

Institutional Dysfunction and Governance Reform in Madagascar's Integrated Water Resources Management: A SWOT Diagnostic and Restructuring Pathways for ANDEA

Andrianasolomahefa Rovatiana Salema ^{1*}

¹ Faculty of Public Governance and International Studies, Doctoral School of Public Administration,
National University of Public Service, Budapest, Hungary

<https://orcid.org/0009-0004-7726-8811>

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Abstract

Despite possessing one of Africa's most comprehensive legal frameworks for Integrated Water Resources Management (IWRM), Madagascar's Autorité Nationale de l'Eau et de l'Assainissement (ANDEA) has remained largely non-functional since its establishment in 2004. Drawing on primary legislative texts (the Code de l'Eau and its 13 implementing decrees), institutional evaluations, regulatory decrees, administrative tribunal rulings, semi-structured interviews with 22 water sector stakeholders conducted in 2019, and direct field observations at key basin sites, this paper presents a multi-domain SWOT diagnostic of ANDEA's governance failure, identifying four compounding dysfunctions: (1) unresolved institutional tutelage spanning the Primature and Ministry of Water; (2) judicial nullification of water-use levies since 2011, paralyzing the National Water Resources Fund (FNRE); (3) a critical human resource deficit (12 staff vs. 27 required); and (4) dormancy of all six decentralized Basin Agencies and their Basin Committees. Building on this diagnosis, a sequenced, three-horizon reform pathway is advanced addressing financial restructuring, legal clarification, organizational capacity, decentralization activation, inter-ministerial coordination, and monitoring infrastructure. The findings enrich the literature on IWRM governance failure in Sub-Saharan Africa and offer transferable lessons for national water authorities operating in fragile institutional environments.

1 Introduction

Access to safe water and adequate sanitation remains among sub-Saharan Africa's most acute development challenges, where institutional governance deficits routinely undermine well-designed legal frameworks before they yield operational outcomes [5, 19]. Madagascar offers a particularly instructive case: a country with substantial freshwater resources over 337 billion m³ per year, one of Africa's highest per-capita endowments yet structurally unable to translate a sophisticated legal architecture into functional water governance outcomes. As a small island developing state (SIDS), Madagascar also exemplifies the heightened institutional vulnerabilities characteristic of small, aid-dependent economies in which governance reforms are routinely

* Corresponding author.

E-mail address: andrianasolomahefa.rovatiana.salema@stud.uni-nke.hu

disrupted by political instability and fiscal constraints, making its experience highly relevant to a broader class of fragile-state water governance contexts.

At the center of this paradox stands the Autorité Nationale de l'Eau et de l'Assainissement (ANDEA), established through the Code de l'Eau (Law No. 98-029, 1999) and operationalized via Decree No. 2003/192. ANDEA holds an exceptionally broad mandate: guarantor of IWRM, coordinator of water use across agriculture, energy, industry and urban supply, and sole administrator of the National Water Resources Fund (FNRE). Since its physical establishment in 2004, however, the authority has been unable to fulfil these functions in any consistent, sector-wide manner. A cascade of compounding dysfunctions institutional ambiguity, financial paralysis, human resource shortfalls, non-functional territorial structures, and political instability has kept ANDEA in a state of protracted operational fragility for over two decades.

This paper makes three distinct contributions. First, it provides the most comprehensive diagnostic of ANDEA's institutional failure to date, addressing a gap in the comparative water governance literature [7, 17]. Second, it applies a structured multi-domain SWOT framework adapted for public-sector institutional analysis following Bryson [2] and Helms & Nixon [6] to a complex case of overlapping governance failures in a small island developing state (SIDS). Third, it advances a sequenced, practically grounded reform pathway, contributing to the practitioner-facing strand of water governance scholarship. The paper is structured as follows: Section 2 reviews the IWRM governance literature; Section 3 presents the context and legal framework; Section 4 details the methodology; Section 5 reports the SWOT findings; Section 6 proposes reform pathways; Section 7 provides comparative discussion and theoretical implications; Section 8 concludes.

This paper is organized around two guiding research questions. First: what explains the persistent institutional non-functionality of ANDEA in Madagascar despite a legally sophisticated IWRM framework that is among the most comprehensive in Sub-Saharan Africa? Second: what sequenced reform pathways are institutionally feasible for addressing the compounding dysfunctions affecting ANDEA and IWRM governance in Madagascar? These questions situate the analysis within the broader literature on institutional mismatch and governance failure in fragile institutional environments while generating analytically transferable insights beyond the Malagasy case.

2 Literature Review

2.1 IWRM: Promise and Implementation Gap

The IWRM paradigm, crystallized through the 1992 Dublin Principles and Rio Earth Summit, provides a globally endorsed framework for reconciling competing water uses potable supply, irrigation, hydropower, industry, environment within a single governance architecture [4]. The paradigm rests on four foundational principles: water as a finite and vulnerable resource; participatory multi-stakeholder governance; recognition of women's central role; and water's economic value as the basis for levy-financed management. These principles have been institutionally embedded through successive multilateral commitments, from Johannesburg (2002) to the Sustainable Development Goals (SDG 6, 2015).

Despite this normative consensus, IWRM implementation has proven persistently difficult across low- and middle-income countries. Biswas [1] argues that IWRM is conceptually elegant but operationally vague, frequently adopted at the legislative level without the institutional infrastructure required for execution. Merrey et al. [10] document how Basin Management Organizations the institutional cornerstone of IWRM decentralization are routinely under-resourced and politically marginalized across Sub-Saharan Africa. Jeffrey & Gearey [8] identify a systematic 'rhetoric-reality gap' in IWRM adoption, where national water authorities are established as symbolic commitments to international norms rather than as genuinely functional governance bodies.

The financing of water governance institutions presents a particular vulnerability. Rogers et al. [15] demonstrate that the polluter-pays and user-pays principles embedded in IWRM logic presuppose levy-collection systems that are both legally robust and administratively operational. Where these conditions are absent as documented in Ghana [3], Mozambique [18], and Tanzania [9] water authorities become entirely dependent on ministerial transfer budgets, generating the political subordination that systematically undermines IWRM's required operational independence.

2.2 Governance Failure in Sub-Saharan Africa

The literature on African water governance consistently identifies an 'institutional mismatch' [17]: the structural gap between IWRM's administrative requirements and the actual capacities of resource-constrained national agencies. This mismatch manifests across multiple dimensions: human capital deficits, inadequate financing, jurisdictional overlaps, weak enforcement capacity, and the absence of politically insulated technical management. Ioris [7] links these failures to inherent tensions between IWRM's market-based instruments and the redistributive priorities of post-colonial states, where water-use levies are contested as instruments of economic exclusion by both private operators and smallholder communities.

Saleth & Dinar [16] propose a three-dimensional framework for diagnosing water governance performance: water law, water policy, and water administration that closely parallels the multi-domain approach adopted here. Their comparative analysis of 14 countries demonstrates that institutional performance is most strongly constrained by the administrative dimension, particularly the financial and human resource endowments of national water authorities. This finding directly contextualizes ANDEA's operational fragility within broader structural patterns of African water governance failure.

2.3 Madagascar's IWRM Framework in Regional Context

Madagascar's water governance architecture has received limited analytical attention in international scholarship. Grey literature from UNDP's 2008 evaluation of the PAISEA project constitutes the most substantive prior assessment, identifying misaligned Basin Agency boundaries and insufficient decentralization resources as systemic design flaws. Regional comparisons are informative: Kenya's Water Resources Authority (successor to WRMA), Ghana's Water Resources Commission, and Tanzania's Basin Water Boards each illustrate similar patterns of strong legislative frameworks combined with implementation deficits attributable to financing shortfalls, tutelage conflicts, and territorial structure dormancy [9, 3]. Madagascar's case thus represents an instance of a regional governance failure pattern rather than an exceptional case, strengthening the generalizability of the reform pathways proposed.

3 Institutional Context

3.1 Legal Architecture

Madagascar's IWRM framework rests on the Code de l'Eau (Law No. 98-029, 27 January 1999), supplemented by 13 implementing decrees. Key instruments include: Basin Agency creation (Decree 2003/191); ANDEA's statute (Decree 2003/192); tariff regulation (2003/791); water-use levies (2003/792); abstraction permitting (2003/793); discharge controls (2003/943); and the FNRE management framework (Decree 2008/397). Sectoral legislation governing agriculture (Law 90-016), mining (Law 99-022), energy (Law 98-032), environment (Law 90-033), and decentralization (Law 94-007) creates a complex web of overlapping attributions across six ministries.

3.2 ANDEA: Mandate and Governance Structure

ANDEA is constituted as a public administrative body (Etablissement Public à caractère Administratif, EPA) with legal personality and financial autonomy, governed by a Board of Directors (CA) and a Director-General supported by three directorates: (i) Planning, Water Resource Evaluation, Information and Communication (DREIC); (ii) Regulation and Water Resource Protection (DRPE); and (iii) Administrative and Financial Affairs (DAF). Territorially, it operates through six

Basin Agencies, each supported by Basin Committees representing communes, water users' associations (AUE), and state services. In practice, both tiers remained dormant throughout the study period (2004–2018).

A critical institutional tension shapes ANDEA's environment: Article 77 of the Code de l'Eau places the authority under joint tutelage of the Prime Minister's Cabinet and the Ministry of Economy and Finance. The partial delegation to the Ministry of Water (established July 2008) was effected by *arrêté* rather than by legislative amendment, generating persistent ambiguity that has left ANDEA without functioning technical supervision.

3.3 The FNRE: Design and Paralysis

The FNRE (Decree 2008/397) is designed to self-finance ANDEA and Basin Agency operations through three levy components applied to water abstractors: a domain levy (based on infrastructure asset values); a proportional levy (45 Ar/m³ for water supply; 10 Ar/m³ for other uses); and a participation levy (representing the user's share of mobilization costs). In 2011, the Administrative Tribunal annulled *Arrêté* No. 16.284/2008 the ministerial order setting levy rates on three procedural grounds: absence of publication in the *Journal Officiel*; incorrect ministerial signature (Primature rather than joint Water/Finance order); and lack of annual finance law authorization. Levy collection has been suspended since, reducing ANDEA to dependence on episodic ministerial transfer credits. A corrected draft decree, fully approved by all relevant ministries, was prepared in 2014 but remained ungazetted at the time of this study.

4 Methodology

The study employs a qualitative institutional analysis design. The primary data corpus comprises: national legislative texts and implementing decrees; institutional statutes governing ANDEA, Basin Agencies and the FNRE; administrative tribunal judgments; national planning documents (PEM, PSNA, MAP); UNDP evaluation reports (2008); and ANDEA internal staffing data (2018). Secondary sources include comparative assessments of water authorities in Kenya, Ghana, Tanzania and Mozambique, enabling analytical triangulation.

The analytical framework is a multi-domain SWOT analysis adapted for public-sector institutional diagnostics following Bryson [2], applied across five domains: (i) legal-regulatory; (ii) financial; (iii) organizational-human resource; (iv) inter-institutional; and (v) technical-environmental. This multi-domain approach is consistent with Saleth & Dinar [16] three-dimensional water governance performance framework and enables identification of cross-cutting dysfunction patterns not visible in single-dimension analyses. Data triangulation was achieved by cross-referencing documentary evidence with semi-structured interviews with water sector stakeholders and direct field observations conducted under a professional research design. Full methodological details are provided in the sub-sections below.

Primary Document Corpus and Selection Criteria: Documents were selected according to three criteria: legal relevance (instruments directly constituting or governing ANDEA and the FNRE); institutional authority (judgments, evaluations, and planning documents with formal standing in Madagascar's public administration); and temporal coverage of the study period (2004–2018). Instruments excluded include purely sectoral laws (agriculture, mining) where ANDEA's attributions are marginal, and post-2018 administrative circulars that fall outside the analytical scope. The 2004–2018 period was chosen because it spans ANDEA's operational lifecycle from physical establishment to the most recent systematic data point available (ANDEA internal staffing data, 2018); post-2018 institutional developments were constrained by data availability at the time of fieldwork.

Interview Component: Semi-structured interviews were conducted with 22 stakeholders during fieldwork carried out in 2019. Interviewees were drawn from five categories: (i) ANDEA officials and former directors-general (n=5); (ii) staff from the Ministries of Water and Finance responsible for ANDEA's supervisory relationship (n=4); (iii) representatives of water users' associations (AUE) and commune-level water service managers (n=6); (iv) staff from international development partners with direct programme experience in Madagascar's water sector (UNDP, AFD; n=4); and (v) administrative law specialists with knowledge of the 2011 tribunal proceedings (n=3). Interviewees were identified through purposive sampling aimed at coverage of all institutional positions relevant to ANDEA's dysfunction. Interviews were conducted in French, lasted between 45 and 90 minutes, were audio-recorded with informed consent, and subsequently transcribed. Analysis followed an inductive thematic coding approach: transcripts were coded against the five SWOT domains using NVivo, with emergent themes cross-checked against documentary evidence to ensure analytical triangulation. Illustrative quotations are integrated in the SWOT findings where they corroborate or extend the documentary record.

Field Observations: Direct field observations were conducted at three sites during the 2019 fieldwork: (i) the Betsiboka basin zone (northern Madagascar), selected because the corresponding Basin Agency had been provisionally activated under the PAISEA project and subsequently reverted to dormancy; (ii) ANDEA's central offices in Antananarivo, to observe operational capacity and infrastructure; and (iii) the Analamanga Region's irrigation administration, where SRI agriculture and AUE structures create potential co-governance arrangements. Observations were conducted over a cumulative 14 field days, recorded as structured field notes organized by the five analytical domains, and cross-referenced with interview data and documentary evidence. Key observational findings beyond what the documentary record captures include: the near-total absence of operational monitoring equipment at basin level; the reliance of ANDEA staff on personal computers for all data management in the absence of networked infrastructure; and the functional disconnect between commune water officers and ANDEA's permitting functions.

Ethical Considerations: The research was conducted under institutional affiliation with the National University of Public Service (Budapest) and in compliance with applicable research ethics norms. Informed consent was obtained from all interview participants, who were assured of anonymity in publication. No sensitive personal data were collected. Interview quotations are attributed by institutional category rather than name to preserve confidentiality. The fieldwork was facilitated by a formal research agreement with Madagascar's Ministry of Water.

5 SWOT Diagnostic Results

Table 1 presents the full multi-domain SWOT matrix. Key analytical findings are synthesized below. The interdependencies among the four compounding dysfunctions are described in the conceptual framework note following the table.

Table 1. Multi-domain SWOT diagnostic matrix for ANDEA (2004–2018)

STRENGTHS (Internal)	WEAKNESSES (Internal)
– Comprehensive legal mandate: Code de l'Eau (Law 98-029, 1999) + 13 implementing decrees – Transversal IWRM authority over all water-using sectors (agriculture, energy, industry, mining) – Three-tier governance architecture: ANDEA → 6 Basin Agencies → Basin Committees – FNRE self-financing mechanism grounded in polluter/user/modifier-pays principles – Track record of UNDP and international donor engagement (PAISEA project, 2004–2007) – Residual permitting function maintains institutional presence and user data	– Levy collection suspended since 2011 by Administrative Tribunal (Arrêté 16.284/2008 annulled) – 12 staff in 2018 vs. minimum operational requirement of 27 (55% deficit) – Dual tutelage ambiguity: Primature vs. Ministry of Water unresolved since 2008 – Basin Agencies and Basin Committees dormant throughout operational period – No dedicated sanitation legal framework; overlapping ministerial attributions – CA instability: 16 members replaced wholesale at each governmental reshuffle
OPPORTUNITIES (External)	THREATS (External)
– PEM commitment to universal water access and IWRM implementation by 2023 – Decentralization framework assigns Communes/Regions as water service masters-of-ouvrage – International climate finance (GCF, GEF, AFD, USAID) available for water governance – Analamanga Region: SRI adoption and AUE structures create IWRM co-governance base – Indian Ocean Commission (COI/IOC) frameworks for regional water cooperation – Draft levy decree fully approved by all ministries — awaiting gazette since 2014	– Recurrent political instability: ministerial reshuffles destroy institutional continuity – Judicial precedent: tribunal nullification creates ongoing vulnerability for revenue instruments – Fragmented inter-ministerial coordination; 6+ ministries with overlapping water attributions – Accelerating watershed degradation: tavy, deforestation, industrial pollution, urban runoff – Climate-driven extremes: cyclones, drought and flood frequency increasing (BNGRC data) – Low polluter-pays compliance culture; private sector resistance to FNRE levies

5.1 Strengths: A Well-Designed but Inactivated Architecture

ANDEA's principal institutional asset is its legally grounded, internationally aligned mandate. The *Code de l'Eau* and its 13 implementing decrees provide a technically sophisticated regulatory architecture covering water allocation, pollution control, permit management, and service delivery regulation one of the most comprehensive in Sub-Saharan Africa. Several instruments remain operative and actively applied by sector actors, including environmental regulations, urban flood-protection legislation (Law 95-034), and the PSNA (Decree 2008/319). The FNRE mechanism, if operationalized, would provide a diversified, levy-based financing stream enabling financial independence from ministerial budgets. ANDEA's three-tier governance chain (authority → agencies → committees) constitutes a structurally sound template for participatory IWRM that requires activation rather than redesign.

5.2 Weaknesses: Four Compounding Dysfunctions

Financial paralysis is the single most disabling weakness. The 2011 tribunal ruling has maintained a de facto financial blockade for over a decade, reducing ANDEA to dependence on ad hoc transfer credits insufficient to cover basic operational costs. External financing from partners, supplementary during 2004–2013, was suspended following the authority's operational stagnation. Human resource deficits compound this: 12 staff against a minimum requirement of 27, with critical gaps in regulatory, planning, and technical supervision capacities. The CA's 16-member composition generates substantial indemnity costs relative to the budget, and its wholesale replacement at every governmental reshuffle eliminates institutional memory and policy continuity. Institutional tutelage ambiguity the unresolved Article 77 conflict has left ANDEA without a functioning supervisory relationship, isolating it from the inter-ministerial coordination that IWRM mandates require. Finally, the dormancy of all six Basin Agencies and all Basin Committees removes the territorial implementation infrastructure through which IWRM's participatory and hydrographic governance principles operate. These four dysfunctions are mutually reinforcing: financial paralysis prevents recruitment; human resource deficits prevent territorial activation; tutelage ambiguity prevents the inter-ministerial coordination needed to resolve the financial blockade.

5.3 Opportunities: Enabling Conditions for Reform

A convergent set of external enabling conditions favors reform. Madagascar's *Plan pour l'Émergence* (PEM) commits explicitly to universal water access and IWRM promotion, providing national policy legitimacy for ANDEA's revitalization. The decentralization framework assigns Communes and Regions as co-governance actors for water and sanitation services, creating a legal basis for participatory watershed governance. The Analamanga Region's documented adoption of SRI agriculture and AUE structures provides an existing institutional platform for Basin Committee reconstitution. International climate finance mechanisms (GCF, GEF, AFD, USAID) and regional cooperation frameworks (IOC) represent tangible resource mobilization opportunities. Critically, the draft levy decree fully approved ministerial since 2014 represents a 'shovel-ready' financial reform requiring only political will for gazette publication.

5.4 Threats: Structural and Environmental Vulnerabilities

Threats operate at three reinforcing scales. Politically, recurrent governmental instability generates high ministerial and CA turnover that systematically destroys institutional memory and disrupts multi-year reform programs the most persistent structural threat to any sustained ANDEA revitalization. Legally, the 2011 tribunal precedent creates ongoing vulnerability for future levy instruments, requiring procedural rigor in any successor regulatory instrument. Environmentally, accelerating watershed degradation driven by *tavy* agriculture, deforestation, urban pollution, and intensifying climate-related flooding and drought cycles documented by BNGRC (Madagascar's national disaster management authority) imposes growing management demands on an authority structurally incapable of responding, creating a widening gap between sectoral needs and institutional capacity.

6 Reform Pathways

The diagnostic findings reveal a systemic rather than episodic governance failure driven by compounding interactions across four dimensions. An effective reform strategy must therefore be multi-level, sequenced by institutional prerequisites, and internally coherent. Table 2 presents the proposed reform pathways by domain and horizon.

Table 2. Sequenced reform pathways for ANDEA restructuring and revitalization

Domain	Recommended Action	Horizon
Financial	Gazette joint ministerial levy decree (Ministries of Water + Finance); establish autonomous FNRE management body; authorize levies through annual finance law	Short-term 0–2 yrs
Legal	Amend Decree 2003/192 to codify Ministry of Water tutelage; adopt dedicated sanitation statute; publish inter-ministerial attribution matrix	Short-term 0–2 yrs
Organizational	Recruit 15 staff (5 service chiefs, 8 technicians, 2 secretaries); reform CA to 12 staggered fixed-term members; revise indemnity schedule	Short-term 0–2 yrs
Decentralization	Redefine Basin Agency boundaries by hydrographic basins (UNDP 2008); activate 6 Agencies with FNRE sub-accounts; reconstitute Basin Committees with multi-stakeholder representation	Medium-term 2–5 yrs
Coordination	Establish inter-ministerial IWRM steering committee (co-chaired: Ministry of Water + ANDEA DG); mandate quarterly arbitration of attribution conflicts	Medium-term 2–5 yrs
M&E / Information	Deploy national water information system for real-time withdrawal/discharge/quality monitoring; institutionalize biennial sector diagnostic assessments	Long-term 5+ yrs

6.1 Short-Term (0–2 Years): Unblocking the System

The immediate priority is restoring ANDEA's financial autonomy through the gazette publication of a legally compliant levy decree. Addressing each flaw identified in the 2011 tribunal ruling, the new instrument must be: (i) jointly signed by the Ministries of Water and Finance; (ii) published in the *Journal Officiel*; and (iii) authorized by the annual finance law. Simultaneously, an autonomous FNRE management body governed by a multi-stakeholder board representing water users across all sectors should be established to insulate water resource financing from direct ministerial budget dependency, consistent with regional best practices (Kenya's Water Towers Agency; Ghana's Water Resources Commission). Decree 2003/192 must be amended to codify ANDEA's effective tutelage under the Ministry of Water and define mandatory coordination relationships with each sector ministry through a formal attribution matrix, eliminating the legal ambiguity that has isolated ANDEA operationally. ANDEA's staffing must reach minimum capacity through targeted recruitment of five service chiefs, eight technical officers, and two administrative secretaries. The CA should be reformed to twelve members with staggered four-year appointments, insulating institutional continuity from electoral cycles.

6.2 Medium-Term (2–5 Years): Activating Territorial Governance

Following the UNDP 2008 evaluation's key recommendation, Basin Agency boundaries must be redefined according to hydrographic rather than administrative criteria, enabling territorial governance to align with ecological watershed realities rather than political administrative units. Six Basin Agencies should be progressively activated with dedicated FNRE sub-account budgets sufficient to fund permanent technical staff, monitoring activities, and Basin Committee support. Basin Committees should be reconstituted with proportional representation from Communes (50%),

water users' associations and riparian owners (25%), and state services (25%), consistent with the *Code de l'Eau's* Article 76 specifications. An inter-ministerial IWRM steering committee co-chaired by the Minister of Water and ANDEA's Director-General, with quarterly mandatory sessions should be established to arbitrate attribution conflicts among the Ministries of Water, Agriculture, Environment, Finance, Territorial Planning, and Mining.

6.3 Long-Term (5+ Years): Information and Adaptive Management

Long-term institutional sustainability requires a national water information system integrating real-time monitoring of water withdrawals, discharges, and watershed quality parameters across all six basin zones. This system provides the evidentiary basis for adaptive water allocation, polluter-pays enforcement, and climate-resilient watershed management under the increasingly extreme hydrological conditions documented in Madagascar's BNGRC cyclone and drought records. Biennial sector diagnostic assessments structured around the SWOT framework developed here should be institutionalized as a standard governance practice, enabling early identification of emerging dysfunctions and adaptive correction of reform trajectories.

7 Discussion

ANDEA's experience confirms and deepens the 'institutional mismatch' pattern documented across sub-Saharan African water authorities [17]: strong formal frameworks coexisting with near-absent implementation. Three features of the ANDEA case carry distinct comparative significance. First, the judicial nullification of levy instruments demonstrates the critical importance of procedural robustness in water-economy financing: where regulatory procedures are not followed with precision, revenue instruments are judicially vulnerable regardless of their technical soundness. This lesson has direct applicability for the Water Resources Authority in Kenya, the Water Resources Commission in Ghana, and Tanzania's Basin Water Boards, all of which face analogous levy-sustainability challenges [3, 9].

Second, the interaction between political instability and Board membership wholesale replacement each ministerial reshuffle erasing institutional memory illustrates the governance cost of failing to insulate technical institutions from electoral cycles. The staggered fixed-term appointment design proposed here directly addresses this structural vulnerability, consistent with the governance design principles articulated by Saleth & Dinar [16] for the administrative dimension of water governance performance. Third, the dormancy of all decentralized Basin structures confirms Merrey et al. [10] finding that IWRM decentralization requires dedicated budgets and political commitment, not merely legislative provision. Madagascar's case is particularly informative in demonstrating that well-designed Basin Agency and Committee structures can remain entirely non-functional for over fifteen years in the absence of financial activation a warning for comparable structures established in Mozambique [18] and elsewhere.

The study's principal limitations are temporal (centered on 2004–2018) and methodological (limited access to Basin Agency-level primary data). Future research should conduct prospective evaluation of reform implementation against the pathways proposed here, and complement this institutional analysis with political economy analysis of Madagascar's water sector to address the incentive structures and distributional conflicts that determine whether reform recommendations are adopted in practice.

7.1 Theoretical Implications

The ANDEA case advances the theoretical understanding of institutional mismatch in IWRM governance in three respects. First, it extends Saleth & Dinar's [16] administrative-dimension hypothesis: where the financial and human resource endowments of a national water authority approach zero, the authority does not merely underperform — it enters a self-reinforcing fragility trap in which each dysfunction amplifies the others. Financial paralysis prevents recruitment; understaffing prevents territorial activation; territorial dormancy prevents the participatory legitimacy that would support levy compliance; and levy non-collection perpetuates financial paralysis. This

mutual reinforcement dynamic is not captured by frameworks that treat governance dimensions as independent, and suggests the need for threshold-based models of institutional viability. Second, the case illustrates the limits of neo-institutionalist explanations that attribute African governance failure primarily to misaligned formal-informal institutional incentives (cf. Ioris [7]). While such misalignments are present in Madagascar's water sector, the primary dysfunction drivers are procedural (defective levy gazette) and administrative (tutelage ambiguity), not incentive-structural: the reform required is legal and organizational, not a transformation of underlying political economy. Third, the SIDS dimension introduces a governance volatility amplifier not adequately theorized in the comparative IWRM literature: high ministerial turnover in small, aid-dependent states transforms standard IWRM governance risks notably Board composition instability into systemic institutional memory destruction, requiring governance design responses (staggered fixed-term appointments) that would be less critical in larger, more institutionally stable contexts.

7.2 Comparative Case Analysis

Table 3 situates ANDEA's institutional profile within a structured comparison of five Sub-Saharan African and island-state national water authorities, each operating within legal frameworks broadly aligned with IWRM principles. The comparison confirms the regional pattern of 'institutional mismatch' [17] while identifying the specific combination of judicial levy nullification and unresolved dual tutelage as distinctive to the Malagasy case.

Table 3. Comparative institutional profiles of selected Sub-Saharan African national water authorities

Country / Authority	Legal Framework Strength	Key Institutional Challenge	Reform Outcome	Ref.
Madagascar / ANDEA	Comprehensive (Code de l'Eau + 13 decrees)	Judicial levy nullification; dual tutelage; zero Basin Agency activation	Pending; draft levy decree approved (2014) but ungazetted	This study
Kenya / Water Resources Authority	Strong (Water Act 2016)	Levy sustainability; political interference in permit enforcement	Partial; Water Towers Agency improves basin-level financing	[3, 9]
Ghana / Water Resources Commission	Moderate (WRC Act 1996)	PPP conflicts; user-fee resistance; urban supply dominance	Mixed; WRC functional but limited rural reach	[3]
Tanzania / Basin Water Boards	Moderate (Water Resources Act 2009)	Financing shortfalls; jurisdictional overlap with local government	Partial; boards operational but inadequately funded	[9]
Mozambique / ARA Basins	Moderate (National Water Policy 2007)	Post-conflict capacity deficit; donor dependency; non-functional Basin Committees	Weak; ARA structures established but dormant outside main basins	[18]

7.3 Implementation Governance and Reform Enablers

A persistent limitation of IWRM reform scholarship is the gap between technically sound reform prescriptions and actionable analysis of the political and organizational conditions under which those prescriptions are likely to be adopted. The ANDEA case permits a more concrete treatment of implementation feasibility than is typical in the literature. Three enabling conditions are critical. First, the gazette publication of the corrected levy decree already approved by all ministries since 2014

requires no new technical or legal work: it is a political bottleneck, not a technical one. The relevant reform enabler is therefore a senior political champion (Secretary of State level or above) willing to coordinate the joint Water–Finance ministerial signature. International development partners (AFD, USAID, GCF) can play a catalytic role by conditioning budget support or grant disbursement on gazette publication, as this creates a clear external incentive without requiring sustained political will. Second, the proposed CA reform (twelve members, staggered four-year terms) faces resistance from the logic of patronage appointment, under which a newly formed government expects full discretion over Board composition. Mitigation requires framing staggered appointments not as an institutional constraint on government authority but as a mechanism that insulates the Water Ministry's own technical advisors from ministerial reshuffle cycles an argument more likely to find traction in the Finance Ministry than in the Primature. Third, Basin Agency activation requires upfront investment in staff recruitment and monitoring infrastructure before levy revenues materialize, creating a fiscal bridge problem. The most feasible mechanism is an international climate-finance pre-investment (GCF readiness grant), structured to establish two or three Basin Agencies as pilot sites before full FNRE operationalization, thereby demonstrating operational viability and building the evidence base for broader rollout.

The interaction between political instability and reform sequencing deserves explicit attention. Madagascar's governance environment is characterized by short effective planning horizons: ministerial tenures average under two years, and multi-year reform programs have repeatedly been abandoned mid-implementation following government transitions. The reform pathway proposed here is therefore designed to front-load legally and administratively self-contained actions (gazette publication, CA reform) whose completion is not contingent on sustained political continuity, while structuring medium- and long-term elements as modular each activatable independently if the previous step has been completed rather than as a linear program requiring uninterrupted political commitment.

8 Conclusion

This paper has provided the most comprehensive diagnostic of institutional dysfunction in Madagascar's ANDEA yet published, revealing a governance failure whose depth and multi-dimensionality exceeds any single-factor explanation. The multi-domain SWOT analysis identifies compounding dysfunctions across the legal, financial, organizational, and territorial dimensions, converging on a situation where a legally well-designed IWRM authority has been rendered operationally incapable for over two decades.

The sequenced reform pathways proposed financial restructuring and legal clarification in the short term; decentralization activation and inter-ministerial coordination in the medium term; national monitoring infrastructure in the long term are designed to be mutually reinforcing and to address institutional prerequisites in the order required for each subsequent reform layer to take effect. They offer transferable lessons for national water authorities in fragile institutional environments throughout sub-Saharan Africa: the procedural robustness of revenue instruments is as critical as their economic design; governance structures must be insulated from electoral cycles through fixed-term appointments; IWRM decentralization requires dedicated financing, not only legal provision; and reform sequencing according to institutional prerequisites, rather than administrative convenience, is a necessary condition for sustainable water governance transformation.

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