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An Enhanced Water Governance Assessment Tool for Resilience and Sustainability: The InnWater Approach

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Abstract

This paper presents the development and pilot validation of an enhanced water governance assessment tool developed within the European InnWater project. Grounded in OECD Principles on Water Governance, the study combines literature review, thematic framework development, and pilot validation with stakeholders. The tool expands existing governance assessment frameworks by explicitly integrating four cross-cutting dimensions that are often insufficiently addressed: circular economy, environmental resilience, local empowerment, and procedural equity with particular attention to vulnerable groups. The assessment framework is organised across five governance domains—mega-trends and resilience; policy, institutions and regulation; financing; data, monitoring and evaluation; and engagement and accountability—and operationalised through a structured questionnaire applied in selected European pilot sites. Insights from initial pilot applications illustrate the tool's capacity to reveal institutional coordination gaps, capacity constraints, and barriers to inclusive and adaptive governance. The paper contributes a replicable, policy-relevant governance assessment methodology designed to support reflexive learning and institutional improvement in diverse European water governance contexts.

Keywords: water governance; resilience; sustainability; circular economy; stakeholder engagement; EU Green Deal; policy assessment; inclusivity; environmental governance

1. Introduction

Water governance stands at the forefront of global efforts to tackle pressing environmental and socio-economic challenges [1–3]. Freshwater resources are vital for human and ecosystem well-being, but pressures such as climate change, population growth, and urbanisation increasingly threaten their availability and quality. Sustainable and resilient water governance is therefore essential to balance competing demands, reduce risks, and ensure equitable access to water services.

The InnWater project, launched in 2023, is a multi-national European initiative focused on advancing social innovation and renewing water governance systems through multi-level and cross-sector collaboration. By integrating economic and financial mechanisms aligned with the EU Green Deal objectives, InnWater aims to develop governance models that strengthen the sustainability and resilience of water systems in France, Italy, Spain, the United Kingdom, and Hungary. The project brings together thirteen partners with expertise



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ranging from environmental science to policy analysis and stakeholder engagement. This ensures an inclusive and interdisciplinary approach.

Water governance refers to the frameworks—political, institutional, and administrative—that guide how water management decisions are made and implemented [1,3,4]. The OECD defines water governance as the ensemble of rules, practices, and processes that allow stakeholders to express their interests, hold decision-makers accountable, and achieve policy objectives. Governance encompasses three key dimensions: effectiveness (achieving policy goals), efficiency (using resources optimally), and engagement (ensuring inclusive participation). Viewing governance as a means to an end emphasizes measurable outcomes such as water security, resilience, and sustainability.

Current water governance challenges are amplified by several global megatrends. The world population has increased by over two billion in the last 25 years, driving higher water demand and rapid urban expansion. Over half of the global population now lives in urban centers, where 80% of the world's GDP is generated. In Europe, 75% of the population resides in cities, intensifying water demand and complicating management across agriculture, energy, and industry.

Climate change further exacerbates these pressures by altering hydrological cycles and increasing the frequency of droughts, floods, and extreme weather events. Global temperatures are rising at approximately 0.18 °C per decade, causing shifts in precipitation patterns and wind regimes that affect water availability and ecosystems. Since 2000, droughts have become nearly 30% more frequent and longer, resulting in significant human and economic losses [5]. In Europe, around 30% of the population experiences water stress annually, with southern regions particularly vulnerable [6]. Floods also affect millions and cause major economic damages, highlighting the need for adaptive risk management strategies [7].

Addressing these challenges requires governance systems that are effective, efficient, and resilient. Resilient systems can anticipate, adapt to, and recover from shocks. Resilience is a critical component of sustainable water management and is embedded in international frameworks such as the SDGs, the Paris Agreement, and the Sendai Framework. These frameworks emphasize strengthening adaptive capacities, reducing vulnerabilities, and fostering inclusive disaster risk management and climate adaptation.

Sustainability complements resilience by promoting responsible management of finite water resources. This approach meets present needs without compromising future generations. It requires holistic, polycentric strategies [8] that protect freshwater ecosystems, minimize pollution, apply circular economy principles, and encourage sustainable infrastructure investments. Despite recognition of these principles, governance frameworks often lack integrated assessment tools that fully consider environmental resilience, social equity, and local empowerment, particularly for vulnerable groups [9].

The InnWater project addresses this gap by enhancing existing water governance assessment frameworks, especially the OECD Water Governance Principles [1]. The project adds dimensions that reflect emerging challenges, including circular economy approaches, environmental resilience, inclusive stakeholder engagement, local empowerment, and integrated governance [10]. The outcome is a comprehensive, scalable governance assessment tool applicable across European pilot sites and beyond.

This paper presents the development and theoretical foundations of this enhanced assessment methodology. It details how traditional governance principles [11] have been expanded to include sustainability and resilience [12]. It also explains the inclusion of circular economy, environmental resilience, local empowerment, and stakeholder engagement targeting vulnerable groups. By outlining the methodological framework and its

innovations, this paper contributes to applied water governance research and provides a practical tool for policymakers, researchers, and practitioners.

Although literature on water governance and sustainability is growing, existing assessment frameworks often fall short in addressing environmental resilience, circular economy, and procedural equity. In particular, they rarely operationalize these dimensions in ways that are both analytically robust and practically applicable across diverse contexts. This paper addresses that gap by piloting an enhanced governance assessment tool within the InnWater project.

Existing water governance assessment frameworks have made important contributions to diagnosing institutional arrangements and policy coherence. The OECD Water Governance Indicator Framework, for instance, provides a structured set of indicators aligned with the OECD Principles on Water Governance, primarily designed to support benchmarking and institutional self-assessment across effectiveness, efficiency, and engagement dimensions. Other recent governance assessment tools similarly focus on regulatory design, coordination mechanisms, and compliance-oriented performance metrics.

The InnWater assessment tool builds upon these foundations but differs in three analytically significant ways. First, while many existing frameworks treat resilience, equity, and sustainability as supplementary or sector-specific concerns, the InnWater tool operationalises these dimensions as cross-cutting governance properties embedded across all assessment domains. Second, the tool re-operationalises high-level governance principles into a question-based diagnostic format designed to stimulate reflexive learning rather than comparative ranking. Third, it explicitly integrates facilitated, multi-stakeholder assessment as a core methodological feature, enabling the identification of governance blind spots—particularly regarding vulnerable groups, institutional capacity constraints, and adaptive readiness—that are often difficult to capture through indicator-based benchmarking alone.

2. Materials and Methods

In this study, “materials” refer to policy documents, governance frameworks, institutional analyses, and stakeholder inputs used for the development and validation of the assessment tool. This study employs a comprehensive, multi-phase methodology combining systematic literature review, thematic analysis, and iterative stakeholder engagement to develop an enhanced water governance assessment framework tailored to contemporary challenges facing European water systems. The methodology is organised into three interconnected phases: (i) a detailed analysis and synthesis of existing governance frameworks and policy instruments, (ii) identification and integration of emerging governance themes that address key gaps in current assessment tools, and (iii) participatory validation and preliminary application through stakeholder workshops and pilot site testing. Together, these phases ensure that the resulting governance assessment tool is theoretically robust, empirically relevant, and practically applicable across diverse governance contexts [13].

2.1. Research Design and Approach

This study is designed as a methodological development and validation exercise rather than a comparative empirical analysis. It follows a structured, multi-phase approach comprising: (i) a purposive and transparent review of academic and institutional literature on water governance assessment frameworks; (ii) thematic framework development building on the OECD Principles on Water Governance and relevant EU policy instruments; and (iii) iterative validation through stakeholder engagement and pilot applications. The empirical material is illustrative, aimed at refining the tool rather than producing statistically generalisable findings.

The literature review was structured around predefined thematic domains common to governance assessment frameworks, including effectiveness, efficiency, coordination, stakeholder engagement, resilience, and equity. Sources were selected based on their relevance to governance design and assessment, with emphasis on peer-reviewed literature, international organisation reports, and EU policy documents. While not intended as a formal systematic review, this approach ensured transparency and conceptual coherence in framework development. This review aimed to establish a solid conceptual foundation and to critically assess existing assessment tools for their strengths, limitations, and alignment with evolving governance challenges. The literature search encompassed peer-reviewed journal articles, reports from international organisations, policy documents, technical guidelines, and project deliverables related to water governance assessment. Particular emphasis was placed on documents that shaped water governance principles at global and European scales, including but not limited to the OECD Principles on Water Governance, the European Union Water Framework Directive, the EU Green Deal, and national water governance strategies from the five countries involved in InnWater (France, Italy, Spain, UK, Hungary).

The review process was structured around key thematic domains common to governance assessment frameworks, such as effectiveness, efficiency, stakeholder engagement, transparency, and accountability. Particular attention was given to the inclusion of social equity, environmental resilience, and cross-sector integration, which have emerged as critical yet often underexplored dimensions in water governance literature. Both academic and grey literature were included to capture practical governance experiences, policy shifts, and emerging priorities in water management.

The outcome of this extensive review was a nuanced understanding of the existing state of water governance assessments, including recurring challenges such as insufficient integration of climate resilience, limited attention to vulnerable stakeholder groups, and inadequate mechanisms for multi-level governance coordination. A key methodological decision was to adopt a mixed-methods assessment approach, combining qualitative and quantitative tools to capture the complexity of governance processes. Qualitative data, such as institutional narratives and stakeholder perceptions, complement quantitative indicators, such as compliance scores and resource allocations, enabling a more holistic evaluation of governance performance. This design aligns with best practices in environmental governance research, which recognise the value of triangulating multiple data sources for robust assessment outcomes [12].

2.2. Identification of Key Governance Themes and Topics

Following the comprehensive literature review, the next methodological step was a detailed thematic analysis aimed at identifying governance themes and topics insufficiently addressed in existing frameworks but critical for managing current and future water governance challenges. This thematic identification process combined deductive and inductive reasoning to expand upon the OECD principles while integrating emerging issues from academic discourse and policy practice. Four principal themes emerged as priorities for enhancement:

1. **Resilience to Megatrends and Environmental Risks:** Water governance must address the increasing frequency and severity of water-related risks driven by global megatrends such as climate change, urbanisation, population growth, and economic globalisation. Resilience in this context refers to governance capacity to anticipate, absorb, and adapt to perturbations such as floods, droughts, and pollution events. Unlike traditional approaches focusing mainly on infrastructure, resilience here encompasses institutional flexibility, adaptive policy cycles, and social learning processes, reflecting

the dynamic nature of socio-ecological systems [6]. Governance resilience involves coordination across scales and sectors to ensure timely and effective responses to crises, maintaining water security and ecosystem integrity under uncertainty.

2. **Environmental Sustainability and Circular Economy:** Sustainability remains a fundamental but challenging goal for water governance, requiring a balance between human water needs and ecosystem protection. This theme focuses on the integration of circular economy principles—minimising waste and promoting resource efficiency—within water management practices [10,14,15]. Sustainable governance promotes the restoration of freshwater ecosystems, reduction in pollutant loads, reuse of treated wastewater, and conservation of water bodies, aligned with EU biodiversity and climate targets. These principles extend beyond traditional regulatory compliance to proactive stewardship of aquatic environments, supporting long-term ecological viability [7]. In the context of the InnWater assessment tool, circular economy principles are operationalised through governance-related indicators rather than technological prescriptions alone. These include the presence of regulatory incentives for water reuse, institutional coordination for nutrient and energy recovery, financial mechanisms supporting nature-based solutions, and monitoring systems capable of tracking circular performance outcomes. By embedding circular economy considerations across multiple governance domains—policy coherence, financing, and data and monitoring—the tool assesses whether circularity is institutionally enabled, rather than merely promoted as a strategic objective.
3. **Inclusivity and Local Empowerment:** Equity and social justice are central to legitimate and effective water governance. This theme highlights the necessity to actively engage vulnerable and marginalised groups—such as low-income communities, indigenous peoples, women, and the older adults—in governance processes. Effective inclusivity requires removing barriers to participation, fostering transparent communication, and recognising diverse knowledge systems, including local and indigenous knowledge [13]. Local empowerment supports decentralisation and capacity-building efforts that enhance community control and decision-making, strengthening social cohesion and adaptive capacity.
4. **Cross-sectoral Integration and Coordination:** Water governance does not exist in isolation but intersects with other sectors including agriculture, energy, urban planning, and climate adaptation. Effective governance demands integrative mechanisms that break down silos, align policy objectives, and foster cooperation across sectors and levels of government. This theme responds to challenges posed by overlapping jurisdictions, competing demands, and fragmented institutional arrangements by emphasizing coherence, shared responsibility, and joint action. It reflects the EU Green Deal’s call for systemic, multi-sectoral transitions to sustainability. These characteristics reflect core features of polycentric governance systems, in which authority is distributed across multiple, overlapping decision-making centres that require coordination rather than hierarchical control.

These themes were systematically incorporated into an expanded governance framework organised into five domains: (i) Mega Trends and Resilience, (ii) Policy, Institutions and Regulation, (iii) Financing, (iv) Data, Monitoring and Evaluation, and (v) Stakeholder Engagement. Within each domain, specific indicators were developed or adapted to capture the dimensions of resilience, sustainability, inclusivity, and integration. The indicators include both process-oriented measures (e.g., stakeholder participation mechanisms) and outcome-oriented measures (e.g., ecosystem health status), enabling a multi-layered assessment.

2.3. Stakeholder Engagement and Preliminary Validation

To ensure the relevance, usability, and legitimacy of the enhanced assessment tool, the third methodological phase involved extensive stakeholder engagement and pilot testing [16]. This participatory approach follows principles of co-production in environmental governance, recognizing that meaningful involvement of governance actors improves tool design and uptake. The governance framework and draft tool were refined through structured workshops with project partners, policymakers, and experts, which provided feedback on thematic structure, indicators, and data feasibility. It was then pilot-tested in rural and urban European sites using interviews, surveys, and document analysis to assess functionality, clarity, and site-specific responsiveness. Feedback from workshops and pilots informed iterative improvements, enhancing the tool's adaptability and potential for broader replication across diverse governance contexts [17,18].

2.4. Scoring, Aggregation, and Facilitation Protocol

The InnWater assessment tool employs a structured scoring system designed to support diagnostic learning rather than predictive evaluation. Indicators are scored using a five-point Likert scale, supplemented by qualitative justification provided during facilitated assessment sessions. By default, governance domains are equally weighted to avoid privileging any single dimension of governance a priori and to reflect the interdependent nature of institutional, environmental, and social governance capacities. Equal weighting was adopted as a pragmatic and transparent baseline; however, the framework allows for alternative weighting schemes where context-specific priorities justify deviation.

Scores are not mechanically aggregated into a single composite index. Instead, domain-level scores are visualised using radar diagrams and traffic-light indicators to facilitate discussion and interpretation among stakeholders. This approach prioritises transparency and interpretability over numerical optimisation.

During facilitated assessments, scoring discrepancies among participants were addressed through structured discussion rounds aimed at reaching a shared interpretive consensus. Where full agreement was not achievable, facilitators documented divergent views and reflected them in the qualitative commentary accompanying scores. Facilitators played a neutral role, guiding discussion without assigning scores unilaterally.

Recognising the risk of facilitator influence and power asymmetries among participants, several mitigation strategies were employed, including the use of standardised facilitation guidelines, explicit encouragement of contributions from less-represented stakeholders, and transparent documentation of scoring rationales. While these measures reduce bias, the authors acknowledge that participatory assessment processes cannot fully eliminate power dynamics.

Sensitivity analysis of domain weighting was explored during pilot applications but remains primarily prospective. Future iterations of the tool will systematically test alternative weighting scenarios to assess the robustness of governance profiles across contexts.

3. Results

Given the methodological focus of the study, the results presented here emphasise tool structure, qualitative insights, and governance patterns emerging from pilot applications, rather than statistical analysis or hypothesis testing. To support comprehensive and forward-looking assessments of water governance systems, we developed an *Enhanced Water Governance Assessment Tool* under the InnWater project. The tool consists of approximately 70 structured questions and expands the scope of conventional governance diagnostics by explicitly integrating environmental resilience, social equity, and institutional coordination dimensions. It was designed not only to identify current institu-

tional arrangements and regulatory frameworks but also to uncover underlying barriers to effective, inclusive, and adaptive water governance.

The tool is divided into two main components: a Preparation Phase (Questions 1–19), which collects baseline institutional and legal information, and an Assessment Phase (Questions 20–77), structured around five thematic pillars: mega-trends and resilience; policy, institutions and regulation; financing; data, monitoring and evaluation; and engagement and accountability.

The section below provides an example of how the questionnaire was implemented at a pilot site in France and the results it generated. In addition, a shorter, digital version of the questionnaire was developed and tested at a UK pilot site. More information on the questionnaire is available on the InnWater website.

3.1. Questionnaire Design

The **Preparation Phase** focuses on mapping the governance landscape of water resources and water service provision. Respondents are asked to identify the roles and responsibilities of institutions at various governance levels (national, regional, local), as well as to describe the presence and mandate of River Basin Organisations (RBOs), their staffing and financing mechanisms. This phase also examines the legal and policy frameworks for water and wastewater management, the structure of regulatory bodies, and the integration of gender equality strategies and pollution control mechanisms into planning and decision-making processes.

The **Assessment Phase** evaluates more dynamic and functional aspects of water governance:

1. **Mega-trends and resilience** address territorial exposure to water-related risks (e.g., flooding, droughts, pollution), the existence of disaster response strategies, and the degree to which national or EU environmental strategies—such as the Nature Restoration Law—have been incorporated into practice. It also explores the legal and operational status of green infrastructure and environmental flows.
2. **Policy, institutions and regulation** examine vertical and horizontal coordination mechanisms, regulatory capacity, policy coherence, and the presence of sectoral conflicts. This section evaluates whether institutions have the authority and resources to regulate tariffs, enforce quality standards, support innovation, and resolve consumer disputes, as well as whether cultural and gender dimensions are embedded in governance frameworks.
3. **Financing** explores how water infrastructure and ecosystem services are funded. It investigates whether financial resources are allocated for vulnerable populations, climate resilience, innovation, and biodiversity, and whether mechanisms such as green bonds, social tariffs, and public–private partnerships are in place. This includes funding mechanisms that explicitly support circular economy practices, such as wastewater reuse, ecosystem restoration, and innovation in resource recovery.
4. **Data, monitoring and evaluation** assesses data availability, standardisation, and integration across institutions. It also probes the digitalisation of monitoring processes and the use of performance indicators for circular economy and social inclusion objectives. Specific attention is given to the availability of indicators that allow institutions to monitor circular economy performance, including reuse rates, pollution reduction, and ecosystem service outcomes.
5. **Engagement and accountability** examines the inclusivity and transparency of governance processes, including participation by women and marginalised groups, stakeholder consultation practices, legal recourse, and anti-corruption safeguards. It con-

cludes with questions on how human rights to water—availability, accessibility, affordability, and acceptability—are upheld in practice.

3.2. *Insights from Initial Piloting*

The initial piloting of the Enhanced Water Governance Assessment Tool across InnWater pilot sites revealed three core findings about its utility and impact.

First, the tool successfully broadened the scope of governance assessment by integrating previously overlooked dimensions such as ecosystem vulnerability, climate resilience, and vulnerable group engagement. Stakeholders across different institutional settings noted that these new areas of inquiry were both necessary and thought-provoking. Questions related to biodiversity restoration, environmental flows, and gender-sensitive governance elicited particularly high levels of engagement and reflection during workshops.

Second, the tool's visual scoring system—which included traffic light indicators and radar diagrams—proved highly effective in conveying complex governance dynamics. These visual outputs were used as facilitation and diagnostic devices during workshops rather than as quantitative analytical instruments. By making governance strengths and weaknesses legible at a glance, these visuals facilitated meaningful discussions among stakeholders with varying technical backgrounds. In several cases, this visual clarity spurred new institutional conversations about how to close governance gaps—particularly around data access, coordination, and stakeholder inclusion.

Third, the assessment process helped uncover previously unrecognised barriers to integrated governance. These included limited access to real-time data, weak vertical coordination between national and local levels, and the absence of formal procedures for engaging non-institutional stakeholders. In response, some institutions expressed interest in embedding the tool into their regular review cycles, signaling its potential for long-term institutional learning.

3.3. *Cross-Case Analytical Synthesis*

Across InnWater pilot sites, the application of the assessment tool revealed several recurring governance patterns. First, coordination challenges between administrative levels emerged consistently, particularly where regulatory responsibilities were fragmented across institutions with limited operational capacity. Second, domains related to data, monitoring, and evaluation tended to score lower than institutional or regulatory design, reflecting widespread gaps in data integration and performance tracking. Third, a recurring trade-off was observed between financial sustainability and social equity: while cost-recovery mechanisms were often weak, targeted measures to protect vulnerable users were also underdeveloped.

The assessment further revealed that resilience-oriented measures were frequently present at the strategic level but insufficiently operationalised in day-to-day governance practices. This pattern suggests that resilience is often articulated as a policy ambition rather than embedded as an institutional routine. These cross-cutting insights demonstrate the tool's capacity to generate comparative governance learning while remaining sensitive to contextual variation.

3.4. *Analytical Interpretation of Governance Patterns*

Beyond descriptive insights, the cross-case findings reveal several governance mechanisms with direct implications for socio-ecological resilience. Persistent coordination gaps between administrative levels limit the capacity of governance systems to respond adaptively to climate-induced shocks, such as droughts or floods, by delaying decision-making and constraining information flows. Similarly, deficiencies in data, monitoring,

and evaluation systems undermine early warning capabilities and the ability to detect ecological thresholds, thereby increasing vulnerability to environmental degradation.

A recurring trade-off emerged between financial sustainability and social equity. In several cases, cost-recovery mechanisms were insufficient to maintain infrastructure resilience, while targeted measures to protect vulnerable populations were also underdeveloped. This dual deficit suggests that governance systems often struggle to reconcile economic viability with distributive justice, a tension that has broader implications for long-term environmental sustainability.

While the empirical findings are grounded in European pilot sites, these governance patterns reflect more general challenges observed in sustainability science: aligning institutional capacity with environmental risk, integrating social equity into resource governance, and translating strategic resilience objectives into operational practice. These insights are therefore transferable as analytical lessons, even where institutional configurations differ.

3.5. Case Study: La Réunion Island

Building on these general insights, the case of La Réunion Island illustrates how the Enhanced Water Governance Assessment Tool can surface critical issues within a unique ecological and institutional setting. A French overseas department located in the western Indian Ocean, La Réunion covers 2500 km² and is home to a highly concentrated population living along a narrow coastal fringe. The island's rugged volcanic interior, shaped by the Piton de la Fournaise (an active volcano) and Piton des Neiges (the highest peak in the Indian Ocean), contains over 120 rivers and streams that provide essential freshwater for domestic use, agriculture, and hydroelectricity.

As part of the InnWater project, researchers from the European University Institute's Florence School of Regulation (EUI/FSR) traveled to La Réunion to conduct a water governance assessment workshop. The University of La Réunion, acting as the lead local institution, convened a diverse set of stakeholders and guided the consultation process. The EUI/FSR team provided facilitation and technical support, ensuring neutrality and enabling open participation, including from typically under-represented voices.

The assessment revealed a strong baseline of institutional clarity. Roles and responsibilities among agencies responsible for water policy, implementation, and regulation were well-defined, reducing jurisdictional overlap and improving accountability. Regulatory frameworks based on EU legislation were robust, and formalised multi-level stakeholder bodies—such as inter-municipal syndicates and river basin committees—enhanced vertical and horizontal coordination across sectors like health, agriculture, energy, and urban planning.

Significantly, La Réunion benefits from centralised and harmonised water databases that integrate both quantitative and qualitative indicators. These databases support regular monitoring and provide essential feedback loops for evidence-based policy adjustments. The island also benefits from well-functioning institutions for strategic planning and risk assessment, aligned with national frameworks.

Nonetheless, the tool surfaced several pressing challenges. A major issue concerns capacity gaps—not only in technical expertise and staffing, but also in time availability and infrastructure condition. Workshop participants noted that despite existing plans, the implementation of infrastructure upgrades remains delayed, with an estimated €800 million required to modernise ageing networks. Coordination alone is not sufficient to overcome these financial and operational constraints.

Another key challenge is social inclusivity. While institutional mechanisms for stakeholder engagement exist, strategies for engaging women, low-income households, and marginalised populations remain weakly implemented. This is particularly concerning

given La Réunion's relatively high poverty rates. Gender-sensitive approaches to water and sanitation—such as menstrual hygiene facilities or targeted community engagement—are still largely absent from mainstream policy discussions.

The island's financial model for water governance also reveals important gaps. Current water pricing mechanisms do not fully recover total costs and fail to reflect environmental externalities. At the same time, no social tariff system is in place to protect vulnerable households. This dual gap—between sustainability and equity—undermines both the financial viability and fairness of the water system.

Finally, the assessment pointed to a need for greater innovation and policy coherence, especially in promoting circular economy practices [19,20]. While technical opportunities exist—such as expanding water reuse in agriculture, nutrient recovery from wastewater, and decentralised sanitation solutions—the assessment revealed that governance barriers remain the primary constraint. These include limited long-term policy support, fragmented institutional responsibilities, and a lack of stable financing mechanisms to move beyond pilot projects. This highlights the importance of aligning circular economy ambitions with enabling governance structures rather than treating circularity as a purely technological challenge.

3.6. Toward Adaptive and Inclusive Governance

The La Réunion case underscores the complexity of governing water in ecologically sensitive, economically constrained, and socially diverse contexts. The Enhanced Water Governance Assessment Tool proved instrumental in highlighting both institutional strengths—such as coordination structures and regulatory alignment—and critical vulnerabilities—especially those related to infrastructure condition, social equity, and innovation uptake.

To meet the island's evolving water challenges—intensified by climate change, extreme weather, and shifting demographic patterns—governance must become increasingly adaptive and inclusive. This entails developing flexible policies and feedback systems that evolve in response to new information, incorporating underrepresented voices into decision-making, and ensuring that financial and regulatory mechanisms are both sustainable and socially just.

As local stakeholders in La Réunion expressed, the assessment process itself became a platform for institutional learning. By making governance processes visible, measurable, and debatable, the tool supported a form of reflexive governance that may ultimately prove more important than any individual metric. It is in this sense that the Enhanced Water Governance Assessment Tool not only diagnoses governance conditions but also contributes to governance transformation.

4. Discussion

The InnWater governance assessment tool represents a significant evolution in the way water governance is conceptualised and evaluated, particularly in the European context. Its design reflects a growing recognition that sustainable water management cannot be achieved through technical or infrastructural solutions alone; instead, it requires governance systems that are inclusive, adaptable, and attentive to social and ecological complexity. By integrating considerations of circular economy, ecosystem resilience, and social equity, the tool moves beyond narrow compliance-based assessments and addresses core challenges facing contemporary water governance. Environmental resilience within the InnWater assessment tool is operationalised through governance indicators that capture the institutional conditions necessary to protect ecosystem integrity and biodiversity over time. These include indicators related to environmental flows, ecosystem restoration, pollu-

tion control, climate risk preparedness, and the integration of nature-based solutions into planning and financing frameworks. Rather than measuring ecological outcomes directly, the tool assesses whether governance systems possess the regulatory capacity, coordination mechanisms, and monitoring infrastructures required to sustain ecological functions and adapt to environmental change. The findings align with existing research on adaptive and polycentric water governance, which emphasises the importance of institutional coordination, learning, and inclusivity in managing socio-ecological systems [16,21].

Although the InnWater assessment tool was developed and piloted within a European policy context, not all of its components are universally transferable without adaptation. Elements such as references to EU legal instruments, regulatory enforcement mechanisms, and data availability are context-dependent and may be less applicable in settings characterised by fragmented authority, informal governance arrangements, or limited institutional capacity. In non-EU or Global South contexts, the tool would require adaptation to reflect alternative governance structures, capacity constraints, and data limitations. While the diagnostic logic and participatory orientation of the framework remain broadly applicable, expectations regarding scoring precision, stakeholder representation, and institutional follow-up must be calibrated to local realities. Acknowledging these limits is essential to avoid overestimating the tool's applicability in contexts where governance capacity is weak or unevenly distributed.

A central innovation of the tool lies in its operationalisation of procedural equity. Traditional stakeholder engagement mechanisms often privilege well-organised, well-resourced actors, leaving out voices from marginalised communities. The InnWater tool challenges this by embedding equity within its core structure—through both the content of its questions and the facilitation of its application. In La Réunion, where poverty levels are high and infrastructure investment needs are substantial, this proved particularly important. The active involvement of stakeholders representing vulnerable groups, enabled by careful facilitation, helped surface governance blind spots and institutional asymmetries that might otherwise have been overlooked. At the same time, facilitated participatory assessments are not without limitations. The framing of discussions, sequencing of questions, and facilitation style can influence outcomes, raising the risk of facilitator bias. Power asymmetries among participants may also persist, potentially marginalising less vocal or less resourced stakeholders [22]. While the InnWater process sought to mitigate these risks through inclusive facilitation and transparent documentation, challenges remain in ensuring meaningful participation of vulnerable groups. Acknowledging these limitations is essential to avoid overestimating the neutrality or inclusiveness of participatory governance tools. In this sense, the tool aligns with polycentric governance approaches by examining how procedural equity and stakeholder engagement operate across multiple governance centres, revealing whether decentralised decision-making enhances inclusivity or instead reproduces capacity and power asymmetries.

The role of the facilitator—as exemplified by the European University Institute's Florence School of Regulation in La Réunion—emerged as critical to the success of the governance assessment process. Facilitators help ensure inclusivity and neutrality, especially in politically sensitive or administratively fragmented contexts. Their presence supports trust-building, especially where historical tensions or power imbalances might hinder open dialogue. In La Réunion, this helped bring to the fore key issues such as limited capacity among local institutions, fragmentation of responsibilities across levels of government, and the absence of mechanisms to ensure water affordability in a context of high poverty.

The La Réunion case also illustrates how the tool can illuminate both governance strengths and structural weaknesses. Clear role allocation among institutions and regular stakeholder coordination platforms (such as the Comité Régional des Acteurs de l'Eau and

the CLEs) were recognised as governance assets. However, these strengths coexisted with systemic challenges: underfunded infrastructure, weak vertical coordination between local and regional authorities, and inadequate pricing mechanisms that failed to reflect either environmental costs or social equity concerns. Capacity gaps, including technical, data, and institutional resources, emerged as a key theme. These findings are not unique to La Réunion; rather, they mirror tensions observed across EU regions grappling with the dual challenge of ecological sustainability and social justice.

Moreover, the tool's ability to stimulate institutional reflection—rather than simply produce a score—was seen as a major advantage [21]. In La Réunion, the process fostered dialogue between departments and helped identify previously under-recognised barriers, leading to increased appetite for institutional reform. This underscores the diagnostic and deliberative potential of the tool: it is not only a measure of performance but also a catalyst for governance learning and adaptation. Beyond its diagnostic function, the InnWater assessment tool is designed to be embedded within existing governance and policy review cycles, particularly in the EU context. Its structure aligns well with periodic review processes such as Water Framework Directive River Basin Management Plan updates, water agency performance reviews, and evaluations linked to the EU Green Deal and the zero-pollution agenda. Policymakers and water authorities can deploy the tool at key moments of the governance cycle—during strategic planning, mid-term reviews, or ex post evaluations—to support reflexive learning on institutional coordination, inclusivity, and adaptive capacity. Because the tool prioritises facilitated discussion and visual synthesis over benchmarking, it complements existing monitoring and reporting frameworks by focusing on governance quality and institutional readiness rather than duplicating outcome-based environmental indicators.

At the same time, the diversity of administrative cultures and governance architectures across Europe poses real constraints on harmonisation [12,23–25]. The tool's strength lies in its flexibility—it can be used in a facilitated workshop setting, as in La Réunion, or as a self-assessment framework for routine governance reviews. However, to maximise its impact, future iterations will need to strike a balance between standardisation and contextual sensitivity.

For application beyond the EU, the tool requires structured contextual adaptation rather than direct replication. Key steps include localising indicators to reflect national legal frameworks, informal governance arrangements, and data availability; conducting stakeholder mapping to capture actual decision-making structures and ensure representation of vulnerable or marginalised groups; and applying capacity-sensitive facilitation protocols. In contexts with limited institutional capacity or asymmetric power relations, greater emphasis may be placed on qualitative deliberation, simplified scoring, and narrative evidence. These adaptations preserve the tool's core diagnostic and participatory logic while enhancing its relevance and usability across diverse governance settings.

Looking forward, digital transformation of the tool will be crucial. Online deployment, integration with real-time monitoring systems, and links to policy dashboards will enhance usability and impact. But digitisation must not come at the cost of participatory depth. The quality of governance assessment still hinges on the inclusivity and credibility of the process. Ensuring that marginalised voices are represented in digital tools and platforms will be a key challenge—and opportunity—for the next phase of development.

The experience in La Réunion and other pilot sites demonstrates that effective water governance requires both technical and political innovation. Tools like the one developed through the InnWater project can help bridge the gap between ambitious policy frameworks and on-the-ground realities. By embedding assessment within broader governance cycles

and aligning it with evolving EU goals—such as the Green Deal and the zero-pollution agenda—the tool can contribute to a more just and resilient water future.

5. Conclusions

This paper presented an enhanced governance assessment tool developed through the InnWater project to support more sustainable and inclusive water governance in Europe. Grounded in OECD principles and aligned with EU policy priorities, it offers a structured method to diagnose governance capacities and identify strategic actions. The tool is not intended to produce comparable governance rankings, but to support reflexive institutional learning and adaptive governance improvement.

Pilot applications confirm the tool's practical value in diverse settings, helping stakeholders visualise gaps, coordinate efforts, and reflect on including marginalised voices and ecological limits in decision-making. This replicable, adaptable framework advances governance practice and supports integrated water management under increasing environmental and social pressures.

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Abbreviations

The following abbreviations are used in this manuscript:

CA	Consortium agreement
D	Deliverable
EC	European Commission
GA	General Assembly
PSs	Pilot sites
SC	Steering Committee
WP	Steering Committee

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