteristics of the resources, community members, and goals; governance: rules, norms, decision-making processes, and interactions with non-members; patterns and outcomes: benefits, costs, and risks associated with the commons. In this thesis, in harmony with its adherence to the theory complexity and institutionalism, all these dimensions are considered as part of the institutional governance framework, adopting a different nomenclature.


*Figure I Dimensions of governance*

2. *The governance framework of institutional platforms for open research and innovation on a macro-regional and global scale*

The following descriptive desk-based analysis covers two continental and cross-border open research and innovation ecosystems characterized by a high degree of formal institutionalization in different macro-regions of the world. The analysis leads to conceptualizing and comparing three different institutional platform models. The hypothesis explored is whether these models or some or a combination of their features are importable in a polity research and innovation ecosystem.

*2.1 The European Open Science Cloud (EOSC)*

The European Open Science Cloud (EOSC) is an open science initiative advanced by the European Commission aimed at developing an open, unified, and interoperable digital cloud[355] infrastructure for scientific data sharing and collaboration across and beyond Europe.[356] The EOSC is designed to provide European researchers, innovators, and citizens, with seamless access to a broad range of scientific digital resources and services.

It is the first continent-wide open science initiative with a view to expanding its range of action to the European Union research partner countries, in harmony with the European standard-setting vocation labeled as the Brussels effect[357]. It was inaugurated following a public consultation with scientific, institutional, and industry stakeholders in 2016 announced with the European Commission Communication on the European Cloud Initiative[358].

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[355] The US National Institute of Standards and Technology (NIST) defines cloud computing as "*a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction*".
Microsoft Azure, one of the main commercial cloud providers, describes it as follows: "*The cloud is not a physical entity, but instead is a vast network of remote servers around the globe which are hooked together and meant to operate as a single ecosystem. These servers are designed to either store and manage data, run applications, or deliver content or a service such as streaming videos, web mail, office productivity software, or social media. Instead of accessing files and data from a local or personal computer, you are accessing them online from any Internet-capable device—the information will be available anywhere you go and anytime you need it.*".

[356] The EOSC contributes to the EU strategic priorities "*creating a cloud area for research data in Europe allowing for better science through open and collaborative knowledge sharing*" and enabling evidence-based decision making across the European Union. European Commission Communication of 20 September 2020. 'A new ERA for Research and Innovation' COM(2020) 628. It was recognized by the Council of the European Union among the 20 actions of the policy agenda 2022-2024 of the European Research Area (ERA) with the specific objective to deepen open science practices in Europe. It is also recognized as the "*science, research and innovation data space*" fully articulated with the other sectoral data spaces defined in the European strategy for data

[357] Bradford A, The Brussels Effect: How the European Union Rules the World (New York, 2020; online edn, Oxford Academic, 19 Dec. 2019).

[358] European Commission Communication on the European Cloud Initiative, COM (2016)178 final. "*The European Cloud Initiative builds on the Digital Single Market (DSM) Strategy, which aims, inter alia, to maximise the growth potential of the European digital economy. It aims to develop a trusted, open environment for the scientific community for storing, sharing and re-using scientific data and results, the European Open Science Cloud. It aims to deploy the underpinning super-computing capacity, the fast connectivity and the high-capacity cloud solutions they need via a European Data Infrastructure. Focussing initially on the scientific*

In 2021, the EOSC gained the status of a European co-programmed Partnership implementing Horizon Europe and the EU Framework Program for Research and Innovation with partner countries. The Partnership is economically sustained by EU funding facilities and in-kind contributions by the participating stakeholders[359].

Based on the concept of 'strategic coordination', EOSC apical governing bodies are the European Union, represented by the Commission, the EOSC Association, representing the multiplicity of stakeholders, the EU Member States and Associated countries convened in the EOSC Steering board (grown to 250). The governance structure is described as 'tripartite' as it coordinates the supranational system (the EU), the horizontal multistakeholder system (the EOSC Association), and the national systems (the EU Member States and Associated countries).

In a project deliverable delineating the EOSC governance framework, the EOSC Pilot project associates the EOSC governance with the concept of *community governance in the public sector*, which is typical of local governments and social community life. Community governance, explains the authors of the paper, "*refers to the processes for making all the decisions and plans that affect life in the community, whether made by public or private organizations or by citizens*"[360]. To be operational, the

*community, the user base will be expanded to the public sector and to industry, creating solutions and technologies that will benefit all areas of the economy and society. Achieving this will require a collaborative effort open to all those interested in exploiting the data revolution in Europe as an essential component of global growth.*"

[359] Memorandum of Understanding for the Co-programd European Partnership for EOSC (30 July 2021). According to the Memorandum, the European Commission envisages to dedicate up to EUR 490 million to actions within the scope of the Co-programd Partnership, and the Partners other than the Union EUR 500 million.

[360] EOSC Pilot, D2.2: Draft Governance Framework for the European Open Science Cloud, November 2017, Zenodo, DOI 10.5281/zenodo.3387541.

model requires "*three core community skills*", namely citizen engagement, the capacity to measure results, and "*getting things done*", hence efficacy[361].

Multistakeholderism marks a distinctive aspect of the EOSC overall. This is also discernible from the Articles of Association of the EOSC Association. A legal entity registered as an international non-profit organization in Brussels, the Association is the governing body gathering the most diversified spectrum of actors from the public, the private, and civil society.

Membership and the status of observer to the EOSC is granted by the General Assembly of the EOSC Association. Eligible entities cover funding organizations, research-performing organizations, service-providing organizations, and any other organizations that may contribute to and impact EOSC's mission. The member or observing organizations must be registered legal entities, national or even intergovernmental organizations[362]. The accepted members and observers shall pledge in writing commitment to the vision and values of the Association.

Each member and observer can designate only one member organization responsible for representing national or intergovernmental interests. For example, the EIROforum[363] designated one mandated organization to advocate for the viewpoints of the Forum. The General Assembly of the Association is the EOSC

[361] Yet, EOSC governance is in constant evolution and the tripartite collaboration is working on its future developments post-2027.
https://eosc.eu/news/2023/12/eosc-governance-meets-to-advance-post-2027-planning/ .

[362] All Members that are international organizations must (i) include a majority of members that are EU Member States or countries associated to the latest EU Framework program for Research and Innovation and (ii) have as a principal objective to promote scientific and technological cooperation in Europe. Observers that are international organizations do not need to fulfil conditions (i) and (ii).

[363] The European Intergovernmental Research organization forum, EIROForum, brings together eight of Europe's largest research organizations with extensive expertise in the areas of basic research and the management of large, international infrastructures, facilities and research programs. EIROforum simplifies and facilitates interactions with the European Commission and other organs of the European Union, national governments, industry, scientists, students and journalists.

supreme[364] decision-making body, composed of one delegate per member, which elects its President and the Directors for a three-year term. One delegate per member has the same voting rights as the others, whilst the observers have one representative lacking voting rights.

As for the EOSC as a whole, its governance structure is articulated in three constituent formations[365]: the Executive Board, a body tasked to ensure implementation and accountability through its thematic and functional working committees; the EOSC Board, gathering all the representatives from the Member States and the Commission to ensure effective supervision of the implementation; the Stakeholder Forum, organized by the EOSC Secretariat, as a group of representatives from a wider range of actors, tasked to provide input, insight, advise, and recommendations. Added to the EOSC governing bodies, from the set up of the Partnership, a Partnership Board gathers the voices of institutions and other relevant civil society organizations, including standardization bodies, certification bodies, regulators, and public procurers as observers. It also has monitoring and reporting prerogatives, the authority to approve or dismiss proposals for policy change or synergies with other programs, and the right request for external expert advice on an *ad hoc* basis.

[364] Article 3 of the Articles of Association gives the General Assembly the power to decide on any amendment to the articles of association, adoption and amendment of bylaws, appointment, dismissal of operational and advosory bodies, appointment, dimissal and discharge of Statutory auditor, approval of the annual budget and accounts, the dissolution of the association as well as the merger, demerger, transformation or any other restructuring, admittance and termination of members and observers and the fees of members and observers.

[365] European Commission, Staff Working Document Implementation Roadmap for the European Open Science Cloud SWD(2018) 83 final.

According to the EOSC Declaration[366], the EOSC is "*a long-term, sustainable research infrastructure*" with "*a strong and flexible governance model based on trust and increasing mutuality*". The EOSC Declaration, signed by some European scientific stakeholders, represents a sort of socio-constitutional recognition of the initiative. Its text enunciates a number of principles and commitments. Among the principles that can be extrapolated are the principles of open access by default, long-term sustainability, and the FAIR guiding principles for scientific data management and stewardship[367]. Further, it states that the governance model should be based on the values of trust, increasing mutuality, representativity, proportionality, accountability, stakeholder inclusiveness, and transparency.

The EOSC purposes can be derived from the EOSC Association's purposes stated in the Articles and the EOSC Partnership objectives contained in the Memorandum of Understanding. The purpose of the Association is three-fold: (1) to provide a single voice for advocacy and representation for the broader EOSC stakeholder community; (2) to promote the alignment of European Union research policy and priorities with activities coordinated by the Association; and (3) to enable seamless access to data through interoperable services that address

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[366] EOSC Declatoration, Brussels, 26th October 2017. The EOSC Declaration and its principles, guiding the implementation of the EOSC, are the tangible result of the EOSC Summit of 12 June 2017.

[367] *ibid.* n. 196 Wilkinson: "*Good data management is not a goal in itself, but rather is the key conduit leading to knowledge discovery and innovation, and to subsequent data and knowledge integration and reuse by the community after the data publication process. Unfortunately, the existing digital ecosystem surrounding scholarly data publication prevents us from extracting maximum benefit from our research investments. Partially in response to this, science funders, publishers and governmental agencies are beginning to require data management and stewardship plans for data generated in publicly funded experiments. Beyond proper collection, annotation, and archival, data stewardship includes the notion of 'long-term care' of valuable digital assets, with the goal that they should be discovered and reused for downstream investigations, either alone, or in combination with newly generated data. The outcomes from good data management and stewardship, therefore, are high quality digital publications that facilitate and simplify this ongoing process of discovery, evaluation, and reuse in downstream studies.* " "*The principles apply not only to 'data' in the conventional sense, but also to the algorithms, tools, and workflows that led to that data. All scholarly digital research objects — from data to analytical pipelines — benefit from application of these principles, since all components of the research process must be available to ensure transparency, reproducibility, and reusability.*"

the entire research data life-cycle, from discovery to storage, management, analysis and reuse across borders and scientific disciplines.

In parallel, the EOSC Partnership has three main objectives: 1) to ensure that Open Science practices and skills are rewarded and taught, becoming the 'new normal'; 2) to enable the definition of standards and the development of tools and services for researchers to find, access, reuse and combine results; 3) to establish a sustainable and federated infrastructure enabling open sharing of scientific results.

The overarching purpose of the EOSC is thus to create a pan-European federation of research data infrastructures made of interconnected nodes, where data is easy to store, find, access, render interoperable, and reuse (i.e. the FAIR principles in a nutshell), while nurturing a Europen Open Science culture. In terms of implementation, it is being developed as a comprehensive data infrastructure that provides for common functions and localized services at the community level. To do so, it is federating resources from national data centers, European e-infrastructures, and already existing research infrastructures. EOSC is thus building a data commons infrastructure where all-level European open research infrastructures converge and resources are pooled.

The EOSC knowledge policy is coherent with the open access mandate of the Horizon Europe Framework and the Open Data directive[368] requiring Member

[368] Art. 10 thereof reads: "*Member States shall support the availability of research data by adopting national policies and relevant actions aiming at making publicly funded research data openly available ('open access policies'), following the principle of 'open by default' and compatible with the FAIR principles. In that context, concerns relating to intellectual property rights, personal data protection and confidentiality, security and legitimate commercial interests, shall be taken into account in accordance with the principle of 'as open as possible, as closed as necessary'. Those open access policies shall be addressed to research performing organizations and research funding organizations.*"

States to adopt national policies addressed to research organizations[369]. Open access must be default for all results of publicly funded research in the EU and its partner countries, except when justification is provided in cases of personal data protection, confidentiality, intellectual property concerns, legitimate commercial interest, national security and defense.

This Cloud Infrastructure-as-a-Service model entails the provision of services according to what can be called an 'open multi-layered network' model, which connects local and national nodes to pan-European nodes to enhance capacity and acquire, instead of further scattering, resources.

Coherently, the implementation of EOSC is governed by a stakeholder-driven criterion, which requires "*organizational readiness and technical capacity to deliver core services, certification activities, joint-procurement initiatives, and adherence to minimum quality standards*" defined in Service Level Agreements (SLAs)[370]. As highlighted in the EOSC Declaration, the EOSC encourages the reuse of existing technological solutions and services from past and ongoing projects at local, national, and European levels. In this way, the best practices are kept and network effects are leveraged - sustainably - to meet scientific community and societal needs through practical use cases.

A key activity of the EOSC is to introduce educational programs in research data management, data stewardship, and data science throughout the EU in higher education, training systems, and on-the-job best practices in the industry. In this

[369] In Italy, for instance, the National Plan for Open Science, published in February 2022, is a programmatic document. As of February 2024, it was still in a pre-implementation phase. See https://openscience.it/it/article?rpk=290245&prs_sel=p_researcher&tpc_sel=t_piano_nazionale_scienza_aperta, February 2024.

[370] "*A service level agreement (SLA) is a contract between a service provider and a customer that defines the service to be provided and the level of performance to be expected. An SLA also describes how performance will be measured and approved, and what happens if performance levels are not met.*". Source: https://www.ibm.com/it-it/topics/service-level-agreement .

context, the figure of the data steward and the instrument of data management plans are fundamental to support the transition towards open data science in current research and innovation ecosystems. Data management plans (DMPs) are formal documents that outline what and how data are handled (collected, processed, generated, accessed, licensed, curated, and preserved) during a research project and after completion.

Already required for participants of the Horizon 2020 Open Research Data Pilot and mandatory in Horizon Europe for projects generating and/or reusing data, the DMPs will become mandatory in all publicly funded research projects using common online tools and methodologies. It would be up to the host institutions to monitor and complete the DMPs and send them to the common data repositories.

EOSC Future, a Horizon Europe consortium set up for the post-2027 framework, is taking the first steps towards the objectives of a system-of-systems approach to the EOSC platform. Once research infrastructures and portals are linked, resources and services will create a fully operational web of data and services, such as data visualization and analytics, long-term information preservation, and monitoring tools for the adoption of open science practices.

On 24th April 2024, the EC announced the launch of the first EOSC EU Node. This will offer automatic file sync and sharing across locations and teams, interactive notebooks, real-time document sharing, and creation, secure large file transfer, virtual machines to design and conduct reproducible experiments, cloud-native applications, and bulk data transfer[371]. During the reporting period ending in 2023, no operational core functions had been implemented, and the

[371] https://open-science-cloud.ec.europa.eu/services/ .

interoperability framework remained fragmented. The EOSC EU Node will address and advance these issues.

Monitoring is exercised by the European Commission in the framework of the EOSC Co-programmed Partnership agreement. All Horizon Europe Partnerships are required to establish a reference monitoring framework aligned with their strategic agendas' general, specific, and operational objectives. These frameworks are designed to track progress toward the goals set forth by the Partnership and focus on specific objectives and indicators that adhere to standardized methodologies. The frameworks facilitate low-burden assessments of community achievements, their impact over time, and the identification of any necessary corrective measures.

Progress towards specific policy objectives and deliverables is monitored through several systems: planning and reporting additional activities, which forecast the annual in-kind contributions from EOSC members and track their delivery. Additionally, the monitoring of the EOSC Partnership's Key Performance Indicators (KPIs) is defined in the Monitoring Framework to ensure effective tracking of progress. The first monitoring of the EOSC Partnership's KPIs took place in November 2022 via a survey sent to EOSC Members. The results highlighted a dynamic environment, with institutional policies on data sharing and reuse either aligned with EU priorities or making significant strides towards this goal. The partners displayed a high degree of 'EOSC-readiness', evidenced by well-documented standards and protocols for data sharing and reuse, as well as rapid advancements towards providing immediate open access to publications. The full impact of the EOSC will only be realized once the EOSC EU Node becomes fully operational, allowing a network of service providers and users to

fully benefit from it.

Information on internal financial auditing within the EOSC governance is given in the EOSC Articles of Association. A Statutory auditor appointed by the General Assembly of the Association advises on and verifies the maintenance of the internal financial procedures and the annual accounts of the Association. The Articles of Association foresee a conflict resolution mechanism concerning any disputes that may arise between the members, the observers, and the Association. Claimers may resort to mediation and arbitration and, in case of failure, the competent national courts of Belgium (where the Association is registered). As for the Co-programmed Partnership, monitoring is exercised through regular monitoring reports (Biennial Monitoring reports), and financial and technical audits and reviews are performed by an independent group appointed by the European Commission.

*2.2 The African Open Science Platform (AOSP)*

The African Open Science Platform (AOSP) operates as well under an institutional collaborative framework. Since 2020 hosted by the National Research Foundation (NRF) of South Africa, the platform was ideated and founded in late 2016 by the International Science Council, its Committee on Data (CODATA), the Department of Science of Innovation of the Republic of South Africa, the Bibliotheca Alexandrina, the Science Granting Council Initiative (partnered by UK, Canadian, Norwegian, Swedish and German funding agencies), and the Academy of Science of South Africa. AOSP has the main objective of positioning African scientists at the forefront of data-intensive science.

The AOSP operates on a hub-and-network-nodes or hub-and-spoke[372] model managed by the Host Secretariat and a Community of Practice[373], comprising various work strands and domains of impact. Regional nodes, aligned with each work strand, form a critical and active component of the AOSP's operational structure. The nodes facilitate communication between regions and the Secretariat and lead the development of their respective work packages/strands, collaborating closely with the Secretariat[374]. The Community of practice is charged with coordination and collaboration with the partner countries and is composed of two organs: the Board, which sets strategy and keeps operational oversight, and the Director, who holds leadership and accountability for the operational management. Plus, the non-managerial staff is appointed or seconded from the partner countries and organizations. The first Director and Deputy Director were appointed at the beginning of 2022, marking the first year of full operation after years of piloting across the African content[375] led by a research team of the University of Botswana[376].

During its inception and pilot phase, the Africa Open Science Platform (AOSP) was overseen by an Advisory Council. As of April 2023, governance has

[372] The Hub and Spoke model is an organizational framework commonly used in healthcare, logistics, transportation, communication and network design. A central hub connects to various peripheral spokes, streamlining processes and enhancing efficiency.

[373] https://aosp.org.za/governance/ .

[374] African Open Science Platform, The Future of Science and Science for the Future, 2018. Both national entities (e.g. Ministries of Science, ITCs or Environment, National Councils for Science and Technology, data gathering initiatives and universities) and pan-African or regional bodies (the African Academy of Sciences and NASAC for academies, AAU and RUFORUM for universities, WACREN and Ubuntunet for National Research and Education Networks).

[375]Meetings have included participants from Botswana, Burkina Faso, Cameroon, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Madagascar, Morocco, Nigeria, South Africa, Tanzania, Uganda and Zimbabwe. Institutions involved in discussions include the African Academy of Science, the Association of African Universities, Ubuntu Net and the National Research and Education Networks (NRENs).

[376] International Science Council,The African Open Science Platform begins to take shape, 28th March 2022, https://council.science/blog/african-open-science-platform-takes-shape/ .

transitioned to a Governing Council, appointed for a three-year term ending in March 2026. The primary responsibilities of the Governing Council include providing strategic leadership and guidance on Open Science initiatives in Africa, as well as advancing the development of the AOSP. This includes formulating and implementing the AOSP Strategy, advocating for the platform on the global stage, supporting fundraising efforts, managing stakeholders, and appointing board members.

Eligible members of the AOSP include existing regional research networks, funding and development partners, scientific bodies (national, regional, and international), academies of science, universities and their representative organizations, research institutions, government departments, national research and education networks (NRENs), service providers, industry, NGOs, networks and associations and, notably, community groups and individuals. Interested entities can apply via the AOSC official website to be admitted as either full members or observers. These members invest resources (time, financial, and/or in-kind) and engage in specific work strands. The AOSP governance is accountable to its members, who play a crucial role in capacity development, sharing research infrastructure, integrating scientific performance, and providing science-policy expertise across various scientific fields in Africa.

As for the value proposition, the AOSCP refers to the principles, policies, and best practices of the Committee on Data of International Science Council (CODATA), which in turn commits to abide by the core principles of the UNESCO Recommendation on Open Science, the Leiden Declaration on FAIR Digital Objects, the Beijing Declaration on Research Data, Open Data in a Big Data World and the OECD Principles of 2021.

The objectives of the AOSP encompass several key initiatives aimed at fostering a robust and collaborative scientific environment across the continent. Primarily, the AOSP seeks to establish a federated network of computational facilities and services, including the development of software tools and the provision of advice on best practices and policies for research data management. Additionally, the platform aims to create a Data Science and AI Institute to drive advancements in these fields. Moreover, it promotes collaboration on a variety of African application programs, covering crucial areas such as health, biodiversity, disaster risk reduction, agriculture, open innovation, resilient cities, and indigenous knowledge[377].

Another significant strand of activity is the development of a Network for Education and Skills for skilling, upskilling and reskilling in data and information, i.e. data literacy and capacity building. The network opens up numerous opportunities for training and professional growth. A further focus is on equipping children to navigate the complexities of a data-rich world. This effort is undertaken in collaboration with the IBM Digital-Nation Africa program, providing young learners with the necessary tools and knowledge to thrive in a data-driven environment. Moreover, the AOSP collaborates with the International Center for Theoretical Physics (ICTP) and the Research Data Alliance (RDA) to deliver comprehensive training workshops in data science and embed these pieces of training into formal education systems. Additionally, the AOSP addresses the increasing demand for professional upskilling in data science

[377] African Academy of Sciences, Academy of Science of South Africa, Committee on Data for Science and Technology, International Council for Science, National Research and Education Networks, Research Data Alliance, South African Department of Science & Technology, National Research Foundation, Square Kilometre Array, and UNESCO, The African Open Science Platform: The Futureof Science and Science for the Future" (2018).

and management by offering short courses tailored for in-service training. The revenue generated from these courses contributes to the financial sustainability of the AOSP Network, ensuring it can continue to support and expand its educational initiatives.

Further, the AOSP aims to establish a Network for Open Science Dialogue to facilitate open communication and collaboration among scientists and stakeholders across the continent. Clearly, AOSP adheres to a knowledge policy of open access and FAIR data stewardship. It promotes collaborative research and the establishment of joint transformative agreements for open access. Also, it supports the formulation of national and institutional open science policies. The Network for Open Science Dialogue aims to encourage active participation in the open science conversation through forums, workshops, and other interactive events. It will feature an access portal for engagement and collaboration between scientists and industry, government, NGOs, community, and citizens. This network is designed to contribute to public policy development, and what the Platform terms as 'data diplomacy' and respond to the needs of the communities it serves.

Apropos of data diplomacy, the AOSP will set up an African Artificial Intelligence Institute and a Data Science Institute to engage in cutting-edge research in data analytics and artificial intelligence in connection with international research projects in the fields. The institutes are set to educate and cultivate a new generation of data scientists and engineers with the skills necessary for data-intensive applications across public and private sectors to build a talent pool for data science research. Moreover, they will offer support in applying advanced analytic techniques for platform users. As a network with

multiple nodes, it will be co-located with institutions specializing in related fields, ensuring each center benefits from a substantial pooling of expertise and resources. In the piloting phase, the AOSP focused on developing the necessary infrastructure to ensure reliable access to cloud computational resources and services for African scientists. This included enhancing connectivity through national research and education networks (NRENs) and providing high-performance computing (HPC) facilities at universities and other institutions. These efforts were particularly crucial for African participation in large-scale international research projects like the Square Kilometre Array (SKA)[378].

No specific information concerning decision-making, monitoring and auditing, conflict resolution, and measurement of impact on communities has been found.

### *2.3. Global Surgical AI Collaborative*

There is currently a pressing research need for a global, open, collaborative platform for surgical AI video analysis, an applied research field with the potential to improve and democratize surgery within the scientific, and medical community, and the public at large. To address this need, the Global Surgical AI Collaborative was started by an informal group of robotic surgeons and academics from Canada, the United States, Japan and Italy with a common

[378] https://www.skao.int/ . The Square Kilometre Array (SKA) is a collaborative international research project aimed at building the world's largest and most sensitive radio telescope. The project is overseen by the Square Kilometre Array Observatory (SKAO), an intergovernmental organization based at the Jodrell Bank Observatory in the United Kingdom.
The SKA project involves numerous countries, such as Australia, South Africa, and various European countries, with contributions from global research institutions and funding agencies. It seeks to tackle fundamental questions in astrophysics, cosmology and fundamental physics. Its objectives include studying the formation and evolution of galaxies, mapping cosmic magnetic fields, searching for extraterrestrial life and testing theories of gravity. The project relies on data processing, signal detection and high-speed computing.

interest in surgical data science and artificial intelligence. Among the founders, some chaired and collaborated in SAGES, the professional organization for surgeons specializing in gastrointestinal and endoscopic procedures, and its Surgical Data Science (SDS)[379] and AI task forces. Both task forces were established to promote and integrate surgical data science and AI for patient care improvement, surgical practices, and education. The AI task force in particular came up with the Delphi consensus on structured recommendations for the surgical video data life cycle[380]. This spans from data structure, acquisition, storage, sharing, use, and exploration, to data governance, which encompasses all ethical and legal requirements associated with the data. Both serve as self-regulatory bodies establishing new benchmarks in the field by defining guidelines and best practices at the crossroads of the medical science and the technological systems.

Global Surgical AI Collaborative (GSAC) was born as an independent yet in-development sister project, founded by some of the surgeons and academics of the mentioned task forces. It takes the legal form of a Canadian non-profit

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[379] "*Surgical data science (SDS) is an interdisciplinary field that utilizes advances in data science to improve the quality and safety of interventional patient care. Broadly, SDS is the assimilation of information about patients and their environment to assist with healthcare delivery. This encompasses the entire spectrum of the data pipeline, including capture, organization, analysis and modeling, ultimately implemented at various phases of the patient care pathway. Unsurprisingly, SDS requires the convergence of skillsets from various fields of computer science, mathematics and engineering with domain-specific expertise in surgical care and research, including quality-improvement, education, innovation, epidemiology, health economics, basic science, and others. The term "big data" is often used pervasively to describe the usage of large stores of data for these purposes, and while this is well-established in many non-surgical domains, scaling these methodologies for surgical care has been limited to date, mainly due to the lack of capture, digitalization, storage, and access of procedural data in a meaningful and comprehensive manner.*". From: Madani A, Liu Y, Pryor A et al. SAGES surgical data science task force: enhancing surgical innovation, education and quality improvement through data science (Surg Endosc 2024).

[380] SAGES consensus recommendations on surgical video data use, structure, and exploration (for research in artificial intelligence, clinical quality improvement, and surgical education), Surgical Endoscopy 37(11) 2023), pp. 1-18.

organization with a solid corporate governance structure. Coherently, GSAC adopts a non-profit business model aiming at self-sustainability with a resort to external sources of funding, both public and private, including research grants.

It is founded on a set of normative commitments expressing a clear value proposition: data transparency, surgical excellence, data-enabled performance improvement, international collaboration, diversity, equity, inclusion (expressed e.g. in tackling surgical gender and ethnic disparities), and innovation. The interviewed member summarised the value proposition of the project with the lemma 'scientific fairness' applied to both human- and computer-driven activities. This points to both FAIR principles for scientific data management, and fair practices of scientific distribution as a realization of epistemic justice.

In practice, the GSAIC platform is designed to provide the surgical community with access to large and heterogeneous - while standardized in format - shared datasets and an infrastructure to use this data to improve surgical care through education and innovation. The primary purpose is to create a digital platform for a global community of surgeons and healthcare operators interested in video-based assessment and dissemination of surgical performance using AI and cloud computing. Second, it purports to democratize surgical care through open dissemination and education that reach out to the wider healthcare community and the larger public.

The types of resources central to the activities of GSAIC are scientific and clinical competence, the experience and expertise of its members, the surgical video management platform itself, the underlying cloud infrastructure, and the generative AI models. Competences and skills span over the development of clinical and AI-based solutions for safer surgery and optimization of performance

in the operating room, and intraoperative surgical decision-making, including through machine learning, computer vision, augmented reality and simulation. These resources are owned by the corporation and the single members according to research and data transfer agreements oriented towards open access policies, provided expressed and informed consent of the patient is given.

GSAIC's corporate governance is spelled out in its bylaws that clearly identify the organs, their rights and prerogatives, basic procedural and voting rules in meetings, a conflict of interest, and financial accounting rules. Among the organs, i.e. members, a board of directors and its chair, a secretary, a treasurer, and a finance committee, the organization relies on specialized figures such as the chief technology officer, the chief scientific officer, the chief design officer and mirroring specialized technology and scientific committees. They are respectively in charge of overseeing the corporation's relevant technology, scientific and research operations, all design and innovation aspects and creating relevant policies on these topics. These roles and entities act as pathfinders for the latest research, technological, and open innovation routes.

The bylaws of the Global Surgical AI Collaborative identify four classes of membership that represent the main actors of the GSAC ecosystem: founding members, individual members, and institutional and industry members. The first class comprises the initial founding members who have applied for and been accepted into membership in the corporation by resolution of the board, and thereafter those individuals admitted as such by the then founding members. The second group consists of individuals interested in furthering GSAC purposes and who have applied for and been accepted into membership by the board at a later stage. The fourth group covers healthcare and academic institutions and the fifth

represents businesses operating in the relevant fields and related industries. All members are entitled to receive notice of, attend, and vote at all meetings of the Members of the corporation. Each member has one vote in the Meetings of the members. Decision-making is democratic and participatory, albeit within the corporate walls. Auditing on financial accounts is assigned to one or more public accountants annually appointed by the board and working in cooperation with the treasurer. No other form of auditing or monitoring nor a conflict resolution mechanism is foreseen in the bylaws.

More specifically, the main categories of actors directly involved in the workings of GSAC are surgeons and researchers in surgical data science, computer scientists, and AI modeling experts. Indirectly, patients, the healthcare teams flanking the surgeons, and those who allocate resources to the project will benefit from the platform operations. Processes, results, and conclusions of scientific research and AI surgical applications will be prospectively available to them in an open and transparent format. In conjunction, access, and ownership rights will be eventually enshrined in a 'bill of rights on data and work ownership and collaborative work engagement', building on the relevant international soft legal sources and ethical guidance for research.

As for the state of development of the digital platform, it is in the designing and building phase of surgical video management and analysis components. Shortly, it will be engaging in multicentric video-based assessment studies for surgical education and quality improvement initiatives and validation of surgical artificial intelligence. To this end, the participating actors of the GSAIC's ecosystem are building and nurturing their interactions through online meetings and, occasionally, in relevant conferences.

*2.3.1 Open Science in GSAC and Perceived Criticalities*

According to the interviewed founder, open science practices, e.g. open, collaborative and inclusive production, dissemination, and evaluation of research data and results, are foundational in GSAIC. Yet, in his opinion, the adoption of this model is not devoid of criticalities in a global digital ecosystem. The first issue highlighted lies in the organizational and coordination burden of a network of surgeons from different countries and jurisdictions, characterized by differing open science policies, practices and sources of funding. Second, article processing charges (APCs) for open-access publications are perceived as a still widely diffused huge burden. Another issue is linked with the pressing need to circulate intermediate and negative results and give more visibility to them, to inform and impact related and future research. Currently, it is hard to publish intermediate and negative results in conventional venues, while it is easier in pre-prints. This is due to a preference by traditional journals, editors and peer reviewers[381] for more 'exciting' and groundbreaking positive results that are perceived as the sole paradigm of scientific novelty and impact, for they contribute clear and definitive advancements to their field. This manifests in the phenomenon of publication bias which stems from the belief that positive findings are more interesting and valuable to the scientific community, the public and the funding agencies and organizations[382].

[381] Reviewers might also view intermediate and negative results as indicative of flaws in study design or execution rather than valuable contributions.

[382] Despite these challenges, there is a growing recognition of the importance of publishing negative and intermediate results to provide a complete picture of scientific inquiry. Initiatives such as the All Trials campaign and journals dedicated to negative results, like the Journal of Negative Results in Biomedicine, are working to combat publication bias and promote the dissemination of all research findings. Nosek BA, Spies JR, Motyl, M, Scientific Utopia: II. Restructuring incentives and practices to promote truth over publishability. (Perspectives on Psychological Science, 7(6), 2012), pp. 615-631.

Regularly, the GSAIC publicly releases annotated datasets containing raw, elaborated, intermediate, and negative data. The video-based platform will help speed up the adoption of this practice. Besides, inconsistency, restrictiveness, and ambiguities of data regulations put an obstacle in data sharing. In the specific case of healthcare data, the interviewed member refers to the regulatory discrepancies. This can be found in the European General Data Protection Regulation (GDPR) *vis-à-vis* the US Health Insurance Portability and Accountability Act (HIPAA) concerning health data subject rights, legal bases for consent, data transfer restrictions, data ownership[383], and licensing.

Although no mention of citizen science is made in the framework of GSAIC, the platform has a high potential to impact the awareness/and trust of common people in the evolution of surgical healthcare through video-based AI. While civic participation is not foreseen in the project by the very expert nature of the surgical practice, patients do play an important role, from the moment they provide their informed and expressed consent throughout the healthcare processes informed by data transparency to which they may get access, i.e. surgical video records[384]. Development costs and platform governance design

[383] Healthcare data ownership has three main phenomenologies: 1) Patient Ownership: Patients are the primary owners of their health data, as it pertains to their personal health information. This perspective is supported by regulations that grant patients rights over their data, like the right to access, erase, amend, and control how their data is shared (e.g. HIPAA in the US and GDPR in the EU). 2) Provider Ownership: Healthcare providers, such as hospitals and clinics, assert ownership over the health data they collect and store. This claim is based on their role in creating, maintaining, processing, ensuring accuracy and security of the data. Providers may use this data for various purposes, including treatment and quality improvement. 3) Shared or Joint Ownership: Some frameworks propose a shared ownership model where both patients and providers have rights and responsibilities regarding healthcare data. This approach aims to balance patient rights with the practical needs of healthcare providers.

[384] "*Videos are composed of still images (i.e., frames) played over time and provide both spatial and temporal information, including the nature of interaction between subjects and objects. In a surgical video, the surgeon acts as a subject, altering the operating field, the object, to achieve a specific goal*". From Eckhoff JA, Rosman G, Altieri MS et al. SAGES consensus recommendations on surgical video data use, structure, and exploration (for research in artificial intelligence, clinical quality improvement, and surgical education), (Surg Endosc 37 2023), pp. 8690–8707.

have been indicated as possible criticalities in the creation and adoption of the platform.

*3. Analysis and conceptualization of the models. Further: Import-ability in a platform ecosystem for a local polity*

In the previous paragraphs, a substantial amount of information on the governance of open research and innovation ecosystems has been reported based on the analytical dimensions elaborated at the inception of this Chapter. It is now attempted to draw the strands together, conceptualize and compare the three governance models emerging from the data collection and elaboration. Further, it bears reflecting on the importability of the models in a platform ecosystem operating in a local knowledge polity.

On a preliminary basis, a first *caveat* shall be made: the information available and published on the web on EOSC and AOSP is far from complete. Hence, a systematic understanding of the governance features of the selected platforms may be gained following further empirical qual-quantitative and action research. A second *caveat* concerns the slight heterogeneity of the case studies that is justified by the amplitude and complexity of the concept of open research and innovation ecosystem, which can contain diversified multi-scale and multi-scope phenomena.

It is worth emphasizing, however, that the three cases share the common feature of representing inter-institutional-societal and digital platforms that leverage the power of scientific knowledge and technology to democratize scientific endeavor and, consequently, inter-societal informational well-being and innovation catalysis. In all cases, a robust and highly institutional governance structure coexists with

the development of a platform or a network of platform nodes to interconnect different institutions and sections of society (societal systems) in pursuance of a common effort to share knowledge and skills for educational purposes, industrial development, societal awareness, and better policies. Another common trait lies in the ambition to create multi-level networks of best practices that trace a link of consistency between international and local research and innovation initiatives, projects, practices, and standards.

Let us gaze closer at the most salient aspects of each model and extract governance features to import into the platform governance for an open research and innovation ecosystem in a local knowledge polity.

The EOSC can be described with the image of a good Leviathan that, instead of inglobing his subjects as depicted in the original cover of Hobbes' seminal work, opens his arms to other public, private, and civil society power-exercising counterparts.

More concretely, the EOSC governance framework is characterized by a markedly bureaucratized model, which is connatural to its complex institutional and intergovernmental genesis, with some temperaments. On the one hand, the choice of an organized multistakeholderism expressed in the effort to include all possible stakeholders in policy planning, advisory, and decision-making through the Association and the Stakeholder Forum, is remarkable. The latter shows an element of representativity of - *inter alia* - subnational civil society organizations that share good practices and local initiatives fostering Open Science. The hypothesis of the import-ability of institutionalized multistakeholderism in the operational functioning of a local platform ecosystem is welcome.

On the other hand, the EOSC governance structure may risk suffering from excessive ramifications of regulative sources, especially when it comes to considering the mosaic of national and subnational implementation measures. In this respect, local actors who wish to connect to the open scientific data cloud infrastructure shall pay particular attention to conforming with the principles and operational standards adhered to and formulated by the EOSC. At the same time, they will have to play an active role in shaping new standards and practices in light of the principles expressed in the EOSC Declaration (above all, the principles of mutuality, transparency, and accountability). This proposition is confirmed by the choice of a 'community governance' model founded on citizen engagement, measurement of results, and efficacy. Relatedly, local public actors need to adopt rigorous monitoring and KPI measurement techniques as concerns both financial and practical implementation of a local node. This will have to comply with the European monitoring and measurement framework and tools advanced by the EOSC, while at the same time may well put forward additional parameters to test the EOSC's *local readiness*, i.e. capacity to respond to local impact needs.

As seen, the overarching purpose of the EOSC is to create a pan-European federation of research data infrastructures made of local interconnected nodes, where data is easy to store, find, access, render interoperable, and reuse (i.e. the FAIR principles) and nurture a Europen Open Science Culture. To this end, the platform open research and innovation ecosystem for a local knowledge polity constitutes the concrete realization of a local node of the EOSC with respect to its open scientific data infrastructural components and the supply of educational programs in research data management, stewardship, and science.

Moving to the AOSP case, likewise the EOSC, it is a multi-level institutional initiative for a cross-continental open science infrastructure displaying hybrid elements of inter-governmental hierarchy and community horizontality. The discursive choice of the community of practice model centered around sharing more than information, but also activities, experiences, and practices. This is even more valuable and easy to operationalize in a local context[385], where opportunities for offline meetings and interchange augment. The AOSP emphasizes the participation of community groups and even individuals, who are eligible for membership, and the need for raising multilingualism and indigenous diversity to knowledge resources to be enhanced. These governance features are crucial to accompany human migration and the migration of ideas across plural and multiethnic communities, where integration starts from cultural exchange and mutual curiosity, rather than the imposition of a cultural tradition. This shall apply also to a local-European open research and innovation ecosystem.

Further, the AOSP exhibits a keen attitude towards welcoming external funding from foreign research funding agencies, projects, and industry-led educational programs. While these options may constitute viable solutions for financially sustaining a local ecosystem, closer-to-the-territory funding sources, crowd-funding, and engagement of local start-ups and SMEs are necessary to spur local development.

Scientific education, skills development, and upskilling across all educational and professional levels result in a common denominator of all three cases, with a

[385] Wenger E, Communities of Practice: Learning, Meaning, and Identity (Cambridge University Press, 1998). The author is the educational theorist who conceived of the notion of a community of practice as a collective of individuals who converge around a shared concern, set of challenges and interest in a particular subject and collaborating to achieve both personal and collective objectives by engaging in regular meetings, discussions and joint activities and developing shared practice (experience, problem solving, tools, guidelines).

particular focus on data science, stewardship, management, and artificial intelligence. This corroborates the proposal to introduce on-platform educational courses, including within a platform for a local open knowledge ecosystem.

In turn, the GSAIC case stresses on the centrality of open scientific community initiatives in stimulating processes of scientific democratization through pondered and regulative experimentation of frontiers technology. This leads to confirming the hypothesis that in a local platform ecosystem researchers and research institutions serve as primary detectors and catalysts of innovation processes. However, while platform development is up to computer scientists and researchers, active maintenance, curation, and updating may well be a common task of the different members of platform governance that encompass members from different societal systems. Like the EOSC, the GSAIC underlying organization adopts a non-profit model, and in all three cases, membership is open to actors from the public sector, the relevant industries, and civil society. A further aspect of GSAIC governance that was previously already marked as fundamental for an open research and innovation ecosystem, is the appointment of advisory committees and chief officers specialized in science and technology matters.

Finally, all three governance models are principles-based and rely on the internationally recognized FAIR principles, on the principles of openness, collaboration, diversity, equity, inclusion, democratic accountability, and representativity (the latter expressed in a ‘one member one vote’ rule).

# IV. CONCLUSIVE REMARKS

This final chapter hoists down the sails of the boat to end the journey through the seas and landscapes of the complex on-platform open research and innovation ecosystem in a local knowledge polity.

The introduction departed from the observation that, in the contemporary global, digital, and knowledge society, the law is de-territorialized in virtual realities and, relatedly, new conceptualizations of sovereignty have come to the fore. Scholars and policymakers currently focus on concepts such as digital and data sovereignty. Against the background of the self-arrogated para-constitutional superpower of digital platforms, they hinted at the necessity or actuality of state control over the data flows involving their citizens for reasons of public order, interest, and good. As well, digital sovereignty has been read as an assertion of self-determination and rights-holdership of individuals in the digital sphere. Both views form integral parts of the platform governance model proposed throughout this dissertation. Public administrations and institutions, allied with the members of the scientific system, re-instate their role of impartial guarantors of superseding public and common goods. The individuals, and all the 'formations' through which their personality develops, must enjoy digital-native and analog rights, and assume responsibilities for the common care of the polity.

Key inspirational elements for this dissertation have been the trans- and interdisciplinary theories which look at society as a complex open ecosystem, a system of systems, and a network of networks, all of which have been thoroughly explored in Chapter I. This ecosystem comprised various sources of normativity,

e.g. legal, ethical, scientific, and technical, with their 'regulative' actors that either retain or share governance prerogatives. The concept of governance, as delineated in Chapter I, elucidates that acts of governing are no longer confined to the physical boundaries of one State's territory and limited by the legal attribution of powers to public bodies and administrations. The open notion of governance welcomes diverse sources and sub-systems of normativity in a complex system that can be set in territories, in a-spatial environments, or be re-territorialized in virtual spaces. It bears highlighting that the review in Chapter I does not militate for a depletion of State's sovereignty and the rule of law, which have primarily contributed to the slow and progressive recognition and acquisition of human and social rights in the digital realm[386]. Instead, it provides examples and models of collaborative forms of governance involving - *inter alia* - the public and reminds us that, since the privatization wave of the 1980s, various actors have entered the public sphere and shaped what can be called common spheres. Through European participatory governance inaugurated with the White Paper and towards contemporary international and local manifestations of multistakeholderism, these actors have shared the intent to care for the public good in cooperation with traditional public entities. The latter still play a central role and have turned into custodians of the public-common sphere and enablers

[386] This is particularly true in the case of European landscape characterized by a pre-eminent human rights approach for designing digital rights, spanning from the recognition of fundamental right to personal data protection and its corollaries, the right to disconnect, social rights in the gig economy, human rights-based legislation on AI, content moderation in the DSA to balance freedom of expression with human dignity and other human rights from the threats of disinformation, hate speech and other abuses, to name a few. Notably, the European Declaration on Digital Rights and Principles for the Digital Decade, among others, stresses the need to take "*the necessary measures to ensure that the values of the EU and the rights of individuals as recognized by EU law are respected online as well as offline*", and set out commitments to ensure solidarity and inclusion through connectivity digital education and digital public services; freedom of choice through interactions with algorithmic systems, participation in the digital public space with access rights, safety, security and sustainability of digital ecosystems.

of inclusive participation and engagement of all possible societal actors. This is exemplified and testified by the experience of the shared administration and care for the common goods in Italian local communities, as well as the lastly seen cross-continental open research data platforms and cloud infrastructures, i.e. the European Open Science Cloud (EOSC) and the African Open Science Platform (AOSP), proposed by intergovernmental actors and research institutions, and open to participation to all possible societal systems and actors. Following years of community practices in local polities, the proliferation of a normative framework of evolving local, regional, state, supranational, and global regulations and practices justifies the recognition of co-governance as a paradigm for care for public and common resources, needs, and ends on all-level basis. As seen, even macro-projects like the continental EOSC and the AOSP adhered to a collaborative and community governance approach, which requires networked, multi-layered, and polycentric engagement of institutions and sections of society, including citizens and individuals. This inter-societal and inter-institutional participatory governance model signals, at least in the intent, a state of complexity and perhaps maturity of contemporary democracies or socio-technical-legal systems inspired by an ideal of open society and collaborative democracy. As seen, this unfolds in governance structures where democracy manifests in active participation in science- and technology-driven activities and strives for fair representation of diverse societal voices in decision-making bodies. A core theoretical foundation of this research lies in the acknowledgment that the rule of law coexists with other normative systems with self- and co-regulating actors (e.g. digital platforms and the experts behind their architectures, or the scientific community) that steer the direction of rules-, policy-making and societal progress.

With some level of abstraction, these normative systems reflect the different components of society or societal sub-systems with their respective actors, discourses, reasons, and communicative means. Along with legal systems, the societal, technological, and scientific normative systems and actors produce socio-technical norms from the bottom up, from facts to norms, give substance to constitutional guarantees, and operationalize processes of collaborative governance. After a long period of self-regulation, technological actors, i.e. platforms and the community of developers, have begun to participate in public regulatory processes, whether as businesses protecting their self-interest or cooperative political actors, to propel future-proof legislation and orient policy programs. In turn, public bodies orient technological advancements towards specific public policy goals such as ethical and human-rights-by-design technological applications (e.g. AI, clouds for data sharing) for mutually agreed public and common good purposes. From the perspective of the public administration, the injection of socio-technical knowledge and practices in public policies and interventions constitutes a process of *internalization* of socio-technical normative developments and their *juridification* based on open and compelling inter-societal dialogue and collaboration. As for the scientific system, it has historically engaged in dialogue with public regulators either as advisors, inventors, and promoters of best practices, methods, and techniques (e.g. the birth of open data and open science within the scientific *milieu*, the role of scientists in platform development). However, it is only in the last decade that the project of like-minded actors of the international scientific community (researchers and research institutions) to open the scientific ivory tower to the public and society has been more decisively recognized and endorsed by global,

regional and national institutions (from self-regulating free and open access outlets to the Open Science regulatory framework). The efforts to enhance scientific accountability and integrity, and drive scientific democratization underline their intent to push for the realization of a rights-based open society informed by a substantial interpretation of the universal human right to enjoy and participate in scientific and cultural advancement[387]. This participation is the precondition for a knowledge polity, i.e. an engaged political community and *pouvoir constituant*, in law and fact, which is based on the application of the evidence-based scientific method to public, private, local, and individual decision-making and opinion-shaping, on the one hand. On the other hand, democratic co-production, evaluation, and communication of scientific data, results, and discoveries lay the basis for inter-institutional and inter-societal engagement into evidence-based public-common scrutiny, critical reasoning concerning scientific, public, and private policies, and commonly agreed problem-solving. These efforts would contribute to diminishing informational and knowledge asymmetries that raise socio-economic and cultural barriers and further inequity in a polity. In a local community, whether remote, rural or urban, or in a network configuration entrenching local communities, processes of scientific knowledge democratization would not just increase participation and trust in science, but foster an open research and innovation ecosystem that empowers better-informed, more resilient and self-sustainable knowledge-based polities.

[387] Article 27 of the Universal Declaration of Human Rights (1948). Article 15.1.b of the International Covenant on Economic, Social and Cultural Rights. United Nations Economic and Social Council's Committee on the Economic, Social and Cultural Rights, General comment No. 25 on science and economic, social and cultural rights (article 15 (1) (b), (2), (3) and (4) of the International Covenant on Economic, Social and Cultural Rights) (2020).

To come full circle, it is worth briefly recollecting the results of each Chapter of this dissertation and envisioning a way forward for future research.

The three preceding Chapters progressively construct the case for a novel governance model tailored to a digital platform that creates and nurtures an open research and innovation ecosystem within a local knowledge polity. Based on cross-disciplinary desk research encompassing academic and gray literature, Chapter I explored and defined the conceptual components of the research question, namely governance, platforms, open research and innovation paradigms, the common good(s), shared administration, and the meaning of polity. This Chapter drew a comprehensive analytical discursive map to acquire the cognitive instruments that lay the groundwork to design the platform governance model for an open research and innovation ecosystem in a local knowledge polity. The main result of this Chapter lies in the design of a coherent representation of the complex and plural manifestations of governance, the societal systems and actors involved, their discursive, socio-technical, and legal means, and philosophical underpinnings. Chapter II introduced the concept of formants of platform governance (legal, technological, and ethical), examined the existing platform governance models (centralized, decentralized, and hybrid), and outlined an *ad interim* proposal for the platform governance model for an open research and innovation ecosystem in a local knowledge polity. The systematization of three different platform governance models highlighted that next to the dominant centralized business platform governance, decentralized and hybrid community- and value-driven models have significantly grown into frontier experimentations and applications in public administrative action in Italy and Europe (as in the case of blockchain technology and open data clouds).

decentralized and hybrid organizational, decision-making, and technological configurations[388] are integral to the preferred model for a platform that unites and coordinates all interested societal actors in a platform ecosystem for a local knowledge polity. These configurations enable networks of nodes to function as autonomous and cooperative agents and, at the same time, allow for collaboration in scientific co-production, evaluation, and communication as well as ethically inspired and legally compliant processes of community participation in technological and local policy development. Chapter III offers an empirical case study analysis of open research and innovation ecosystems characterized by a high degree of institutionalization coupled with a community governance approach. The descriptive desk-based analysis of the European Open Science Cloud and the African Open Science Platform, and the qualitative analysis of the Global Surgical AI Collaborative, led to conceptualizing and comparing three different institutional platform models. As pointed out in the analysis, the three cases share the common feature of representing inter-institutional-societal digital platforms that leverage the power of scientific knowledge and technology to democratize scientific endeavor and, consequently, societal informational well-being and innovation catalysis. In all cases, a robust and highly institutional governance structure coexists with the development of a platform or a network of platform nodes to interconnect different institutions and sections of society (societal systems) in pursuance of the common effort to share knowledge and skills for educational purposes, industrial development, societal awareness, and evidence-based policies. Another common element lies in the ambition to create

[388] Blockchain, smart legal contracts, open APIs, open cloud infrastructures, on-platform AI developing initiatives, data literacy and capacity building.

multi-level networks of best practices that trace a link of consistency between international and local research and innovation initiatives, projects, practices, and standards. The Chapter further explored the hypothesis of whether these models or some or a combination of their features are importable in an open research and innovation ecosystem for a local knowledge polity. Among other positive findings, the feasibility of connecting and embedding the platform for a local knowledge polity within the EOSC architecture has been positively assessed. Through the integration of theoretical and empirical approaches, this thesis aims to contribute to understanding how digital platforms can govern and be governed by a plural, open and knowledge-based local community to promote research, innovation and open democracies.

For future research directions, further empirical analysis may yield additional insights into platform governance for open research and innovation ecosystems. This could enhance understanding of the practical implementation of the governance models described and analyzed in this dissertation, as well as future models to come.

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