Speaking Science to Law
Toward a Multidimensional and Actor-Centric Framework

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ABSTRACT: The picture sketched here rests upon a deep and wide-ranging transformation in both the methods and paradigms that structure the exercise of power. It also constitutes an invitation to interdisciplinary communities of scholars and practitioners to engage in empirically grounded and forward-looking discussions about the sources of legitimacy upon which democratic institutions should rely when adopting laws, which are paradigmatic and foundational acts of authority and power.

KEYWORDS: sciences; expertise; normativity; legitimacy; innovation

1. Introduction

Over the past decades, democratic institutions have undergone an unprecedented and double-edged transformation. On one hand, a central pillar of the modern paradigm, namely representative institutions and their mechanisms of electoral and delegative legitimisation, has been progressively hollowed out. This erosion stems from the weakening of political parties and the growing imbalance between legislative and executive powers, developments that have been extensively examined by political scientists and sociologists.

On the other hand, the process of norm production, particularly in the form of regulatory acts and procedures, has increasingly absorbed scientific and technical dimensions. This shift has brought about a more frequent and intense dialogue between political elites and scientific communities, especially in policy areas shaped by rapid scientific innovation and the complex interplay between mathematics and the natural sciences.

Environmental regulation offers a telling example in this respect: many of its core issues rely on theories and models derived from the physical and natural sciences, whose language is often expressed through equations and mathematical formulations rather than words. More recently, regulation in strategically

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sensitive and politically contested sectors such as energy has also come to be framed in scientific and technical terms.

From the perspective of lawmaking, both developments, the recalibration of checks and balances in favour of the executive and the expansion of science and technology into the domain of legal expertise, represent irreversible transformations. A simple comparison between a legislative instrument adopted in the 1970s and a legislation enacted by a European country or by the EU in fields such as healthcare, water management, or energy suffices to reveal the extent to which science and technology now "speak" to law.[1]

It should be noted, however, that the encounter between science and law is not unique to our contemporary age. Looking back three decades, one finds that scientific knowledge has long been in continuous dialogue with law. This is particularly true when connecting European experiences of the 1990s with developments in the United States concerning regulatory agencies and quality control in public services.[2]

The picture sketched here rests upon a deep and wide-ranging transformation in both the methods and paradigms that structure the exercise of power. It also constitutes an invitation to interdisciplinary communities of scholars and practitioners to engage in empirically grounded and forward-looking discussions about the sources of legitimacy upon which democratic institutions should rely when adopting laws, which are paradigmatic and foundational acts of authority and power.

Among the perspectives offered by contemporary scholarship, socio-legal studies, combined with Science and Technology Studies (STS), provide particularly fruitful insights. Within comparative politics and public policy analysis, the role of science in the various functions performed by governments and their agencies is often associated with the late twentieth-century synthesis of evidence-based policymaking and technocracy.

In his seminal 1992 work, Haas illustrated the significance of epistemic communities through a global lens: international organisations depend on such communities to gather knowledge and to ground soft law, guidelines, and standards in supposedly objective and independent insights derived from scientific expertise.[3] More recently, this phenomenon has been examined within domestic political systems. As Head (2016) observes, the growing complexity of societal problems and the demand for evidence-based policymaking have heightened the need for advanced expert knowledge. Yet, as Christiansen and others remind us[4], experts are not free from pressure: they are accountable both to their epistemic communities and to the political elites they advise. Nevertheless, the demand for robust, rigorous, and reliable knowledge in complex policymaking processes remains indisputable (Rothstein, 2023). Some scholars

[1] M. Volpi (a cura di), *Governi Tecnici e Tecnici al Governo*, Torino, 2017; C.M. Radaelli, *Technocracy in the European Union,* London, 1999.

[2] S. Sutcliffe, J. Court, E*vidence-Based Policymaking: What is it? How does it work? What relevance for developing countries? London: Overseas Development Institute,* 2005.

[3] C. Boswell, *The Political Functions of Expert Knowledge: Knowledge and Legitimation in European Union Immigration Policy*, in *Journal of European Public Policy*, 15(4), 2008, 471-488.

[4] J. Christensen, *Expert knowledge and policymaking: A multi-disciplinary research agenda*, in *Policy Press*, 49(3), 2020, 455-471.

have even argued that democracies should embrace an "epistemic turn" to reinforce legitimacy by rendering the exercise of power accountable to both citizens and science.[5]

Without claiming exhaustiveness, the following pages outline a possible framework for comparatively assessing the trends and models that characterise European democracies, with specific attention to the first stage of the law's life cycle, its adoption. Building on the aforementioned scholarship, the discussion draws on three key notions:

- Legitimisation processes;
- Accountability;
- Experts' professionalism.

The rationale underpinning this proposal rests on three interpretive hypotheses:

1. The role of experts within cabinets and, more broadly, during the initial phase of the lawmaking process, drafting and adoption, is a sociological phenomenon.
2. This phenomenon forms part of a broader and multifaceted process: the legitimisation of power.
3. This process of legitimisation involves reference to four types of normative criteria or anchors: legal, political, societal, and public.

The explanatory hypothesis that informs this actor-centred approach to the increasingly institutionalised role of experts and scientists in law-adoption arenas may be formulated as follows:

> The weaker the legitimacy grounded in legal and political norms, the more the exercise of power seeks compensatory grounding in public and societal forms of normativity, primarily through evidence-based discourse and by framing decisions in objective, scientific, and preferably quantitative terms that substantiate the appropriateness of governmental or administrative choices.

2. A Polysemous Concept: The Quest for Legitimacy and the Multiple Settings of Normative References

The notions of normative reference and normative criterion are multifaceted and polysemous. They generally denote a form of normativity that is not legally binding in the strict sense, originates from a specific domain or technical expertise, refers to a sector of human activity, and yet retains meaning independently of the cultural orientations or value frameworks of its field of application and of the actors involved.

When understood in this way, law immediately reveals its dual nature. On one side, it appears in its specificity, distinguishing itself from other forms of normativity such as technical or regulatory standards. On the other, it reveals its generality, insofar as it comes into play across diverse domains of action and influences the capacity to act. From the standpoint of normativity, science and technology possess almost opposite characteristics to law: technicality, lack of cultural connotation, adaptability, and direct engagement with the dimension of action. Crucially, in recent decades science and technology have acquired a social and political vitality linked to their evaluative function. The normativity generated within scientific and technological domains also aims to establish metrics for evaluation. This gives rise to their a-cultural dimension, as science and technology, according to definitions widely accepted by institutional

[5] M. Bovens, *Analysing and Assessing Public Accountability: A Conceptual Framework*, in *European Governance Papers, 2005;* P. Day, R. Klein, *Accountabilities: Five Public Services,* London: Tavistock, 1987.

actors and technical bodies in public policy and innovation, are perceived as the keystone of the capacity to assess the acceptability of an action, practice, product, process, or body of knowledge.

From an empirical perspective, normative references or criteria represent the cognitive, ideational, and cultural dimensions of social and political systems. They are endorsed, internalised, or strategically used by actors for instrumental reasons. In these pages, the term "normative reference" does not denote a deontic object. Instead, it describes a factual element of social life that operates at different levels. At the macro level, it refers to the set of shared values and orientations that dominate public life at a given moment or under particular political conditions within a country. At the micro level, it refers to the normative ideas or principles that an individual draws upon to justify, legitimise, or make a decision, argument, or authoritative action appear acceptable.

The 1960s and 1970s witnessed an exponential expansion of both material and cognitive investments in domains of public action, deeply permeated by technical knowledge. In the United States, this phenomenon corresponded to the growth of institutional capacities (regulatory agencies, independent evaluation bodies, and planning institutions) entrusted with overseeing the design, implementation, and validation of public policies based on technical expertise. The functional demand addressed by these innovations was twofold: first, to secure non-political legitimacy for policies that profoundly affected citizens' lives, such as those concerning the environment, energy, or water, and second, to ground public decisions on seemingly objective foundations.

At this juncture, standard emerged as technical norms situated at the intersection of these forces. As Wildavsky observed, this marked the advent of "speaking with science and technology in power," a mode of governance that sought to remove subjectivity, arbitrariness, and uncertainty from political decision-making This meant narrating action as certain and based on objective criteria, especially in areas involving large-scale investments. Standards thus operated as devices that could mitigate political conflict, owing to their apparently aseptic and neutral character. Their authority derived from their reference to science and technology, rather than to interest-based, culturally inflected, or value-laden positions. This a-cultural dimension explains much of the enduring appeal of standards, particularly in political arenas that need to generate norms without engaging in overtly conflictual interactions. As Head aptly noted:

> The general proposition that reliable knowledge is a powerful instrument for advising decision-makers and for achieving political success is a very old doctrine, linked to the exercise of effective statecraft and efficient governance in early modern Europe. In later periods, the distinctively modern foundation of the knowledge/power relationship has been closely associated with the rise of the empirical social sciences – sociology, economics, political science, social psychology, etc. – which emerged in the 19th century and expanded very rapidly in the 20th century.

Scholars of European integration have underscored that, in a system requiring sustained cooperation among the Member states, whose preferences are often divergent or even polarised, standards have been the recurrent instrument of choice. Europe's experience is particularly instructive: it was here that one witnessed the paradoxical consequences of impeccably drafted parliamentary laws (adopted through proper democratic procedures) that ultimately disrupted the order of fundamental rights.[6]

[6] P. M. Haas, *Epistemic Communities, Constructivism, and International Environmental Politics*, London, 2016; B. W. Head, *Reconsidering evidence-based policy: Key issues and challenges*, in *Policy and Society,* 29(2), 2010, 77-94.

Once the production of normativity through the definition and adoption of standards becomes the primary mode of regulation, however, the use of those same standards opens up a field of indeterminacy. The norm no longer dictates what must be done, but merely defines the scope within which action may occur. A salient example is the European Union's policy on the quality of justice, which seeks to improve judicial systems through the development of standards. Here, as in other fields such as healthcare, governance through standards exemplifies the shift from normative to performative forms of regulation. The implementation of standards as a mode of public action unfolds through adaptation and reciprocal adjustment: inputs originate both from markets, that is actors who design the tools, instruments, and technologies required for implementation, and from the diverse contexts in which standards interact with other normative forms, including social practices, routines, regulations, and law itself.

From the deconstruction of the key stages of this evolution, we can derive new avenues for empirical investigation. The triumph of performativity over normativity, manifested in the ascendancy of organisational over legal aspects, is only one facet of a broader process. This process has produced a functional and instrumental conception of law, one that accommodates the demands of legal harmonisation in two distinct ways: first, by using law to harmonise socio-legal systems (as in the project for a European Civil Code); and second, by harmonising law itself through the standardisation of legal procedures.

These various normative references enter the rule-making lifecycle according to different logics. To clarify, let us define the lifecycle empirically. The innovation that underpins this study lies in taking a step back from purely systemic or structural analyses, which tend to be anchored in assumptions about state structures, and instead adopting a functional view of the three key dimensions of normativity:

- Adoption: the process through which a change agent (a political leader) proposes and guides a norm or reform through the institutional arena.
- Implementation: the process through which the adopted reform is operationalised along the policymaking chain, from the highest administrative levels to the lowest tiers of bureaucracy, jurisdiction, or state agencies.[7]
- Internalisation: Internalisation is the process through which all actors within a sectoral ecosystem endorse the normative and behavioural implications of an adopted rule, thereby acknowledging its value, rather than perceiving it merely as a constraint.[8]

Each phase of this process involves different actors. The adoption of a law, in particular, is an act whose legitimacy rests on the democratic processes that sustain the legislative branch. A vast and well-established body of scholarship has shown that the adoption of legal norms has gradually shifted away from legislatures and towards the executive branch. This shift has required the emergence of a new form of technocratic legitimacy to support cabinet decisions. It is no coincidence that the rise of regulatory governance in contemporary democracies has occurred alongside the expansion of standard-setting

[7] L. Morlino, *Changes for Democracy: Actors, Structures, Processes*, Oxford 2011.

[8] D. Piana, *Reforming the judiciary through standards: Agency empowerment and centre (re)building in Italy, 2001–2015*, in *International Review of Administrative Sciences,* 83(4), 2017, 757-772; D. Piana, L. Verzelloni, *Dal centro disperso al centro ritrovato? Riflessioni a partire dalle riforme della giustizia in Italia*, in *Quaderni di scienza politica*, 23(2), 2016, 241-267.

practices, proceduralised regulatory assessments, and the establishment of expert committees providing technical, advisory, and scientific input to political decision-making.

Scholars have rightly questioned whether experts themselves undergo a process of legitimisation that is shaped primarily by their relationship with their epistemic communities: **"**a network of professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue-area has been a crucial process in the advent of modern societies". In a recent and insightful comparative analysis, Germinario examined expertise in judicial reforms within the broader lifecycle of rule-making.[9] He observed that experts are characterised by the following shared attributes:

> Shared principled beliefs. Such beliefs provide a value-based rationale for social action by the members of the community, Shared causal beliefs or professional judgment. Such beliefs provide analytic reasons and explanations of behavior, offering causal explanations for the multiple linkages among possible policy actions and desired outcomes. Common notions of validity: intersubjective, internally defined criteria for validating knowledge. A common policy enterprise: a set of practices associated with a central set of problems.

While most scholarship on the relationship between science and politics focuses on the meso level of analysis, examining collective actors such as epistemic communities or policy networks, it is also useful to adopt a different, although not contradictory, perspective. This involves shifting the empirical analysis of the "science-speaking-to-law" phenomenon towards a focus on actorness and agency. Christiansen (2020) highlights that

> First, focusing on expert […] implies seeing experts as one type of actor that provides input in the political system and competes with other actors for influence, rather than granting experts a special status as providers of neutral and apolitical evidence. In other words, an influence framing steers clear of the normative assumption that experts and expertise ought to play a greater role in policymaking, which underpins much of the work on evidence-based policymaking (p. 9).

From an actor-centred standpoint, it becomes essential to consider both the professional profile of experts appointed as advisors and the organisational contexts in which they operate. These elements illuminate the complex interplay between scientific expertise, law drafting, and law adoption. [10]If, as seems to be the prevailing trend in democratic systems, scientific expertise is increasingly involved in the early stages of legislative development, then experts must be understood as situated actors. As Ostrom put it, "a situation of action features distinctive procedures, constraints, opportunities, cognitive and instrumental resources, as well as a given number of co-players".[11] Within such situations, experts and advisors operate as actors in a complex rule-making process that incorporates, mediates, and transforms scientific and technically accountable input.[12]

[9] C. Germinario, *The "evidence turn" in the justice sector*, Bologna 2023.
[10] C. Dallaram D. Piana, *Networking the Rule of Law: How Change Agents Reshape the Judicial Governance in the EU*, Farnham, 2014.
[11] E. Ostrom, *Governing the Commons. The Evolution of Institutions for Collective Actions,* Cambridge,1990
[12] Ibidem.

From this perspective, accountability may be redefined as an empirical notion: "to blind or to restrain the set of alternative actions that an actor is allowed to consider before deciding what to do or what to say".[13] Normative references form part of these situations of action. Acting within a situation therefore requires referring to, or taking into account, the relevant normative frameworks to ground and legitimise decisions, arguments, and actions.

Accountability is inherently multidimensional. This is because it emerges from a combination of normative references that jointly create both constraints and mechanisms of acceptability and legitimacy. For instance, the adoption of a legal act aimed at reducing intergenerational inequality is likely to rest on a combination of political, scientific, and legal references. These are political inputs, to which the decision is answerable; scientific inputs, which provide socio-economic evidence and theoretical justification; and legal inputs, ensuring coherence with the existing legal order. When scientific knowledge becomes one of the criteria used to evaluate the acceptability of political decisions, the providers of that knowledge act within a context shaped by multiple, coexisting rationalities.

In brief, developing an empirical understanding of the growing role of experts and committees established by cabinets and legislatures to support the rule-adoption phase requires an actor-centred analytical approach. This perspective should be complemented by a systemic view, which remains equally valuable for understanding the broader institutional and normative dynamics at play.

3. The Quest for Politics or the Quest for Science? What People Trust According to Surveys and Evidence

The "scientific turn" in democratic governance dates back to the 1990s and coincided with major transformations in representative institutions. The modern paradigm situates the legitimisation of power within a democratic circuit composed of representation, election, delegation, and accountability. As democratic systems have faced deep and widespread crises, supplementary sources of legitimacy have increasingly been called upon to sustain and justify the law-making process across its main stages: adoption, implementation, and socialisation.

From an empirical standpoint, analysing the scientific turn in democratic institutions within the broader transformation of democracy and its relationship with institutional trust is particularly fruitful. The manifestation of this democratic crisis is captured in public surveys measuring citizens' confidence in political and social institutions.

According to the most recent Eurobarometer survey on "European citizens' knowledge and attitudes towards science and technology," more than eight in ten citizens (83%) consider the influence of science and technology on society to be positive. Furthermore, two-thirds (67%) agree that science and technology make life easier, healthier, and more comfortable. As summarised by the European Commission:

> The latest Eurobarometer survey on "European citizens' knowledge and attitudes towards science and technology" released today shows that more than eight in ten citizens (83%) think that the overall

[13] D. PIANA, *Rule of Law,* in *International Encyclopedia Political Science*, New York London, 2011.

influence of science and technology is positive. Two-thirds of respondents (67%) equally agree that science and technology make our lives easier, healthier, and more comfortable.

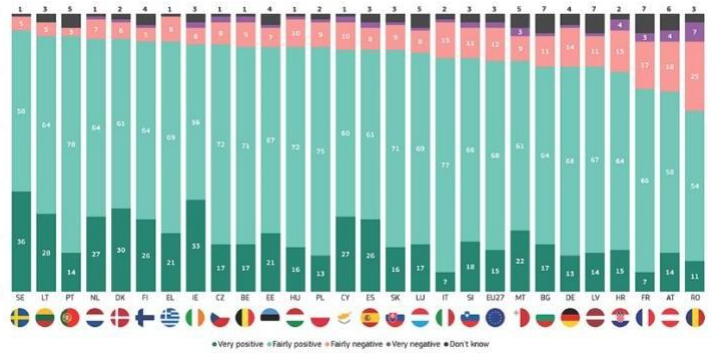


Fig. 1. Do you think that the impact of science on society is: very positive/fairly positive/fairly negative/negative? (Source: Eurobarometer, 2025, "European Citizens' Knowledge and Attitudes Towards Science and Technology")

The figure above reveals a telling distribution of trust in science across European democracies. In several areas, public confidence in scientific progress appears particularly strong. Respondents are most likely to believe that renewable energy (87%), information and communication technology (79%), and vaccines and the fight against infectious diseases (77%) will have a positive impact on daily life in the next two decades.

The same survey also shows that a majority of Europeans express a desire to learn more about scientific developments (58%). Nevertheless, significant obstacles remain: 40% cite a lack of time, 37% a lack of interest, and 36% a lack of knowledge in the fields of science and technology. These findings highlight a tension between curiosity about scientific advances and the barriers that prevent citizens from actively engaging with them.

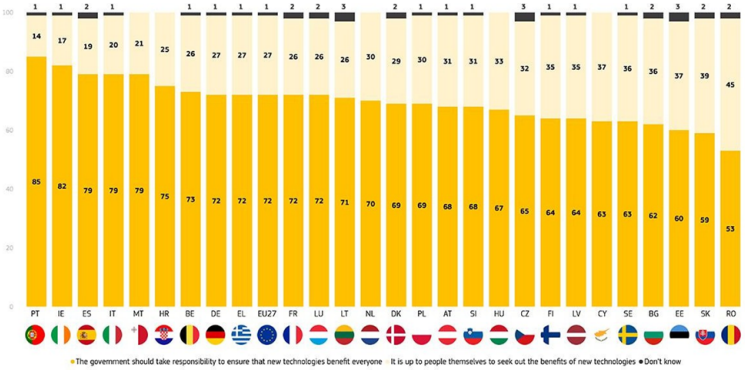


Fig. 2. Which of the following statements is closer to your belief? (Source: Eurobarometer, 2025, "European Citizens' Knowledge and Attitudes Towards Science and Technology")

The survey further explored broader questions of trust and equity in science. Seventy-seven percent of respondents agree that science and technology should take into account the needs of all groups in society when developing new solutions and products. Another 72% believe that governments should ensure that technological innovation benefits everyone. At the same time, a majority of citizens express concerns

regarding the potential misuse of scientific applications: 58% agree that such applications may threaten human rights. Nearly two thirds (64%) believe that science and technology can improve the environment and help combat climate change, but they also think these advances primarily benefit corporate interests.

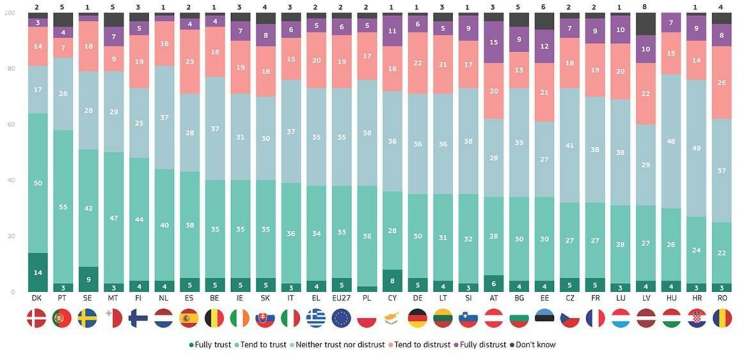


Fig. 3. Do you trust governments? (Source: Eurobarometer, 2023, "Trust in Institutions")

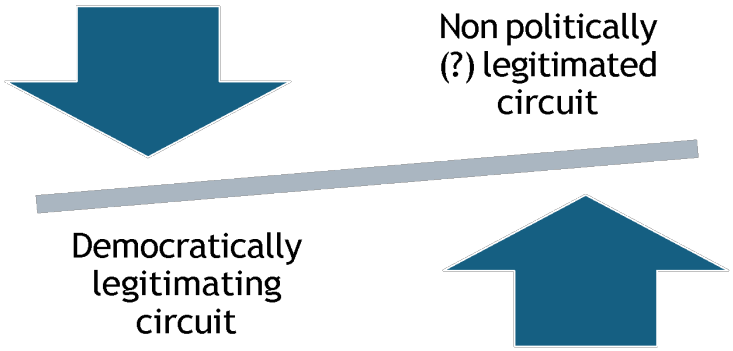
The contrast with politics and representative institutions is striking. Since the autumn of 2023, trust in national political institutions has declined for both national governments and parliaments, while it has slightly increased for political parties and local authorities. Only 33% of respondents express trust in their national government, compared with 61% who do not. A slightly higher proportion (36%) trust their national parliament, while 57% "tend not to trust" it. In contrast, six in ten Europeans (60%) express trust in regional or local public authorities, compared with 35% who do not.

These findings show an ongoing erosion of legitimacy derived from representative and electoral processes, the very foundations of democratic authority. Political elites responsible for law making now find themselves seeking legitimacy beyond the traditional political circuit. In this context, expertise, scientific evidence, and objective knowledge increasingly serve as alternative sources of legitimacy.

Hence, one can reasonably argue that there is a growing demand for:

- Facticity, understood as the anchoring of political decisions in verifiable and demonstrable evidence.
- Evidence-based legitimacy, grounded in the authority of knowledge rather than electoral representation.

At the same time, democracies have witnessed a continuous decline in public trust in parliaments, the traditional sites of lawmaking. This trend is closely linked to the weakening of party politics and the related rise of new technical regulation. The result is a transformation in the way political authority is justified and exercised, shifting from representative legitimacy to technocratic and epistemic legitimacy.



This line of reasoning leads to the next step in the argument, which connects the growing presence of expert committees and scientific advisors involved in the early stages of rule-making, particularly in the development and adoption of legal acts, to the declining ability of democratic processes to legitimise the exercise of power.[14]

A more thorough understanding of the expansion of scientific advisory structures in government is reached by examining another closely related phenomenon. At the systemic level, democracies have progressively lost the capacity of their legislative branches to maintain control over the legislative process. At the same time, political parties have undergone a prolonged internal transformation. This is reflected in the increasing prominence of leaders' personalities, the decisive role of their staff and collaborators, and the resulting concentration of influence around the leader once in office.

In some situations, this process has led to the appointment of advisors through direct relationships with political leaders. This creates a principal and agent relationship, in which the advisors are politically accountable to the appointing authority. Nevertheless, many advisory positions are also filled through competitive selection procedures designed to guarantee both expertise and independence. There is therefore the need for further research within the framework of multiple accountabilities, as discussed by Piana[15]. Science, when interacting with law, remains accountable to its own professional standards of quality and validation. In many disciplines, such accountability is measured through citation indices and peer recognition. However, this form of accountability does not exist in isolation. To what extent other forms of accountability, including legal, political, or social ones, interact with scientific accountability in shaping the various rationalities that underpin decision-making remains an open empirical question.

4. An Agenda for the Future: Research and Professionalism

One of the main justifications for establishing and consolidating scientific advisory committees within government and administrative bodies has been their potential responsiveness to social needs. The argument holds that the more objective and impartial the cognitive basis on which political decisions are made, the more responsive those decisions are likely to be. This view aligns with the idea of an epistemic turn in democracy, as discussed by Rothstein (2020), according to which democratic legitimacy should increasingly rely on knowledge-based reasoning.

However, the reflections offered here suggest a slightly different interpretation. Law has traditionally been associated with continuity and stability. Legal certainty enables social actors to rely on legal norms beyond the circumstances of everyday life. The validity and authority of law are meant to apply to all individuals within the same system, regardless of their specific situations. Laws and regulations are designed to ensure a stable, predictable, and comprehensible framework of action.

Yet, when this traditional conception of law meets present-day realities, its adequacy becomes limited. Contemporary challenges such as climate change, digital transformation, artificial intelligence, and the

[14] T.M. Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*, Princeton, 1995; C.M. Radaelli, *The Role of Knowledge in the Policy Process*, in *Journal of European Public Policy,* 2(2), 1995, 159-183. C. Seaford, *The multiple uses of subjective well-being indicators*, in *Social Indicators Research*, 114, 2013, 29-43.

[15] D. Piana, *op cit*.; D. Piana, *Le istituzioni nella mente*, Soveria Mannelli, 2005.

fragile balance between humans and nature require law to act as a catalyst for change. Law is now expected to contribute to the creation of new social paradigms, inclusive and plural forms of coexistence, and continuous processes of learning within complex and multicultural contexts.

This emerging situation must also be examined in light of the profound cultural transformation that affects collective memory, identity, and the institutions through which societies build and maintain legitimacy. The argument developed here relies on research experience that provides valuable insights into the dynamics of institutional change generated by the interaction between law, culture, and memory. When science becomes part of law drafting, whether within governmental institutions or through expert committees, the connections that arise are deeply shaped by institutional legacy, cultural memory, and organisational context.

This approach supports the idea that normativity should be understood as a composite field in which legal norms coexist and interact with other forms of normativity, including social practices and embedded cultural constraints. The concept of the situation of action, discussed earlier, offers a useful analytical framework for describing what happens in the interaction between law and science.

A second point concerns the use of artificial intelligence tools, particularly generative AI, to support legal drafting. These tools may operate in combination with scientific analyses or expert opinions provided by advisory committees. They often rely on preliminary analyses of data, which are then used to assist in the composition of legal texts. However, autonomy remains an irreducible space where different forms of normativity coexist and must be balanced. Autonomy cannot be translated into mere data or numerical variables. For this reason, a human-centred approach to governance should not be considered as a prescriptive ideal but rather as an empirical necessity. The working hypothesis suggested here is that institutional actors continually seek to balance and combine diverse sources of normativity, culture, and memory.

Whenever the sciences participate in the process of reasoning that justifies authoritative decisions, they inevitably encounter the language of law. Conversely, when related to scientific reasoning, legal categories derive an additional layer of legitimacy from it that extends beyond traditional legal logic. To infer an obligation, whether in terms of what ought to be or what ought to be done, on the basis of factual knowledge about social, environmental, or epidemiological phenomena, involves a process that deeply engages institutions in the construction and consolidation of the legitimacy of their decisions.[16]

It is precisely in this process of construction and consolidation that the categories of science and law converge and intertwine. Contemporary democracies have hold considerable experience with regulatory policies that have been testing grounds for the legitimacy of rules developed from the classification of different types of risk. In fields such as environmental protection, consumer safety, and food regulation, the European Union has adopted a regulatory methodology that generates direct obligations for Member states by classifying situations according to an assessment of risk levels. The legitimacy of these regulatory decisions rests on two conditions: first, that the assigned level of risk corresponds to the situations experienced by society, and second, that the norms are formulated in a manner that is comprehensible and transparent.

[16] H. T. Davies, S. Nutley, P.C. Smith, *What Works? Evidence-Based Policy and Practice in Public Services.* Bristol, 2000; P. Davies, *Is evidence-based government possible?* Jerry Lee lecture presented at the 4th annual Campbell collaboration colloquium. Washington, DC 2004.

Addressing the intersection between law and science today means engaging with one of the most complex, yet unavoidable, dimensions of regulation. Given the urgency and importance of the topic, consideration must be given to the entire regulatory cycle, from formulation to implementation, in both abstract and practical terms. In the formulation of legal norms that incorporate scientific categories, there is a simultaneous process of legitimising both the legal instrument, to which society attributes the authority to regulate behaviour, and the scientific knowledge supporting it. Ethical integrity and the accountability of professional expertise play an essential role in both aspects.[17]

This raises two questions: where does the renewed interest in this subject come from, and why does this research matter now? After the pandemic and amid the ongoing ecological and digital transformations, science has been called upon to support decision-making and to define the categories that guide individual and collective behaviour.

Three dimensions are of particular interest. The first is impartiality. The process of normative co-design will achieve greater balance when both law and science share an epistemological commitment to distance and independence of judgment. This characteristic is closely linked to the functioning of democratic institutions. The more the legitimacy of non-neutral decision-making bodies declines, the more political systems will rely on third-party forms of rationality, such as legal reasoning and scientific expertise. It is not certain, however, that systemic equilibrium will necessarily benefit from this trend.[18]

From this dual analytical level, several insights can be drawn regarding the construction, formation, and dissemination of norms. It is in the triangulation between the quality of legislation, the impartiality and competence of the actors involved, and the quality of public debate that the essential guarantees for both law and science can be located. Their interaction forms the foundation of the legitimate and accountable responses that these two domains, working together, can offer to society.

At the same time, new challenges and complexities are emerging from the interaction between legal norms and the forms of normativity produced by science and technology. We now face a regulatory frontier defined by the convergence of multiple forms of intelligence, each with its own normative dimension. Artificial intelligence developed through machine learning or deep learning processes already embodies normative references, as it is based on principles of technical reliability, mathematical soundness, and methodological consistency. Similarly, intelligence generated by automated systems performing precision tasks results from the design and implementation of structured knowledge applied through mechanical means governed by clear rules and standards.

The central issue, however, is not the technical construction of these forms of intelligence, but the fact that swaths of legal regulation now derive from their functioning. These systems have far-reaching consequences for the stability of legal norms, particularly those intended to safeguard collective interests and uphold inalienable fundamental rights The intersection between technology and collective life is a defining feature of contemporary societies. The institutions that have emerged throughout modern and postmodern history (whether economic, social, legal, political or administrative? have been profoundly influenced by scientific theory and practice.

[17] I. SANDERSON, *Complexity, "practical rationality" and evidence-based policymaking*, in *Policy & Politics,* 34(1), 2006, 115-132.

[18] B.W. HEAD, *Reconsidering evidence-based policy: Key issues and challenges*, in *Policy and Society,* 29(2), 2010, 77-94; A. WILDAVSKY, *Speaking Truth to Power*, New York, 1987.

This is not merely a matter of acknowledging the importance of computational intelligence in decision-making or in the search for solutions within well-established frameworks of action. It is also, and above all, a matter of observing and regulating the new spaces that open up when knowledge-building processes based on mathematical validation become part of broader frameworks of action, whether expert or non-expert. These processes influence what is considered legitimate, relevant, and authoritative in contexts where the link between knowledge, action, and quality of life is under pressure and undergoing profound transformation.

The dominant narrative surrounding this paradigm shift has been strongly influenced by a particular conception of human intelligence, both individual and collective. The emergence of digital technologies and advances in computational rationality have been presented as catalysts capable of reducing three key sources of inefficiency in human decision-making: the time spent searching for information relevant to decisions, the time required to justify and support those decisions, and the lack of coordination among different decision-makers who act across diverse spatial and temporal contexts and pursue different goals or values.

More generally, digital technologies and computational methods are expected to provide large data sets which, if analysed through sophisticated mathematical tools, can reduce gaps in access to relevant information, minimise distortion in decision-making, and mitigate the lack of coordination among actors who operate under differing circumstances or worldviews.

At the core of this vision lies an understanding of human intelligence and rationality that is reductive and, to some extent, mechanistic. Even if intelligence and rationality are assumed to explain human behaviour comprehensively, instrumental rationality, which seeks efficiency and optimisation, cannot account for the entire range of factors that shape social action. Human cognition involves processes of interpretation, creativity, and ethical reflection that cannot be replicated by computational reasoning.[19]

A jurist working in the field of justice, for example, acts through a complex interplay of elements in which information and knowledge are essential. Nonetheless, both coexist with the capacity to generate meaning in social interactions, to establish trust-based relationships among actors within the same institutional arena, to interpret observations with both critical awareness and creative flexibility, and to embody a professional role that is formally defined but substantively dynamic and context-dependent.

Seen from this perspective, the daily work of legal scholars and experts in governmental or administrative roles integrates multiple forms of intelligence. These forms consolidate into what can be called social intelligence, understood as the capacity to combine normative rationality with instrumental and evidence-oriented reasoning, in a way that remains sensitive to the ethical and cultural dimensions of institutional life.

The transformation of social, organisational, and institutional action, and the forms of rationality applied to the decisions of experts and citizens, opens a space that requires interdisciplinary exploration.

Within this space, organisational factors and institutional legacies play a decisive role. They operate at the meso-interactional level and characterise specific sectors or subsystems of public policy. These factors combine values and deontological orientations with merit-based and methodological competencies. They also involve forms of awareness, understood as the capacity to create actions that possess meaning not

[19] A. Abbott, *Professional ethics*, in *American Journal of Sociology*, 88(5), 1983.

only for oneself but also for others, including those who are not present in the same spatial or temporal setting in which the action takes place.

Discussing professional, legal, scientific, and technical intelligences therefore requires a pluralistic epistemological perspective to follow the life cycle of knowledge and of the institutions that embody it.[20] Digital transformation and artificial intelligence show that hybrid forms of intelligence can produce paradigm shifts and, consequently, new ways of creating, validating, and testing knowledge. These paradigm shifts influence how collective forms of action are regulated. Whether they are directed towards shared goals or inspired by common values, they lead to reconsider the importance attributed to know-how. In the examples highlighted above, know-how once again becomes the central guide to action.

This condition, which seems to characterise our present, and even more so our future, calls for research in this hybrid space of knowledge and practical competence. Such research should identify solutions that respond to the needs associated with the application of standards across multiple domains. These include global health, governance of sustainable cities, conflict resolution, and the management of complex organisational processes in the workplace.

Meeting these challenges requires training professionals in new forms of coexistence and cooperation. It also justifies the production of systematic feedback to inform regulatory bodies and the creation of narratives capable of addressing the social demand for legitimacy, inclusion, and respect for disagreement. This process is essential for shaping our commitments and values in the digital era.

[20] A. Abbott, *The System of Professions: An Essay on the Division of Expert Labour*, London, 1998.