RESPONSIVE ENFORCEMENT IN INNOVATION-INTENSIVE MARKETS: PROCEDURALIZATION AS A CONDITION OF LEGITIMATE ADAPTIVE GOVERNANCE

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Abstract: Technology-intensive markets challenge traditional models of regulatory enforcement. Sanction-centered, command-and-control approaches may generate overdeterrence, adversarial escalation, and chilling effects on innovation. At the same time, adaptive instruments such as responsive regulation and regulatory sandboxes raise concerns about opacity, unequal treatment, and administrative capture. This article examines how these instruments can remain legitimate within a constitutionalized administrative order. Through a conceptual and doctrinal analysis drawing on administrative law, regulatory theory, and technology governance scholarship, it argues that the core issue is not whether regulators should choose rigidity or flexibility, but under what institutional conditions discretionary power can be lawfully exercised. The article advances the claim that proceduralization is the legal infrastructure of adaptive governance. By structuring decision-making through reason-giving, transparency, participation, monitoring, and reviewable constraints on discretion, proceduralization converts regulatory flexibility into accountable public action. It enables responsive enforcement and experimental governance to support innovation and learning without collapsing into opaque discretion, selective privilege, or punitive rigidity.

Keywords: responsive regulation; regulatory sandboxes; proceduralization; chilling effect; administrative law; law and technology.

INTRODUCTION

Technology-intensive sectors have become a stress test for classic regulatory enforcement. Legal categories and prescriptive standards often lag behind rapidly evolving products, data-driven business models, and complex technical infrastructures. In this setting, regulators confront a recurrent dilemma. If they rely on rigid ex ante prescriptions and sanction-first enforcement, they may induce overdeterrence, amplify adversarial dynamics, and suppress valuable experimentation. If, instead, they pursue flexibility through negotiated pathways and bounded experimentation, they expand the discretionary footprint of the administrative state, intensifying concerns about legality, equal treatment, and accountability.

This article argues that this is not a choice between regulation and deregulation, nor between "hard" and "soft" law in the abstract. The central issue is institutional: how public authorities decide under uncertainty, and how those decisions remain legitimate, controllable, and stable over time. In technology governance, uncertainty is not merely

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technical. It is also legal and procedural. Actors respond not only to substantive rules and sanction threats, but also to the predictability of decision criteria, the availability of channels for clarification and contestation, and the perceived openness of the regulatory process to revision in light of evidence.

The paper advances a process-oriented hypothesis: responsive regulation and experimental governance can only deliver their promise if the exercise of discretion is anchored in procedural integrity. As regulatory systems become more adaptive and interactive, legality must be reconstructed through decision procedures that constrain discretion, structure reasons, and preserve public accountability. This is why the question of procedures is not secondary. It is the doctrinal and institutional condition that reconciles adaptive governance with public law. It also reframes the chilling effect. Innovation is chilled not only when sanctions are harsh, but when regulatory interaction is procedurally opaque, unpredictable, or selectively accessible, increasing expected legal exposure even in the absence of formal enforcement.

Methodologically, the article offers a conceptual and doctrinal analysis rather than an empirical evaluation of any single sector or jurisdiction. It proceeds in three steps. First, it reconstructs the internal logic and limitations of command-and-control enforcement in innovation settings, emphasizing how sanction-centered approaches can degrade information flows and encourage adversarial escalation. Second, it maps two influential adaptive responses, responsive regulation and regulatory experimentalism, highlighting how escalation, negotiated instruments, and sandboxes are designed to manage uncertainty through learning and calibrated intervention. Third, it develops a public-law argument about legitimacy: it identifies why these adaptive tools are especially vulnerable to opacity, unequal treatment, and capture risks, and why procedural design functions as the institutional technology that can mitigate these vulnerabilities while preserving the protective mandate of the State.

The relevance of the argument is twofold. Normatively, it addresses a core problem of contemporary administrative law: how to legitimate discretionary governance in contexts where the State must be close enough to markets to learn, but autonomous enough to remain publicly oriented. Practically, it speaks to the stability of regulation in high-innovation environments, where the costs of institutional distrust are high and where judicialization, understood here as the displacement of regulatory conflict to courts and external review, can freeze learning and reinforce defensive rigidity. The paper's contribution is a framework for evaluating adaptive governance through a public-law lens.

Rather than treating enforcement style and experimental tools as separate policy choices, the analysis begins from the point where regulatory tension is most visible: the limits of sanction-centered command-and-control enforcement when applied to fast-moving, technology-intensive environments. From this baseline, the discussion moves to adaptive responses that have gained prominence in contemporary governance, and then to the central legal question that follows from them. If discretion, negotiation, and bounded experimentation are increasingly necessary to govern innovation, what makes these forms of administrative action legitimate and stable within public law? The argument developed here is that this stability depends less on the availability of flexible instruments and more on the procedural conditions under which they are exercised, including reason-giving, transparency, and reviewable constraints on discretion.

I. THE LIMITS OF COMMAND-AND-CONTROL ENFORCEMENT IN TECHNOLOGY-INTENSIVE SECTORS

The command-and-control model has been widely used in the institutional construction of Brazilian regulatory agencies and is often presented as a centralized and prescriptive form of state intervention. Its core mechanics are familiar: the authority defines detailed rules of conduct, monitors compliance, and applies sanctions when regulated actors deviate from what was prescribed. In the early phases of the Brazilian regulatory state, this design contributed to stabilizing expectations and to affirming public authority, especially where baseline compliance had not yet been internalized by regulated markets.

The same architecture, however, becomes increasingly strained as markets become more complex and innovation accelerates. When technological change compresses regulatory cycles, a rigid, sanction-centered posture tends to perform poorly because it assumes that deviation is primarily conflict driven, and that deterrence is the best route to compliance. In practice, the sanction-first logic can create incentives for opacity and resistance and can amplify judicialization, undermining both regulatory efficiency and the perceived legitimacy of administrative decisions.

These dysfunctions are not limited to substantive outcomes. They are also procedural and institutional. In several regulated sectors, decision-making processes remain weakly structured, with limited channels for sustained dialogue between regulators and regulated parties, and with insufficient institutional openness to incorporate specialized knowledge and contestation in an organized manner. Where procedural safeguards are thin, conflicts tend to be displaced to external review bodies, particularly courts, which are often asked to resolve technically complex issues without consistent deference to administrative expertise. This dynamic weakens the pedagogical and cooperative potential of regulation and reinforces an adversarial posture in which compliance is treated as a risk management exercise rather than as a shared institutional objective.

The institutional costs are significant. Excessive judicialization is a visible symptom of fragility in traditional enforcement models because it transfers high complexity regulatory disputes to the judiciary and increases uncertainty for both public authorities and regulated actors. At the same time, the underlying legitimacy deficit tends to reproduce itself: without structured participation, objective criteria, and transparent deliberation, administrative decisions become harder to justify, harder to scrutinize rationally, and more vulnerable in review.

A. Command-and-Control as a Governance Assumption

In technology-intensive sectors, a central limitation of command-and-control enforcement is that it approaches uncertainty primarily as a compliance deviation to be deterred, rather than as a structural condition of governance. Historically framed as prescriptive or directive regulation, this paradigm relies on unilateral legal obligations and treats sanctions as the main instrument for shaping behavior. It is grounded in an assumption of technical and legal superiority of the state apparatus, positioning the administrative authority as the exclusive decision center responsible for setting rigid conduct rules, monitoring compliance, and imposing penalties in cases of deviation.

This design carries a distinctive operational profile. It is marked by verticality, legalism, and reactivity, combining centralized decision-making, detailed and binding normative instruments intended to predetermine what is permitted and what is prohibited, and a sanction-first logic focused on repression rather than prevention, dialogue, or cooperation. In Brazil, its diffusion accompanied the strengthening of the state and the institutionalization of regulatory agencies, often justified by the search for stability in strategic sectors such as energy, telecommunications, and health.

As markets become more complex and dynamic, however, the shortcomings of this governance assumption become increasingly visible. The effort to anticipate regulated behavior through general and abstract rules tends to produce rigid frameworks that struggle to adapt to accelerated innovation and to heterogeneous technical and institutional arrangements. These limits are compounded when participation is low and institutionalized listening mechanisms are weak. In such cases, administrative decisions may remain insufficiently responsive to shifts in the regulated environment, reinforcing perceptions of a closed and impositive model.

These procedural features are not peripheral. They shape the conditions of legitimacy and the quality of regulatory interaction, especially where relevant knowledge is distributed across firms, experts, users, and regulators. When structured channels for dialogue and participation are scarce, conflict resolution tends to externalize into adversarial review, increasing uncertainty and weakening the regulator's capacity to learn from emerging practices. In contrast, governance-oriented accounts emphasize that regulatory performance depends on institutional criteria such as predictability, procedural transparency, and public accountability, which support mutual trust and facilitate voluntary compliance in high-complexity environments.

For law and technology governance, the implication is straightforward. The core challenge is often not the existence of regulation, but the capacity to decide under uncertainty in ways that remain intelligible, contestable, and revisable. A sanction-first closed decision model tends to underdeliver on these demands. This misalignment creates the rationale for shifting attention from purely substantive prescriptions to procedural design, with enforcement architectures that can incorporate expertise, enable critique, and stabilize legitimacy over time.

B. Chilling Effects and the Misalignment Between Sanctioning and Innovation

A persistent sanction-centered regulatory culture can compromise the development of institutional environments conducive to innovation, entrepreneurship, and long-term investment, particularly when novel solutions emerge near the frontier of legality or within regulatory gray zones not fully disciplined by existing categories. In technology-intensive markets, experimentation is often a prerequisite for evidence generation and risk discovery. Yet the expected gains from innovation depend not only on technical feasibility, but also on predictable regulatory interactions and on the availability of procedural routes to clarify expectations and adjust conduct over time.

This context helps explain the chilling effect, understood as a behavioral response to legal risk in which actors refrain from engaging in potentially beneficial conduct due to fear of sanctions, uncertainty, or exposure to costly dispute resolution. In sanction-first environments, the relevant driver is frequently not the actual imposition of penalties, but expected exposure combined with limited clarity about how authorities will interpret emergent practices. When sanctions are perceived as disproportionate or unpredictable, regulated actors may avoid efficient solutions not explicitly anticipated by existing rules, even where controlled experimentation could generate socially valuable information and support regulatory improvement.

The chilling effect tends to intensify when enforcement is embedded in closed and weakly participatory decision-making structures. Where institutionalized dialogue is scarce, regulated actors have fewer safe procedural spaces to disclose uncertainty, request clarification, or propose controlled tests. This fosters adversarial interaction and undermines regulatory learning, because information becomes strategically withheld and innovation is more likely to be framed as deviation rather than as a source of evidence about risks and market dynamics.

From the perspective of innovation dynamics, this misalignment is structural. Disruptive models frequently challenge incumbent architectures and expose mismatches between legacy rules and emergent practices, which makes overdeterrence a recurring risk if novelty is treated as wrongdoing by default. The sanctioning function remains necessary for harmful conduct, but it becomes counterproductive when applied indistinctly to uncertainty-driven behavior. A more adequate enforcement posture distinguishes between strategic misconduct and good-faith experimentation undertaken within acceptable risk parameters, reserving punitive interventions for repeated resistance, high-risk harm, or fraudulent behavior.

At the ecosystem level, sanctioning rigidity is associated with reduced attractiveness of the regulated environment and with the weakening of innovation ecosystems by discouraging investment and limiting entry. The mechanism is cumulative: reduced entry narrows the variety of solutions available to address public problems and decreases the opportunities for regulatory learning that arise from real-world experimentation. In addition, where innovation increases enforcement exposure without offering procedural channels for clarification and adjustment, experimentation may migrate to jurisdictions perceived as more predictable.

For these reasons, the appropriate response is not to relax the protective mandate of the State, but to recalibrate how protection is achieved. Sanctioning can be repositioned as a last-resort instrument within strategies that value dialogue, proportionality, and institutional responsiveness. This repositioning provides the conceptual bridge to responsive regulation and to experimental instruments such as regulatory sandboxes, which reduce informational asymmetries and enable learning under controlled conditions while strengthening legitimacy through procedural design.

The chilling effect, however, should not be attributed solely to the fear of sanctions. In technology-intensive sectors, uncertainty is also procedural. When actors cannot anticipate how regulators will interpret emergent practices, which criteria will govern discretionary choices, or how and when decisions may be revised, expected legal exposure increases even in the absence of formal enforcement. In this sense, procedural opacity and weak reason-giving can amplify overdeterrence by transforming innovation into a high-variance bet, discouraging disclosure and experimentation. This connects the behavioral consequences of sanction-centered cultures to a structural institutional diagnosis: the quality of regulatory procedures becomes a determinant of innovation incentives as well as legitimacy.[1]

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[1] Ian Ayres & John Braithwaite, *Responsive Regulation: Transcending the Deregulation Debate* 19–35 (Oxford Univ. Press 1992), at 19–20, 35, 52–53; *see also* Robert Baldwin & Julia Black, *Really Responsive Regulation*, 71 Mod. L. Rev. 59, 61–62 (2008).

II. RESPONSIVE REGULATION AND EXPERIMENTAL GOVERNANCE

Regulators operating in technology-intensive sectors increasingly face a recurrent dilemma. Rigid, ex ante prescriptions often lag behind fast-moving markets, while purely ex post sanctioning can amplify adversarial dynamics and reduce the informational quality of regulatory interactions. In response to these limits, two families of approaches have gained prominence: responsive regulation and regulatory experimentalism. Both seek to improve regulatory performance under uncertainty by shifting attention from unilateral imposition to institutional responsiveness, iterative adjustment, and learning-oriented governance.

Responsive regulation is commonly associated with the idea that enforcement should follow an escalation logic. The regulator should begin with softer interventions that privilege persuasion, information, and dialogue, and only escalate to more severe sanctions in cases of persistent resistance. This approach does not eliminate the sanctioning function. It reframes it as a last-resort instrument integrated into a broader strategy that emphasizes calibrated incentives, trust-building, transparency, and predictability of expected behaviors.

In parallel, regulatory experimentalism has developed as a complementary framework focused on building institutional environments in which innovative solutions can be tested under controlled conditions. Instead of imposing a closed normative pattern from the outset, the State acts as a facilitator of learning by collecting evidence, adjusting guidance, and sharing responsibilities with regulated actors. This logic has become particularly relevant in domains such as financial services and digital technologies, where disruption and uncertainty demand adaptive and iterative responses.

These approaches converge on an institutional claim with direct implications for law and technology governance. The legitimacy of administrative decisions is increasingly linked to the capacity to listen, justify, and revise choices based on empirical information and qualified participation. As regulation shifts away from unilateral imposition, the regulatory process itself becomes a space of continuous deliberation and collective learning.

A. Responsive Regulation and Learning-Oriented Enforcement

Responsive regulation can be read as a theory of enforcement design for complex societies in which regulated actors display heterogeneous motivations, capacities, and compliance cultures. Instead of assuming that the threat of punishment is the most efficient baseline for steering behavior, responsive approaches treat enforcement as an adaptive architecture. The regulator is expected to calibrate interventions to context, gradually increasing intensity as needed, and using early interventions to shape incentives, clarify expectations, and preserve institutional trust.[2]

The most recognizable expression of this architecture is the enforcement pyramid. The pyramid models enforcement as a sequence in which the regulator starts with low-intensity measures such as advice, guidance, persuasion, and negotiated problem-solving, and escalates to more coercive tools only when cooperation fails or when the risks involved make immediate intervention unavoidable. The point is not to weaken state capacity, but to discipline it. By sequencing interventions, the regulator can reduce unnecessary conflict, avoid premature escalation, and preserve coercion for the cases in which it is normatively justified and behaviorally effective. In technology-intensive sectors, this sequencing is particularly important because uncertainty is frequent, knowledge is distributed, and compliance often requires iterative adjustment rather than instantaneous alignment with a fully settled rule set.

The enforcement pyramid also carries an epistemic function. Early interventions can operate as structured opportunities for information elicitation. They can reveal whether noncompliance is driven by uncertainty, low organizational capacity, negligence, strategic evasion, or bad faith. When regulators jump directly to punitive responses, they not only raise the cost of error but may also deteriorate the informational quality of the relationship, because regulated actors internalize incentives to conceal uncertainty and to litigate defensively. This dynamic feeds the classic concern with overdeterrence. Under conditions of uncertainty, fear of sanctions can discourage legitimate experimentation and suppress potentially beneficial conduct, even before any formal decision is issued.

This is the background in which the chilling effect becomes analytically relevant. Chilling effects capture the behavioral response to legal exposure in which actors refrain from engaging in desirable or lawful conduct due to perceived risk of sanctions, dispute costs, or interpretive unpredictability. In innovation settings, the chilling effect can be particularly damaging because learning frequently depends on real-world testing and feedback loops. If enforcement signals that novelty will be treated as deviation by default, the governance system can unintentionally select against experimentation, lowering the evidence base available for regulatory refinement and narrowing the range of solutions that reach the market.[3]

Responsive regulation addresses these risks by combining cooperation with credible escalation. Cooperative measures are meaningful because they are embedded in a system capable of moving upward when resistance persists. At the same time, the availability of

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[2] Ian Ayres & John Braithwaite, *Responsive Regulation: Transcending the Deregulation Debate* 35–39 (Oxford Univ. Press 1992), at 35–39. *See also* Alexandre Gianni, *Regulação Responsiva e Processo Estrutural: Um Diálogo Possível?*, 11(1) Rev. Direito Setorial e Regulatório 390, 396–399 (maio 2025)

[3] Ian Ayres & John Braithwaite, *Responsive Regulation: Transcending the Deregulation Debate* 101–32 (Oxford Univ. Press 1992), at 101–05.

escalation can make early compliance rational for many actors, especially when expectations are communicated clearly and applied consistently. This interaction between sequencing, information, and credibility helps explain why responsive enforcement is often framed as a learning-oriented model: it protects public interests while preserving institutional space for experimentation, adjustment, and norm-development in areas where uncertainty is unavoidable.

B. Consensuality and Negotiated Instruments as Enforcement Infrastructure

Responsive regulation is frequently associated with escalation and the enforcement pyramid, but its practical and dogmatic implications go further. A core implication is that enforcement can be structured as a relationship of inducement rather than a sequence of unilateral commands. In this perspective, negotiated instruments are not anomalies within the administrative state. They are part of a broader regulatory logic that treats compliance as something that can be produced through dialogue, calibrated commitments, and credible backstops, instead of through punishment as the default mode of interaction.[4]

This shift matters in technology governance because uncertainty often makes strict ex ante specification unrealistic. When rules do not fully anticipate emergent practices, regulators need institutional forms that can clarify expectations, fix obligations proportionally to risk, and create pathways for correction without immediately triggering adversarial dynamics. Negotiated instruments can serve precisely this function by enabling tailored commitments, staged adaptation, and structured accountability under public supervision. As a result, the regulatory relationship becomes less centered on blaming past deviations and more centered on preventing harm and producing learning while preserving the State's protective mandate.

From a doctrinal standpoint, however, consensuality is not equivalent to informality. Its legitimacy depends on whether negotiated instruments remain compatible with due process guarantees and with reviewable standards of justification. A useful way to frame this is to treat administrative agreements as procedural devices that must incorporate safeguards such as adequate adversarial participation, reason-giving, and "safety clauses" capable of managing uncertainty and ensuring enforceability. In other words, negotiated administration only qualifies as legitimate regulation if it is embedded in a rule-governed decision process

[4] Gustavo Justino Oliveira & Wilson Accioli Barros Filhos, *Inquérito Civil Público e Acordo Administrativo: Apontamentos sobre Devido Processo Legal Adequado, Contraditório, Ampla Defesa e Previsão de Cláusulas de Segurança nos Termos de Ajustamento de Condutas (TACs)*, *in* Acordos Administrativos no Brasil: Teoria e Prática 91, 91–126 (Gustavo Justino Oliveira coord., Almedina 2020), at 100–101.

that constrains discretion and allows external scrutiny.[5]

This connection between consensuality and procedural integrity also helps address a classic objection to negotiated governance: the risk that agreements become opaque or selectively available, producing inequality of treatment and accountability gaps. The response is not to reject negotiation, but to proceduralize it. Public standards for when agreements are available, transparent criteria for their content, and documented reasoning about proportionality and risk can reduce perceptions of arbitrariness and strengthen the defensibility of negotiated outcomes. The relevance of these safeguards increases in technology-intensive sectors, where agreements can influence market structure and innovation trajectories.

Consensuality also links to a broader account of legitimacy in regulatory governance. When decision-making processes are designed to incorporate qualified participation and deliberation, they may increase the perceived rationality and acceptability of administrative choices, particularly in domains where technical judgments and value trade-offs are unavoidable. This legitimacy effect is not merely symbolic. Governance-oriented criteria for regulatory performance commonly emphasize transparency, accountability, and predictability as foundations for trust and compliance, which negotiated instruments can strengthen when they are procedurally structured rather than discretionary or opaque.[67]

Finally, negotiated enforcement is increasingly mediated by new forms of compliance infrastructure, including technology-enabled supervision and reporting. In areas such as financial regulation, the literature on FinTech and RegTech highlights how evolving regulatory architectures reconceptualize oversight, including through instruments that rely on continuous information flows and adaptive compliance mechanisms. While these developments do not eliminate the need for sanctions, they reinforce the broader point of responsive governance: enforcement can be designed to produce compliance and learning through calibrated interaction, provided that negotiated pathways remain bounded by procedural safeguards and public accountability.[8]

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[5] Conrado Hübner Mendes, *Direitos Fundamentais, Separação de Poderes e Deliberação* (Ph.D. dissertation, Faculdade de Filosofia, Letras e Ciências Humanas, 2008), at 195–196.

[6] Judith Stern & Stuart Holder, *Regulatory Governance: Criteria for Assessing the Performance of Regulatory Systems*, 8(1) Utilities Pol'y 33, 33–50 (1999), at 36–44.

[7] Douglas W. Arner, János Barberis & Ross P. Buckley, *FinTech, RegTech and the Reconceptualization of Financial Regulation*, 37(3) Nw. J. Int'l L. & Bus. 371, 371–413 (2017), at 397–405; *see also* Kenneth A. Bamberger & Deirdre K. Mulligan, *Privacy on the Ground: Driving Corporate Behavior in the United States and Europe* (MIT Press 2015), at 29–35.

[8] Douglas W. Arner, János Barberis & Ross P. Buckley, *FinTech, RegTech and the Reconceptualization of Financial Regulation*, 37(3) Nw. J. Int'l L. & Bus. 371, 371–413 (2017), at 371–80.

C. Regulatory Experimentalism and Sandboxes as Learning Arrangements

Regulatory experimentalism begins from a premise that is both descriptive and normative. In technology-intensive sectors, the State often cannot define ex ante, with sufficient precision, the full set of standards needed to govern new products, services, or business models without either overregulating innovation or underprotecting public interests. Experimental governance responds by treating regulation as an iterative process of evidence production and institutional learning, in which provisional arrangements can be tested, monitored, and revised before generalization.[9]

The regulatory sandbox has emerged as one of the most visible institutional expressions of this experimental posture. In its basic form, a sandbox creates a bounded environment in which innovative solutions can be deployed under supervisory oversight, subject to tailored constraints, monitoring obligations, and defined conditions of participation. The key point, from a doctrinal perspective, is that the sandbox should not be treated as a zone of exemption. Its legitimacy depends on whether experimentation is constrained by publicly articulable criteria and by a governance framework capable of justifying why flexibility is granted, to whom, for how long, and at what level of acceptable risk.

This emphasis on boundedness is essential for law and technology governance because experimental tools implicate classic administrative concerns such as legality, equality, proportionality, and accountability. Sandboxes inevitably distribute benefits and burdens. They may privilege certain market actors through access to regulatory dialogue, temporary flexibility, or reputational signaling. They also reallocate risk by authorizing real-world exposure under controlled conditions. For this reason, experimental governance must be understood as a form of discretionary power that requires legal rationalization through procedural constraints, rather than as a managerial technique that operates outside the grammar of public law.

From a governance standpoint, the sandbox also performs an epistemic function. It reduces information asymmetries by creating structured interaction between regulator and regulated actors, enabling the State to observe emergent practices, identify risk patterns, and refine its standards based on empirical performance rather than abstract speculation. This is particularly relevant where innovation is disruptive in the sense of restructuring market architectures and challenging legacy

[9] Douglas W. Arner, János Barberis & Ross P. Buckley, *FinTech, RegTech and the Reconceptualization of Financial Regulation*, 37(3) Nw. J. Int'l L. & Bus. 371, 371–413 (2017), at 405–10. *See also* Jefferson L. C. Dalmoro, *Atuação Parlamentar e a Teoria da Regulação Responsiva na Regulação da IA no Brasil*, 11(2) Rev. Direito Setorial e Regulatório 1, 28–29 (out. 2025).

assumptions embedded in existing rules. In such environments, enforcement strategies that treat novelty as deviation by default risk overdeterrence. Experimental governance offers an alternative route by distinguishing learning problems from wrongdoing problems and by organizing oversight around adaptive feedback loops.

The institutional ambition of experimental tools, however, should be framed carefully. Learning-oriented governance is not equivalent to deregulation. It is better described as a reconfiguration of state capacity, in which the public authority remains responsible for defining objectives, setting boundaries, monitoring outcomes, and deciding whether and how experimental findings should translate into general standards. This view is consistent with broader accounts that treat the State as an active organizer of innovation trajectories rather than a passive corrector of market failures. At the same time, credible experimentalism requires institutional competence and autonomy, because regulators must be able to interact closely with markets while preserving public-purpose discipline and avoiding capture dynamics that can emerge from proximity.[10][11]

Finally, the sandbox is best understood as an institutional bridge between responsive enforcement and procedural legitimacy. If experimentation is to generate learning without undermining legality and trust, the sandbox must be governed through transparent criteria, reason-giving duties, and reviewable decision pathways. Without these constraints, experimentation risks becoming opaque discretion. With them, it can operate as a legitimate learning arrangement within a constitutionalized administrative order. The next subsection develops this bridge by showing how experimental tools and negotiated enforcement both converge on a common requirement: proceduralization as the condition for legitimacy under uncertainty.

III. PROCEDURALIZATION AS A GOVERNANCE TECHNOLOGY

Proceduralization can be understood as the institutional move that turns regulatory discretion into a structured and reviewable decision process. In technology-intensive sectors, where uncertainty is persistent and knowledge is distributed, the quality of regulation depends less on the ability to prescribe exhaustive rules ex ante and more on the capacity to

[10] Peter B. Evans, *Embedded Autonomy: States and Industrial Transformation* 61 (Princeton Univ. Press 1995), at 61.

[11] Julia Black, *Proceduralising Regulation: Part I*, 20 Oxford J. Legal Stud. 597, 597–600 (2000). Black conceptualizes proceduralization as the institutional redesign of organizational decision-making processes involving the redistribution of competences, the creation of channels of external responsiveness, and the structuring of mechanisms through which organizations internalize the effects of their own decisions. She distinguishes a "thin" proceduralization, oriented toward preference aggregation and bargaining, from a "thick" one oriented toward deliberation, reciprocity, and the discursive formation of legitimacy.

organize how decisions are formed, tested, revised, and justified. This is why transparency, participation, and reason-giving are not auxiliary virtues. They operate as governance mechanisms that stabilize legitimacy, improve information flows, and reduce the incentives for adversarial escalation.[12]

In practical terms, proceduralization aims to align innovation-friendly regulatory tools with the demands of legality, equality, and accountability. When experimental arrangements such as sandboxes are framed as bounded programs with explicit criteria, measurable objectives, monitoring duties, and clear termination pathways, they become compatible with external control and legal certainty, rather than exceptions that depend on opaque discretion.

A. Why Procedural Design Matters Under Uncertainty

In technology-intensive sectors, uncertainty is not a temporary anomaly. It is a persistent feature of governance. New products and business models routinely emerge before regulators can stabilize categories, metrics, and enforcement expectations. In these conditions, the central regulatory challenge is not only to define substantive standards, but to structure how public authorities decide when evidence is incomplete, risks are evolving, and knowledge is dispersed across multiple actors. Procedural design therefore becomes a core dimension of regulatory capacity. It determines whether discretion will be exercised as a reviewable, intelligible, and accountable form of public reasoning, or as an opaque exercise of administrative will.[13]

Procedural robustness matters, first, because it is a legitimacy technology. When regulators must choose among competing risk assessments, trade-offs, and policy priorities, legitimacy cannot be derived solely from formal competence or technical expertise. It depends on whether decisions are produced through processes that can be publicly justified, contested, and, when necessary, revised. Deliberative accounts of institutional decision-making emphasize that the distribution of reasons and the openness of decision procedures are not decorative values. They are conditions for the acceptability of authority in contexts of disagreement and complexity. In practical regulatory terms, procedures that require reason-giving, documentation of evidence, and structured participation reduce perceptions of arbitrariness and improve the defensibility of decisions under external review.[14]

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[12] Judith Stern & Stuart Holder, *Regulatory Governance: Criteria for Assessing the Performance of Regulatory Systems*, 8(1) Utilities Pol'y 33, 33–50 (1999), at 33.

[13] Conrado Hübner Mendes, *Direitos Fundamentais, Separação de Poderes e Deliberação* (Ph.D. dissertation, Faculdade de Filosofia, Letras e Ciências Humanas, 2008), at 200–202; *see also* Julia Black, *Proceduralising Regulation: Part I*, 20 Oxford J. Legal Stud. 597, 601–606 (2000).

[14] *See* Judith Stern & Stuart Holder, *Regulatory Governance: Criteria for Assessing*

Second, procedural design has an epistemic function. Under uncertainty, regulators need mechanisms that improve the informational basis of decisions and reduce the risk of overdeterrence. When the regulatory relationship is organized through procedural channels that incentivize disclosure and structured dialogue, authorities can detect risks earlier and calibrate interventions more proportionally. The inverse is also true. Closed processes and unpredictable enforcement tend to induce strategic concealment and defensive conduct, which deteriorate information quality. This is especially costly in innovation settings, where learning depends on timely feedback loops and on the ability to distinguish good-faith uncertainty-driven conduct from strategic wrongdoing.

Third, proceduralization stabilizes governance by shaping predictability and trust. Regulatory systems do not perform well simply because they are coercive. They perform well when regulated actors can anticipate how standards will be interpreted, when accountability is credible, and when the regulator's behavior is consistent over time. Governance-oriented criteria often treat predictability, transparency, and accountability as central dimensions of regulatory performance, precisely because they reduce transaction costs and support compliance as a rational strategy rather than as a defensive posture. Under uncertainty, procedural commitments are one of the main ways to generate this predictability without freezing innovation into outdated categories.[15]

Finally, procedural design addresses structural risks of modern regulatory governance, including capture and unequal access. The more regulation relies on proximity, technical dialogue, negotiated pathways, or experimental programs, the greater the risk that discretion will be perceived as selective, opaque, or biased. This risk is not hypothetical. Accounts of state capacity stress that effective governance requires embeddedness in societal and market realities, but also autonomy from particularistic interests. Procedural constraints are one of the primary ways to reconcile these demands. They allow the regulator to be close enough to learn and adapt, while remaining bound by standards that preserve equality, auditability, and public-purpose discipline.[16]

For these reasons, procedural design is not an accessory topic in law and technology governance. It is a doctrinal and institutional condition for regulating under uncertainty. It enables the State to remain protective without defaulting to sanction-first rigidity, and it enables innovation without collapsing into deregulated discretion. The sections that follow develop how this procedural dimension operates, and why it becomes decisive for legitimacy and review-resilience in responsive and

the Performance of Regulatory Systems, 8(1) Utilities Pol'y 33, 33–50 (1999), at 36–40.

[15] Peter B. Evans, *Embedded Autonomy: States and Industrial Transformation* 61 (Princeton Univ. Press 1995), at 61.

[16] *See* Judith Stern & Stuart Holder, *Regulatory Governance: Criteria for Assessing the Performance of Regulatory Systems*, 8(1) Utilities Pol'y 33, 33–50 (1999), at 36.

experimental regulatory settings.

For analytical clarity, proceduralization in innovation governance operates at two levels. At the micro level, it structures individual administrative choices, such as admission and exit decisions in experimental programs, escalation steps in responsive enforcement, and the formation of negotiated commitments, ensuring that discretion is bounded by criteria, reason-giving, and contestability. At the macro level, it structures how experimental learning and supervisory practice are translated into general standards, shaping the pathway through which provisional arrangements become stable regulation under transparency and accountability duties.[17]

B. Proceduralization, Legitimacy, and Due Process in Experimental Settings

Experimental governance tools, including regulatory sandboxes, intensify a classic problem of administrative law: how to legitimate discretionary choices that distribute benefits and burdens under conditions of uncertainty. Unlike conventional rulemaking, experimental programs frequently operate through selective admission, tailored obligations, and individualized supervision. These features may be functionally justified, but they also raise doctrinal concerns related to legality, equality, proportionality, and accountability. The central claim of proceduralization is that these concerns are not solved by technical expertise alone. They are addressed by turning discretion into a structured, reviewable process that can be justified publicly and audited externally.[18]

In this context, due process should be understood not merely as a defensive barrier against arbitrariness, but as a governance technology that shapes the legitimacy and informational quality of regulation. When administrative decisions affect rights, economic opportunities, and the distribution of risks, procedural guarantees are part of what makes those decisions acceptable within a constitutional order. Deliberative accounts of institutional authority emphasize that legitimacy depends on the existence of reason-giving, contestability, and channels for participation that make the exercise of power intelligible and responsive to critique. In

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[17] Douglas W. Arner, János Barberis & Ross P. Buckley, *FinTech, RegTech and the Reconceptualization of Financial Regulation*, 37(3) Nw. J. Int'l L. & Bus. 371, 371–413 (2017), at 380–97.

[18] Conrado Hübner Mendes, *Direitos Fundamentais, Separação de Poderes e Deliberação* (Ph.D. dissertation, Faculdade de Filosofia, Letras e Ciências Humanas, 2008), at 200–202, 208–209; Robert Baldwin & Julia Black, *Really Responsive Regulation*, 71 Mod. L. Rev. 59, 68–69 (2008); *see also* Gustavo Justino Oliveira & Wilson Accioli Barros Filhos, *Inquérito Civil Público e Acordo Administrativo: Apontamentos sobre Devido Processo Legal Adequado, Contraditório, Ampla Defesa e Previsão de Cláusulas de Segurança nos Termos de Ajustamento de Condutas (TACs)*, *in* Acordos Administrativos no Brasil: Teoria e Prática 91, 91–126 (Gustavo Justino Oliveira coord., Almedina 2020), at 100–101.

experimental programs, these requirements acquire a specific configuration: they must be compatible with adaptive oversight and iterative learning without collapsing into managerial informality.[19]

A first component of procedural legitimacy in experimental settings is the existence of publicly articulable criteria. Sandboxes, for example, involve decisions about admissibility, scope, duration, and exit. Without articulated standards, discretion becomes difficult to justify and risks being perceived as preferential treatment. Criteria perform both a legal and an institutional function. Legally, they constrain arbitrariness and support equal treatment. Institutionally, they stabilize expectations and provide a framework for reasoned contestation. This is especially important in innovation ecosystems, where access to experimental programs can influence market structure and signaling, and where perceived inequality may undermine trust.

A second component is justification. Experimental settings require regulators to explain why a particular form of flexibility is compatible with public protection, what risks are being accepted, and why the chosen safeguards are proportionate. In responsive enforcement, the logic of escalation provides a template for justification because it connects intervention intensity to behavioral signals and harm potential rather than to novelty alone. In experimental governance, justification must also address the rationale for learning itself. The regulator should be able to explain why experimentation is necessary, what evidence is sought, and how evidence will affect subsequent regulatory decisions.[20]

A third component is participation and institutionalized listening. Experimental arrangements are often built on proximity between regulator and regulated actors, yet proximity can increase concerns about capture and selective access. The solution is not to sever contact, but to structure it. Participation mechanisms widen the epistemic base of regulation and create conditions for contestation, while procedural constraints ensure that interaction does not become informal privilege. This is consistent with accounts of state capacity that stress the need for embeddedness in social and market realities, combined with autonomy from particularistic interests. In practice, proceduralized participation can include consultations, technical hearings, public reporting, and structured feedback cycles that allow scrutiny by affected stakeholders and by oversight institutions.[21]

A fourth component is accountability and transparency, calibrated to

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[19] Ian Ayres & John Braithwaite, *Responsive Regulation: Transcending the Deregulation Debate* 35–39 (Oxford Univ. Press 1992), at 35–36. *See also* Alexandre Gianni, *Regulação Responsiva e Processo Estrutural: Um Diálogo Possível?*, 11(1) Rev. Direito Setorial e Regulatório 390, 411–412 (may 2025).

[20] Peter B. Evans, *Embedded Autonomy: States and Industrial Transformation* 61 (Princeton Univ. Press 1995), at 61.

[21] Judith Stern & Stuart Holder, *Regulatory Governance: Criteria for Assessing the Performance of Regulatory Systems*, 8(1) Utilities Pol'y 33, 33–50 (1999), at 40–44.

the realities of confidential information. Governance-oriented criteria emphasize that transparency, accountability, and predictability are core dimensions of regulatory performance. In experimental programs, transparency should be oriented toward what is necessary to sustain public control: objectives, governance structure, admission criteria, safeguards, monitoring metrics at an appropriate level of aggregation, and evaluation results. Confidentiality may remain legitimate for trade secrets, personal data, and security vulnerabilities, but it should not swallow the visibility of the program's public-purpose discipline.[22]

Finally, proceduralization connects due process to review resilience. In technology governance, disputes often concern technical judgments under uncertainty. Procedurally robust decisions are more likely to be treated as rational and accountable outcomes of a structured process, which can narrow disputes and improve the prospects of deference in external review. Procedural integrity also supports learning over time because it transforms experimental outcomes into audit-ready evidence that can be generalized, revised, or terminated through intelligible criteria rather than through ad hoc discretion. Experimental governance becomes institution-building only when it produces not only outcomes, but reasons and records that can be evaluated, contested, and incorporated into future standards.[23]

C. Judicialization and Administrative Deference

One of the most tangible institutional consequences of weak procedural design is the displacement of regulatory conflict to external review, particularly courts. In technology-intensive sectors, disputes often involve technical uncertainty, competing risk assessments, and contested policy trade-offs. When the administrative process is perceived as closed, insufficiently reasoned, or selectively accessible, affected actors have stronger incentives to litigate, not only to contest outcomes but also to obtain clarity about standards and expectations. Procedural fragility therefore operates as a driver of judicialization by transforming governance disagreements into adversarial legal disputes.[24]

Judicialization, in turn, has effects that go beyond litigation volume. It can freeze regulatory learning, delay corrective adjustments, and increase uncertainty for both regulators and market actors. It also tends to reinforce a sanction-centered posture when agencies anticipate that any

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[22] Conrado Hübner Mendes, *Direitos Fundamentais, Separação de Poderes e Deliberação* (Ph.D. dissertation, Faculdade de Filosofia, Letras e Ciências Humanas, 2008), at 209–210, 218–219.

[23] Judith Stern & Stuart Holder, *Regulatory Governance: Criteria for Assessing the Performance of Regulatory Systems*, 8(1) Utilities Pol'y 33, 33–50 (1999), at 33.

[24] Conrado Hübner Mendes, *Direitos Fundamentais, Separação de Poderes e Deliberação* (Ph.D. dissertation, Faculdade de Filosofia, Letras e Ciências Humanas, 2008), at 200–202, 205–206.

innovation-sensitive flexibility will be challenged as unlawful or arbitrary. Under such pressures, regulators may choose rigidity as a defensive strategy, even when rigidity produces overdeterrence and reduces the evidence base needed for better policy. The broader institutional cost is a feedback loop: procedural weakness increases litigation, litigation increases risk aversion, and risk aversion intensifies reliance on traditional command-and-control tools.

Proceduralization targets this loop by improving review-resilience. When the regulator provides an intelligible decision trail, documents its evidence base, addresses relevant objections, and explains proportionality between risks and restrictions, the decision becomes easier to scrutinize rationally and harder to attack as arbitrary. Deliberative accounts of institutional authority frame this effect in terms of reason-giving and contestability: the legitimacy of public power under disagreement depends on the capacity to offer reasons that can be publicly assessed and, where appropriate, revised. Procedural design thus functions as a bridge between technical expertise and external control, allowing courts and oversight bodies to review administrative decisions through standards of rationality rather than substituting their judgment wholesale.[25]

This is where the idea of administrative deference becomes relevant as an institutional outcome. Deference is rarely a purely doctrinal artifact. It is partly produced by the credibility of the decision process. Governance-oriented criteria for regulatory performance emphasize predictability, transparency, and accountability as core dimensions of trust-based compliance and institutional stability. In review settings, these same features contribute to the perception that the agency has acted in a disciplined, consistent, and publicly oriented manner. Where this perception is present, external reviewers are more likely to treat technical judgments as outcomes of a competent process rather than as discretionary will, even when uncertainty persists.[26]

The relevance of proceduralization increases in contexts that rely on responsiveness and experimentation. Responsive enforcement and negotiated pathways can be contested as selective or informal if they are not clearly bounded by standards and transparent triggers for escalation. Sandboxes can be challenged as unequal treatment or as deregulation by exception if admission, monitoring, and exit conditions are not justified publicly. In both cases, proceduralization supplies the mechanism that converts flexibility into legality: it constrains discretion, renders choices auditable, and preserves equality by clarifying when differentiated treatment is warranted.[27]

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[25] Judith Stern & Stuart Holder, *Regulatory Governance: Criteria for Assessing the Performance of Regulatory Systems*, 8(1) Utilities Pol'y 33, 33–50 (1999), at 36–44.

[26] Ian Ayres & John Braithwaite, *Responsive Regulation: Transcending the Deregulation Debate* 35–39 (Oxford Univ. Press 1992), at 35–39.

[27] Douglas W. Arner, János Barberis & Ross P. Buckley, *FinTech, RegTech and the Reconceptualization of Financial Regulation*, 37(3) Nw. J. Int'l L. & Bus. 371, 371–413

Proceduralization also refines the posture of judicial review itself. Courts confronted with complex technology disputes often face a binary choice between full deference and intrusive substitution. Procedurally robust administration enables a third route: review can focus on whether the process was rational, transparent, and accountable, rather than on whether the court would have chosen the same technical outcome. This model is particularly compatible with uncertainty governance because it allows the regulator to remain adaptive while remaining accountable. It also reduces incentives for regulated actors to litigate as a primary mechanism for regulatory clarification, because procedural channels provide clearer standards for engagement, contestation, and revision within the administrative domain.

Finally, proceduralization should be understood as a stability mechanism for innovation governance. Innovation requires predictable pathways for interaction with the State. When procedures are clear and reviewable, experimentation is more likely to be perceived as bounded and legitimate, and responsive enforcement is more likely to be viewed as principled rather than discretionary. The institutional result is not the absence of conflict, but the relocation of conflict to structured administrative channels and the reduction of adversarial escalation. Over time, this can support a more productive equilibrium in which regulators learn while protecting public interests, and innovators engage while internalizing compliance expectations in a predictable and legitimate framework.

D. Risks and Limits of Experimental and Responsive Governance Without Procedural Integrity

The strongest promise of responsive regulation and experimental governance is also their main vulnerability. Both approaches depend on discretion exercised in proximity to markets, technical communities, and regulated actors. They seek to replace rigid ex ante prescription with adaptive oversight, negotiated pathways, and bounded experimentation. Yet the moment regulation becomes more flexible, more tailored, and more interactive, the legitimacy burden increases. In a constitutionalized administrative order, flexibility is not self-justifying. It must be converted into legality through procedures that constrain discretion, secure equality, and preserve public accountability.[28][29]

A first and decisive risk is opacity. Experimental programs are often defended as temporary and controlled, but without robust transparency

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(2017), at 405–10.

[28] Conrado Hübner Mendes, *Direitos Fundamentais, Separação de Poderes e Deliberação* (Ph.D. dissertation, Faculdade de Filosofia, Letras e Ciências Humanas, 2008), at 195–196, 200–202.

[29] Judith Stern & Stuart Holder, *Regulatory Governance: Criteria for Assessing the Performance of Regulatory Systems*, 8(1) Utilities Pol'y 33, 33–50 (1999), at 36–44.

and reason-giving duties they can function as governance by exception. This is not merely a reputational problem. Opacity weakens the epistemic basis of learning and undermines the capacity of external institutions to evaluate whether experimentation is proportionate to risk and consistent with public objectives. Governance-oriented criteria treat transparency, accountability, and predictability as core dimensions of regulatory performance for precisely this reason. They are the conditions under which the exercise of authority becomes intelligible and reviewable, rather than discretionary and insulated. In practice, opaque experimentation tends to produce two undesirable effects at once. It intensifies suspicion of favoritism, and it deteriorates the quality of the evidence produced, because what is not recorded, disclosed at an appropriate level, or justified cannot be scrutinized, compared, or generalized.[30]

A second risk is unequal treatment, sometimes described as the distributive asymmetry of experimental governance. Sandboxes and negotiated pathways necessarily select. They choose who enters a program, which obligations are relaxed or tailored, which risks are tolerated, and which performance outcomes count as success. In innovation ecosystems, such choices can shape market structure by creating compliance advantages, reputational benefits, and access to regulatory dialogue that are not equally available. This distributive dimension is not an accidental side effect. It is intrinsic to experimental tools. As a result, equality concerns cannot be addressed by good intentions or technical oversight alone. They require publicly articulable criteria for selection and termination, and reason-giving that can justify why differentiated treatment is warranted considering public objectives and risk profiles. When these constraints are absent, experimentation is likely to be challenged as arbitrariness. Even where it survives formal legality, it may lose social legitimacy and provoke defensive judicialization.[31]

A third risk is capture through proximity, or what can be called the "embeddedness dilemma." Innovation governance demands contact with markets, because relevant knowledge is distributed and technical uncertainty is persistent. Yet proximity can produce selective access, informational dependence, and subtle forms of alignment with the preferences of the most capable or well-resourced actors. State capacity

[30] Judith Stern & Stuart Holder, *Regulatory Governance: Criteria for Assessing the Performance of Regulatory Systems*, 8(1) Utilities Pol'y 33, 33–50 (1999), at 36–44. *See also* Jefferson L. C. Dalmoro, *Atuação Parlamentar e a Teoria da Regulação Responsiva na Regulação da IA no Brasil*, 11(2) Rev. Direito Setorial e Regulatório 1, 46–47 (out. 2025).

[31] Peter B. Evans, *Embedded Autonomy: States and Industrial Transformation* 61 (Princeton Univ. Press 1995), at 61; *see also* Peter Mascini, *Why Was the Enforcement Pyramid So Influential? And What Price Was Paid?*, 7 Reg. & Governance 48, 57–58 (2013).

accounts frame this as the need to balance embeddedness with autonomy. Effective governance requires deep engagement with economic and technical realities, but also institutional independence from particularistic interests. Proceduralization is one of the few tools capable of making this balance stable. It does so by transforming proximity into structured interaction, documented, contestable, and framed by criteria that limit discretionary drift.[32]

A fourth risk is the dilution of accountability through the rhetoric of innovation. Experimental governance is frequently presented as a learning strategy, but learning can be used as a permissive narrative that lowers the discipline of public power. In law and technology, this risk is acute because experimentation often implies real-world exposure of users, consumers, and data subjects. If monitoring duties, reporting obligations, and termination triggers are not treated as binding legal commitments, experimentation can normalize uncertainty while weakening the protective mandate of the State. This is the point at which a sandbox shifts from bounded learning to managerial informality. The doctrinal response is not to reject experimentation. It is to demand a clear account of responsibility: who defines acceptable risk, who monitors, who decides on escalation, and how and when programs end. Without these constraints, flexibility becomes hard to defend as legitimate public governance.[33]

These risks also interact with one another. Opacity amplifies inequality because selective access cannot be evaluated. Proximity without procedural constraints amplifies capture because decisions become difficult to audit. Weak accountability amplifies overdeterrence because regulators may respond to legitimacy challenges by reverting to sanction-first rigidity, which can generate chilling effects on experimentation and suppress socially valuable innovation. The institutional result is a cycle in which the failure to proceduralize flexibility produces backlash, litigation, and defensive regulation. In other words, the absence of procedural integrity can eliminate the very benefits that responsiveness and experimentation aim to secure.[34]

For this reason, proceduralization should be treated as the doctrinal condition that makes adaptive governance compatible with public law. It provides a language and a set of constraints that translate flexibility into

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[32] Douglas W. Arner, János Barberis & Ross P. Buckley, *FinTech, RegTech and the Reconceptualization of Financial Regulation*, 37(3) Nw. J. Int'l L. & Bus. 371, 371–413 (2017), at 405–13; *see also* Kenneth A. Bamberger & Deirdre K. Mulligan, *Privacy on the Ground: Driving Corporate Behavior in the United States and Europe* (MIT Press 2015), at 29–35.

[33] Carolina Moehlecke, *The Chilling Effect of International Investment Disputes: Limited Challenges to State Sovereignty*, 64(1) Int'l Stud. Q. 1, 1–12 (2020), at 1–5, 10–12.

[34] Conrado Hübner Mendes, *Direitos Fundamentais, Separação de Poderes e Deliberação* (Ph.D. dissertation, Faculdade de Filosofia, Letras e Ciências Humanas, 2008), at 209–210, 215–219.

legality. It also offers a method for distinguishing legitimate differentiation from arbitrary privilege. When admission, monitoring, escalation, and exit are framed by criteria that can be publicly defended, reviewed, and revised, experimentation becomes more than a temporary workaround. It becomes institution-building, capable of producing reasons, records, and standards that can be generalized responsibly. Deliberative accounts of institutional legitimacy reinforce this point by linking authority under disagreement to the capacity to offer reasons that are contestable and revisable. In that sense, proceduralization is not a formal add-on. It is the mechanism that prevents responsive and experimental governance from collapsing into either opaque discretion or punitive rigidity. It is also the most credible way to reconcile innovation as a legitimate policy objective with the State's continuing duty to protect rights and manage public risk.[35]

CONCLUSION

This article examined a recurrent governance problem in technology-intensive sectors: how to regulate and enforce under persistent uncertainty without defaulting either to punitive rigidity or to discretionary flexibility that erodes legality and trust. The diagnosis began with the limits of command-and-control enforcement in innovation settings. Where regulatory categories lag behind technological change, sanction-first postures tend to amplify adversarial dynamics, foster strategic concealment, and incentivize the migration of conflict to courts. The consequence is not merely higher litigation. It is a degradation of the informational basis of regulation and a tendency toward defensive regulatory behavior that can suppress socially valuable experimentation.

The analysis then turned to two prominent responses that have gained traction in contemporary law and technology governance. Responsive regulation reframes enforcement as an adaptive architecture rather than a sequence of isolated punitive acts, emphasizing escalation, proportionality, and differentiated treatment through an enforcement pyramid. Experimental governance, in turn, treats regulation as a learning process and relies on bounded arrangements such as regulatory sandboxes to generate evidence, reduce information asymmetries, and refine safeguards through supervised testing. These approaches share a pragmatic ambition: to preserve the State's protective mandate while creating institutional space for iterative adjustment and innovation.

The central contribution of the article is the claim that neither responsiveness nor experimentalism can deliver their promised benefits without proceduralization. The more regulation relies on discretion, proximity, and tailored pathways, the higher the legitimacy burden

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[35] Mariana Mazzucato, *O Estado Empreendedor: Desmascarando o Mito do Setor Público versus Setor Privado* (Portfolio-Penguin/Companhia das Letras 2014), at 1–30.

becomes. Flexibility is not self-justifying within public law. It must be converted into legality through procedures that constrain discretion, secure equality, and preserve accountability. This conclusion is not merely normative. It is also functional. Proceduralization improves the informational quality of regulatory interactions by creating incentives for disclosure and structured dialogue, and it stabilizes governance by making expectations more predictable and decisions more reviewable.

Two clarifications further refine this argument. First, the chilling effect should not be attributed solely to the fear of sanctions. In technology governance, uncertainty is also procedural. When regulated actors cannot anticipate how authorities will interpret emergent practices, which criteria will govern discretionary choices, or how and when decisions may be revised, expected legal exposure increases even absent formal enforcement. This procedural uncertainty can suppress experimentation and reduce the evidence base available for regulatory refinement, thereby linking legitimacy deficits to innovation outcomes. Second, proceduralization operates at two levels. At the micro level, it structures individual administrative choices, including admission and exit decisions in experimental programs, escalation steps in responsive enforcement, and negotiated commitments. At the macro level, it structures the translation of experimental learning and supervisory practice into general standards, shaping the pathway through which provisional arrangements become stable regulation under transparency and accountability duties.

The argument has concrete implications for the doctrinal evaluation of modern enforcement and experimental tools. In responsive governance, the availability of cooperative measures is normatively defensible only if paired with credible escalation and publicly intelligible triggers. The enforcement pyramid is not simply an efficiency device. It is a legitimacy device that disciplines coercion through sequencing and proportionality. In negotiated administration, consensuality cannot be equated with informality. Agreements require due process compatibility, reason-giving, and safety clauses capable of managing uncertainty while preserving enforceability. In experimental governance, sandboxes should not be treated as exceptions justified by innovation rhetoric. Their legitimacy depends on boundedness, transparency, and reviewable justification, because experimental programs inevitably distribute benefits and burdens and may influence market structure and innovation trajectories.

The article also emphasized that the risks of adaptive governance are not marginal. Without procedural integrity, responsive and experimental tools may collapse into the very pathologies they seek to remedy. Opacity undermines evidence production and external control. Unequal access and selective flexibility can erode equality and trigger perceptions of favoritism. Proximity without procedural constraints can intensify capture risks by creating informational dependence and privileged channels of influence. These vulnerabilities are particularly acute in technology-intensive sectors, where regulators must remain embedded enough to learn while preserving autonomy from particularistic interests. At the same time, weak accountability can encourage a backlash dynamic: litigation and legitimacy challenges may lead regulators to revert to defensive rigidity, reinforcing overdeterrence and chilling experimentation. Governance criteria that emphasize transparency, accountability, and predictability help clarify why these risks should be treated as structural rather than incidental.

A broader implication is that contemporary law and technology governance should be assessed not only by substantive outcomes, but also by process quality. When decision-making is procedurally robust, conflict is more likely to be managed within administrative channels through reasoned contestation and revision rather than displaced into generalized adversarial litigation. This does not eliminate disagreement. It changes its institutional form. It also improves the prospects that external reviewers will treat administrative expertise as an accountable outcome of structured reasoning rather than as discretionary will. In this sense, proceduralization is closely tied to review-resilience and to the institutional conditions of deference under uncertainty.

Finally, the article supports an agenda for further research that remains compatible with a dogmatic orientation. Future work can clarify how proceduralization interacts with equality in selective programs, including the criteria and justificatory burdens that should govern admission and termination. It can also examine how learning generated in experimental settings should be translated into general standards without undermining legal certainty, including the role of transparency, public reporting, and institutional accountability in the generalization of experimental outcomes. Another promising line concerns the procedural limits of experimentation, identifying cases in which bounded flexibility is normatively unacceptable due to critical or irreversible risks, thereby refining the relationship between innovation policy and fundamental rights protection.

In sum, the core claim of this article is that adaptive regulatory governance does not stand in tension with legality. Rather, legality becomes the condition of possibility for responsiveness and experimentation in complex technology domains. By framing adaptive tools within procedurally structured decision-making, regulators can preserve the State's protective mandate, sustain innovation as a legitimate policy objective, and strengthen the legitimacy and stability of administrative authority under uncertainty.

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