

The Achilles' Heel of Hydrological Commons Governance: Lessons from Mariana on Institutional Capture and Power Asymmetries

Abstract

The 2015 Fundão dam collapse in Mariana (Brazil) exposed a systemic Achilles' heel in the governance of hydrological commons. This paper argues that economic power asymmetries embedded in a mining-dependent regional political economy appear to bias regulatory mechanisms, reorienting them from instrumental problem-solving toward ceremonial validation of the status quo. Drawing on Original Institutional Economics and theory-testing process tracing, the study examines how corporate actors and specific state licensing agencies co-constructed a regulatory environment conducive to escalating risk. The analysis documents that (i) licensing conditionalities displaced precaution, (ii) basin-committee agendas excluded dam safety, and (iii) the Renova Foundation institutionalized cost-shifting, and it treats the Foundation not merely as a buffer, but as a mechanism for converting open-ended social liabilities into bounded and administratively programmable expenses. To counteract these pathologies, the paper proposes Institutional Scaffolding—design heuristics centered on epistemic independence and democratic auditability—while critically assessing failure modes.

Keywords: Institutional Capture; Hydrological Commons; Ceremonial Governance; Institutional Scaffolding; Social Costs.

JEL Codes: B52, Q58, D72, K32

1. Introduction

Across hydrological commons, the expansion of participatory governance bodies and formal licensing requirements has not reliably increased socio-ecological resilience. The catastrophic failure of the Fundão dam in Mariana, Minas Gerais (2015), illustrates this gap. Releasing approximately 43 million cubic meters of mine tailings (ALMG, 2016; though estimates vary across technical reports), the event destroyed communities and compromised a vital watershed. This revealed that regulatory oversight was ceremonial, validating the status quo through ritualistic compliance, rather than instrumental in solving material safety and livelihood problems, thereby reproducing existing power relations. Through the lens of Original Institutional Economics (OIE), technical deficits or budget constraints are not causes but symptoms of a deeper pathology: the asymmetric distribution of economic power allows dominant actors to define and enforce the system's "working rules" (Commons, 1934).

In the Rio Doce, the interaction between transnational mining capital and the Brazilian State created a path dependence that systematically favored extraction over ecological integrity.

Minas Gerais' reliance on large-scale mining is more than a sociological impression; it acts as a structural constraint unlike diversified regional economies; this dependence limits the political feasibility of precautionary enforcement. Mining dependence is operationalized through fiscal exposure, sectoral weight in regional output and employment, and pro-growth licensing frames.

Official documents and statistics capture these channels in CFEM fiscal salience, mining shares in value added/employment (ANM, 2020; IBGE, 2018), and planning frames that cast licensing as a “competitiveness bottleneck” (MME, 2011). In OIE terms, this dependence stabilizes extractivist habits of thought and weakens precautionary enforcement. The State was not a monolithic victim. Specific executive and regulatory agencies actively promoted this neo-extractivist mindset, notably the state environmental licensing apparatus (SEMAD/COPAM) and federal mining administration (DNPM, now ANM), in contrast to oversight bodies such as the Public Prosecutor's Office (MPF), creating an ideological convergence with private capital that normalized risk. Tracing specific regulatory decisions substantiates this argument, such as the granting of the 2013 Operating License despite known technical failures, and the establishment of the Renova Foundation as a liability-containment vehicle.

The analysis asks: How do power asymmetries convert participatory water governance into ceremonial oversight, and what counter-power architecture can prevent this drift? OIE anchors the explanation, complemented by a multidimensional power framework specifying the mechanisms through which economic power becomes regulatory and epistemic dominance. The paper models a causal sequence—structural asymmetry, ideological convergence, working-rule capture, and ceremonial governance—and evaluates design principles that can interrupt it.

2. Theoretical Framework: The Institutional Anatomy of Capture

To understand governance failure not as an accident but as an evolutionary outcome of economic power, we must synthesize OIE with a robust theory of power.

2.1. Ceremonial vs. Instrumental Functions

Building on Veblen (1899), Ayres (1962) and Bush (1987) frame institutions as a tension between instrumental functions (problem-solving) and ceremonial functions (status validation, hierarchy, and invidious distinction): a governance structure is instrumental if it effectively manages physical risks and ensures resource reproduction; it becomes ceremonial when its

procedures serve primarily to legitimize the position of dominant actors while failing to address substantive feedback from the physical environment.

In the context of hydrological commons, ceremonial dominance presents itself when regulatory agencies prioritize procedural licensing rituals over the substantive goal of safety. Vested interests drive this shift by systematically externalizing social costs onto communities and ecosystems when enabled by institutional control (Kapp, 1950).

2.2. The Heterogeneous State and Ideological Convergence

Traditional capture theory often portrays the regulator as a unified victim of external pressure. However, drawing on Karl Polanyi (1944) and the Latin American structuralist tradition (Furtado, 1974; Svampa, 2019), this paper treats the State as contested terrain and its heterogeneity presents itself in the contrast between developmentalist licensing bureaucracies, which frequently prioritize acceleration, and oversight bodies such as the Federal Public Prosecutor's Office (MPF), which orient their mandates toward protection. This convergence appears in official planning documents casting regulation as a development constraint and mining as a national priority (MME, 2011). This reduces capture costs: regulators need no coercion to disregard risks already viewed as bureaucratic hurdles.

2.3. Working Rules and Power Dimensions

John R. Commons (1934) distinguishes between formal laws (*de jure*) and the working rules that govern transactions (*de facto*). Capture is the process by which vested interests alter these working rules to their benefit. Capture is operationalized via a synthetic, multidimensional power framework consistent with Steven Lukes' (2005) stratified conception:

- a) Direct Power (Dahl, 1957): Lobbying and the “revolving door,” creating a shared cultural environment.
- b) Agenda Exclusion (Bachrach & Baratz): The power of “non-decision making,” effectively keeping critical issues (e.g., dam safety risks) off the table in deliberative bodies like River Basin Committees.
- c) Epistemic Power (Lukes/Foucault): operates through an epistemic monopoly¹: control over evidence narrows the feasible set of regulatory action. Foucault is mobilized heuristically rather than as a full genealogical framework under which evidence control becomes policy control.

¹ Epistemic monopoly is coded when decision files rely predominantly on proponent-commissioned studies and lack independent technical assessments.

3. Methodological Note: Process Tracing

The study uses theory-testing process tracing to assess the hypothesis of Ideological Convergence and Working-Rule Capture in the trajectory of the Fundão dam failure (2005–2015) and in the subsequent damage reparation process (George & Bennett, 2005; Collier, 2011; Young, 2002).

The analysis of data sources relies on: (1) Legislative Inquiry Reports, specifically the 2016 Report of the Parliamentary Commission of Inquiry by the Minas Gerais Legislative Assembly - ALMG; (2) Regulatory Documents from SEMAD/DNPM (now Agência Nacional de Mineração - ANM) with licensing records spanning from 2007 to 2015; (3) Official Government Plans (MME, 2011; PNM, 2030); (4) sectoral and regional statistics (ANM 2020; IBGE, 2018); and (5) Meeting minutes records and agendas retrieved directly from the CBH-Doce digital repository (CBH-Doce, 2013, 2014, 2015).

Inferential Logic and Bias Mitigation:

The incompetence hypothesis implies that regulators distribute errors randomly or act on apparent data gaps. While incompetence may coexist, the empirical pattern indicates directional bias consistent with capture. In contrast, the capture hypothesis predicts systematic deviations toward cost-cutting and licensing acceleration, favoring production over safety despite risk data. The diagnosis captures this bias of co-occurrence with direct interactional mechanisms, distinguishing it from mere ideological drift.

The Mariana case evidence indicates that the capture hypothesis holds, with the explicit acknowledgment of drainage and stability failure risks in internal technical correspondence, referenced in ALMG (2016) acting as a smoking-gun type indicator of prior risk awareness, consistent with the capture hypothesis (Collier, 2011).

4. The Mariana Case: Mechanisms of Ceremonial Dominance

The collapse of the Fundão dam serves as a paradigmatic case of ceremonial governance driven by economic power and state complicity. The Rio Doce basin, ostensibly governed by a decentralized and participatory committee system (Brazil's National Water Resources Policy Law, Law No. 9,433/1997), was in practice ruled by the economic gravity of the mining consortium (Samarco, controlled by Vale and BHP).

4.1. Ex Ante: Normalization of Deviance and Ideological Convergence

A symbiotic relationship between the mining sector and state planners laid the groundwork for the disaster. The National Mining Plan 2030 offers explicit evidence of ideological

convergence, in which the Ministry of Mines and Energy portrays strict environmental licensing not as a safeguard but as a “bottleneck to competitiveness” (MME, 2011, p. 23) and explicitly calls for the “modernization” of regulations to accelerate project approvals.

Regulators translated this convergence into the concrete “working rules” governing the licensing of the Fundão dam. Although formal environmental norms (*Deliberação Normativa COPAM 74/2004*) require demonstrable stability guarantees for license renewal, the 2013 Operating License process (SEMAD Process nº 0047/1999/006/2013) indicates institutional drift. According to *Parecer Único* No. 047/2013 issued by the state environmental agency (SEMAD, 2013), technical staff highlighted critical anomalies, identifying failures that would typically lead to the suspension of operations; however, regulators chose to rely on conditional clauses to reconcile regulatory demands with ongoing operations.

Authorities granted the license subject to conditions (e.g., Condition 16) requiring ex-post stability studies while permitting continued deposition. This converted the precautionary principle into an “ex post conditionalization” logic, shifting the operative rule to “operate now, mitigate later.” Overlooking the risks in the process, regulators structurally aligned with the economic imperatives of production continuity via ceremonial validation.

4.2. Agenda Exclusion in the Basin Committee

The governance failure extended to the Doce River Basin Committee (CBH-Doce), designed as a “parliament of waters.” While theoretically a venue for multi-stakeholder deliberation, in practice, it suffered from severe agenda exclusion (Bachrach & Baratz, 1962).

An analysis of the Committee’s dynamics shows that committee members systematically sidelined structural safety issues related to tailings dams. In the CBH-Doce plenary meetings held on December 5, 2013 (CBH-Doce, 2013) and December 5, 2014 (CBH-Doce, 2014), participants focused the agendas on the implementation of water charging and administrative allocation, while they excluded any items addressing tailings-dam safety or rupture scenarios. The omission persisted through subsequent agendas. The working rule established was clear: dam safety is treated as ‘out-of-scope’ for the basin parliament, effectively deactivating participatory oversight. When civil society representatives attempted to question mining impacts, corporate proponents utilized epistemic power, presenting voluminous technical dossiers that created an insurmountable information asymmetry. Without independent technical support, the Committee could not exercise its oversight function, reducing participation to a ceremonial ritual.

4.3. Ex Post: Buffer Institutions and the Privatization of Remedy

The capture extended disastrously into the ex-post governance of reparation. Instead of state-led remediation, the settlement agreement (TTAC) created the Renova Foundation, a private entity funded and governed by the polluters, as established in the Transaction and Conduct Adjustment Agreement (TTAC, 2016). This architecture exemplifies the concept of Buffer Institutions.

Functioning as a Kappian cost-shifting mechanism, the Foundation converted the companies' open-ended liability into bounded, administratively programmable expenses via a budget-constrained governance structure.

Renova's administrative practices produced attrition with the victims, thereby revealing the institution's buffer function. The *Cadastro Integrado* (Integrated Registry) applied a burden of proof that conflicted with local realities. As a result, administrators frequently rejected or reclassified the claims of informal artisanal fishermen—who lack formal tax returns or professional licenses—as cases of “insufficient documentary evidence,” even though local communities widely recognized these livelihoods as common knowledge within the territory (Zhouri, 2018). The institution functioned as a welfare-like interface under a claim-minimization logic, while operating analogously to a private insurance mechanism. Functionally, this insulated parent companies from liability volatility. This dynamic exemplifies institutional drift: decision-makers transformed the reparation mechanism into a barrier and shifted the burden of proof and the social costs of administrative compliance onto the most vulnerable to shield corporate capital.

Table 1:
Mechanisms of Power and Institutional Manifestations

Power Mechanism	Theoretical Basis	Manifestation in Mariana (Evidence)	Institutional Consequence
Ideological Convergence	Habits of Thought (Veblen)	Official plans (MME 2011) treating regulation as a "bottleneck" (<i>gargalo</i>).	State Complicity: Regulator aligns with the regulated.
Epistemic Monopoly	Power/Knowledge (Foucault)	Near-exclusive reliance on corporate reports + no counter-study (as coded).	Epistemic Closure: Complexity used to silence dissent.
Agenda Exclusion	Bachrach & Baratz	Safety risks absent mainly from 2013–2015 Basin Committee agendas.	Ceremonial Oversight: Rituals without force.
Cost-Shifting	Social Costs (Kapp)	Renova Foundation converting liability into an administrative procedure.	Privatization of Remedy: Liability containment.

Source: Author's elaboration.

5. Toward Instrumental Governance: Institutional Scaffolding

Since participation alone cannot reverse ceremonial drift, we propose Institutional Scaffolding (Table 2): design heuristics to disrupt key links in the capture sequence.

Table 2:

The Framework of Institutional Scaffolding

Principle	Instrumental Function (Target)	Operational Mechanism	Failure Mode & Mitigation Strategy
1. Epistemic Independence	Breaks Epistemic Monopoly: Separates risk knowledge production from proponent control to prevent "working-rule" capture via technical dominance.	Creation of Independent Technical Advisory Bodies (ATIs) funded through user levies but accountable to communities; provides counter-expertise to scrutinize licensing files.	Risk: Dominant actors may attempt to co-opt experts via funding pressures.
2. Binding Deliberative Parity	Reconfigures Veto Points: Shifts participation from a ceremonial consultative ritual to structured bargaining with actual decision rights.	Parity & Qualified Veto: River Basin Committees are empowered with binding influence and suspensive veto power over high-impact projects.	Risk: Judicialization/Lawfare by firms. Mitigation: Clear statutory thresholds for veto use and expedited judicial review protocols.
3. Democratically Auditable Enforcement	Makes Monitoring Non-Ceremonial: Prevents the manipulation or hiding of safety data, ensuring triggers are automatic and objective.	Democratically Auditable Triggers: Real-time public access to telemetry; open-source trigger logic; independent custody of monitoring infrastructure.	Risk: Data overload or technical gatekeeping. Mitigation: Standardized data formats and minimal, verifiable trigger criteria.
4. Multiscalar Integration	Constrains Forum Shopping: Limits	Unified Accountability Chain: Binding	Risk: Inter-agency deadlock. Mitigation: Pre-defined

regulatory arbitrage where actors exploit gaps between federal, state, and local jurisdictions.	coordination rules linking federal mineral regulation, state licensing, and basin oversight.	precedence rules and time- bound coordination protocols.
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Source: Author's elaboration.

The Paradox of Reform and Failure Modes

Institutional Scaffolding faces predictable failure modes. First, dominant actors may co-opt counter-experts if agencies control funding. Mitigation requires funding through escrow mechanisms independent of the political budget cycle.

Corporations also generate a second failure mode by inducing institutional fatigue through lawfare. When institutions enforce binding deliberative parity, firms may judicialize the process and stall committee decisions in court for years. This dynamic indicates that institutional scaffolding must operate alongside judicial reforms that prioritize the precautionary suspension of operations during litigation, thereby reversing the incentive to delay. Without these safeguards, asymmetric economic power relentlessly pushes even well-designed institutions back toward ceremonialism.

6. Conclusion

The collapse of the Fundão dam was not an accident; it was the institutionally consistent outcome given prevailing incentive structures that evolved under incentives prioritizing accumulation over safety, rendered brittle by the weight of unchecked economic power. By analyzing this tragedy through the lens of Original Institutional Economics, this paper exposes the ceremonial nature of current hydrological governance. The Achilles' heel is not technical incompetence, but the vulnerability of decision-making to capture by those with the economic and symbolic capital to define reality.

This article advances institutional theory by moving beyond the binary of state vs. market. It reveals how segments of the State, aligned with neo-extractivist habits of thought (MME 2011), actively co-construct the conditions for disaster. Overcoming this requires a departure from the naive belief that participation alone yields equity. True sustainability demands Institutional Scaffolding: counter-power architecture combining independent knowledge and democratically auditable enforcement. Without structural change, reforms remain ceremonial rituals of regret.

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