

Natural Resources Management
Legislation and Environmental
Sustainability in the Cuvelai–Etosha
Basin: An Interpretive Case Study

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Research Article

Authors: Lukas Nghihalwa¹, Tjitunga Elijah Ngurare², Gabriel F Mwaninga¹ **Affiliation:** The International University of Management, Namibia¹, Africa Research University Zambia¹, and The International University of Management Namibia ²

Corresponding author: Lukas Nghihalwa, Email: lukashnghihalwa@gmail.com

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Abstract

Introduction: Natural resource management (NRM) legislation is a principal instrument through which societies regulate access to land, water, biodiversity, forests, wildlife, and other ecosystem resources. However, its existence does not guarantee environmental sustainability. The decisive issue is whether the legislation is understood, legitimate, coordinated across institutions, adequately resourced, monitored, enforced, and adapted to changing ecological and social conditions. This article examines the implementation problem in the Cuvelai–Etosha Basin (CEB), a climate-sensitive and densely settled transboundary socio-ecological system shared by Namibia and Angola. It addresses two objectives from the underlying thesis: to explore the role of NRM legislation in environmental sustainability and to assess the effectiveness, strengths, and weaknesses of the legislation.

Methodology: This study used an interpretivist qualitative case study design. It synthesises the thesis's semi-structured interviews, focus group discussions, direct observations, and documentary analysis conducted on the Namibian side of the CEB. The study used a purposive and institutional census approach involving 90 stakeholders from line ministries, regional and local authorities,

traditional authorities, civil society, academic institutions and resource-dependent communities. Thematic analysis was used to identify patterns in stakeholder accounts. The analysis in this study was restricted to the first two thesis objectives.

Results: The findings show that NRM legislation performs five major roles: regulating resource use, protecting ecosystems and wildlife, supporting sustainable livelihoods and development, addressing environmental pressures, and promoting sustainable water management. Its principal strengths are the existence of a formal legal framework, recognition of conservation and sustainable use objectives, and opportunities for community and traditional authority involvement. However, its effectiveness is uneven. Stakeholders reported improved awareness of water conservation and examples of collaborative management but also described a persistent gap between legal provisions and practice. Weak enforcement limited institutional capacity, inadequate monitoring, low public awareness, fragmented coordination, livelihood pressures, and insufficient participation were the main weaknesses.

Conclusion: The CEB case confirms that environmental legislation is best understood as an institutional platform rather than a self-executing solution. The findings correspond with recent global and African scholarship, showing that regulatory quality, accountability, institutional capacity, and legitimate participation condition environmental outcomes. For Namibia, the practical priority is to connect national legislation with basin-level coordination, customary governance, accessible communication in local languages, community monitoring, adaptive reviews, and measurable environmental indicators. The article concludes that strengthening implementation, not merely adding new laws, is the most credible pathway toward environmental sustainability in the CEB.

Keywords: Cuvelai–Etosha Basin; environmental sustainability; environmental governance; natural resources management; legislation; implementation; customary authorities; Namibia

1. Introduction

1.1 Background and global context

Environmental sustainability requires societies to maintain ecological functions while meeting their social and economic needs. In natural resource governance,

this requirement is translated into rules governing who may use resources, under what conditions, with what safeguards, and through which institutions. Legislation can establish protected areas, regulate

water abstraction, control land conversion, allocate communal land, require environmental assessments, and create sanctions for harmful conduct. It can also recognise rights, responsibilities, and public participation. However, legislation is only one component of governance. Its environmental effect depends on implementation capacity, the legitimacy of the rules, institutional coordination, compliance incentives, monitoring systems, and the extent to which affected communities can influence the decisions.

At the global level, natural resources are increasingly treated as interconnected ecological assets, the management of which involves local, national, regional, and international responsibilities. The International Law Association's guidelines emphasise that legal frameworks should connect sustainable use with environmental protection, human rights, transboundary cooperation, participation, monitoring, reporting and enforcement (Cordonier Segger & Schrijver, 2021). Therefore, global governance depends on institutions that can coordinate competing interests and translate general principles into context-specific actions.

Recent empirical research cautions against the assumption that better laws automatically produce better environmental outcomes. A cross-country study by Handoyo (2024) found that regulatory quality and political stability are positively associated with national environmental performance, whereas other governance effects vary by economic context. In resource-dependent and lower-income settings, formally sound rules may be undermined by limited funding, weak administrative reach, competing livelihood needs, and low enforcement capacities.

The implementation gap is also shaped by sanction credibility, and subnational incentives. Guo (2023) found that weak punishment and local protectionism limited China's earlier environmental inspection system, while more credible inspections altered local government incentives. Although the context differs from Namibia, the study reinforces that legal effectiveness requires a visible connection between violations, monitoring, responsibility, and consequences.

Therefore, the global literature presents a central implementation proposition: legislation is necessary but not sufficient for sustainability. Laws define authority and acceptable conduct; however,

sustainability outcomes arise from the interaction of law with institutions, social norms, knowledge, incentives, livelihoods, and ecological change. This proposition provides an analytical lens for interpreting CEB findings.

1.2 Regional African context

At the regional African level, implementation problems are intensified by dependence on natural resources, poverty, climate variability, and overlapping formal and customary institutions. A scoping review of 135 articles on environmental governance in Southern Africa found that the most frequently reported challenges involved inadequate coordination, accountability, capacity, skills, and resources (Falayi et al., 2021). These findings are directly relevant to the CEB, where national laws operate through regional councils, traditional authorities, communities, line ministries and basin-level arrangements.

The African evidence further demonstrates that the quality of regulation matters. Using data from 28 sub-Saharan African countries, Oteng-Abayie et al. (2022) found that environmental regulatory quality improves environmental sustainability, whereas unsustainable natural resource exploitation damages it.

Their conclusion calls for the rigorous implementation of environmental policies and regulations. This is consistent with the distinction between *de jure* governance, represented by formal laws, and *de facto* governance, represented by what institutions and communities can implement.

Afolabi (2023) reaches a related conclusion using sub-Saharan African evidence: natural resource rents are associated with poorer environmental quality, whereas regulatory quality moderates the adverse relationship. This places CEB pressures within a wider political economy context in which monitoring, distribution, and consistent application shape environmental risk.

Customary institutions are particularly important in this context. A systematic review of 68 studies found that customary authorities in sub-Saharan Africa perform management, support, enforcement, and, in some cases, rent-seeking roles in environmental governance (Schwaiger et al., 2024). Their effects are more often positive when they support communities and biodiversity protection, but unclear divisions of authority between customary institutions and the state are associated with poorer governance. This does not imply that customary authority should

replace the statutory government. Rather, legal systems should clarify roles, recognise legitimate local knowledge, prevent elite capture, and create accountable forms of collaboration.

1.3 Namibian and Cuvelai–Etosha context

At the national level, Namibia's environmental governance system includes legislation on environmental management, water resources, communal land, forests, wildlife, and traditional authorities. The Environmental Management Act, Communal Land Reform Act, and Water Resources Management Act provide the CEB with central statutory reference points (Republic of Namibia, 2002, 2007, 2013). The Namibian side of the basin is governed by these national instruments, while also being affected by regional and transboundary dynamics.

The CEB is shared between Namibia and Angola. It contains seasonal iishana, wetlands, flood pathways, agricultural land, grazing areas, wildlife habitats, and settlements that depend heavily on natural resources. The basin experiences recurrent flooding and drought, changing rainfall patterns, land-use pressure, population growth, and competing

demands for water, land, and biodiversity resources. These conditions make the translation of legal principles into local practice particularly consequential for the region.

Recent research on the physical environment reinforces place-sensitive governance. Hamunyela et al. (2022) found substantial interannual variation in CEB inundation and warned that infrequently flooded areas may produce severe losses during extreme events. Bäumle et al. (2024) showed that deep freshwater aquifers contain complex mixtures of younger and ancient saline waters. Therefore, legislation must address both visible seasonal water and less visible groundwater dynamics through monitoring and spatial information.

Namibia-specific research illustrates practical stakes. Salom and Khumalo (2022) found that governance, leadership, training, community involvement, coordination, and institutional support were critical for rural water management in Ohangwena, while Shaamhula et al. (2024) found that Efundja risk management in the CEB was incomplete, reactive, and top-down in nature. Mapani et al. (2023) similarly showed that climate variability, evaporation, and rising demand require additional storage, recharge, and

water harvesting strategies for water security in Namibia. These studies suggest that decentralisation must be accompanied by resources, communication, accountability, and local influence.

The transboundary nature of the issue adds another institutional layer. Mndzebele (2025) argues that SADC legal frameworks, functional basin institutions, capacity support, information exchange, and cooperation help contain transboundary water conflicts. CEB implementation should therefore support Namibia–Angola data sharing and coordinated decision-making, rather than treating the national boundary as the ecosystem boundary.

1.4 Problem statement, objectives, and analytical argument

The existence of NRM legislation in Namibia does not, by itself, demonstrate that environmental sustainability is being achieved in the CEB. The key problem is the implementation gap between legislative intent and environmental and social outcomes. The gap may arise when responsibilities overlap, enforcement is weak, communities do not understand the rules, monitoring is irregular, or restrictions conflict with the livelihood needs.

However, less attention has been paid to how these dimensions interact in the CEB from the perspective of stakeholders who implement, interpret, or live under NRM laws.

This article responds to two objectives of the thesis.

1. To explore the role of NRM legislation in environmental sustainability in the Cuvelai–Etosha Basin.
2. To assess the effectiveness, strengths, and weaknesses of NRM legislation in the Cuvelai–Etosha Basin.

This article argues that NRM legislation in the CEB has a strong normative and institutional role, but its environmental performance is limited by an implementation gap. This gap cannot be attributed to a single defective statute. It arises from the interaction of fragmented mandates, weak enforcement, inadequate monitoring, uneven awareness, limited capacity, livelihood pressures, and insufficiently institutionalised participation.

Figure 1 presents the funnel and implementation logic used in this study. Global principles are translated through regional governance conditions and national laws into basin-level implementation. Environmental outcomes depend on communication, participation,

monitoring, enforcement, adaptive reviews, legitimacy, and local knowledge.

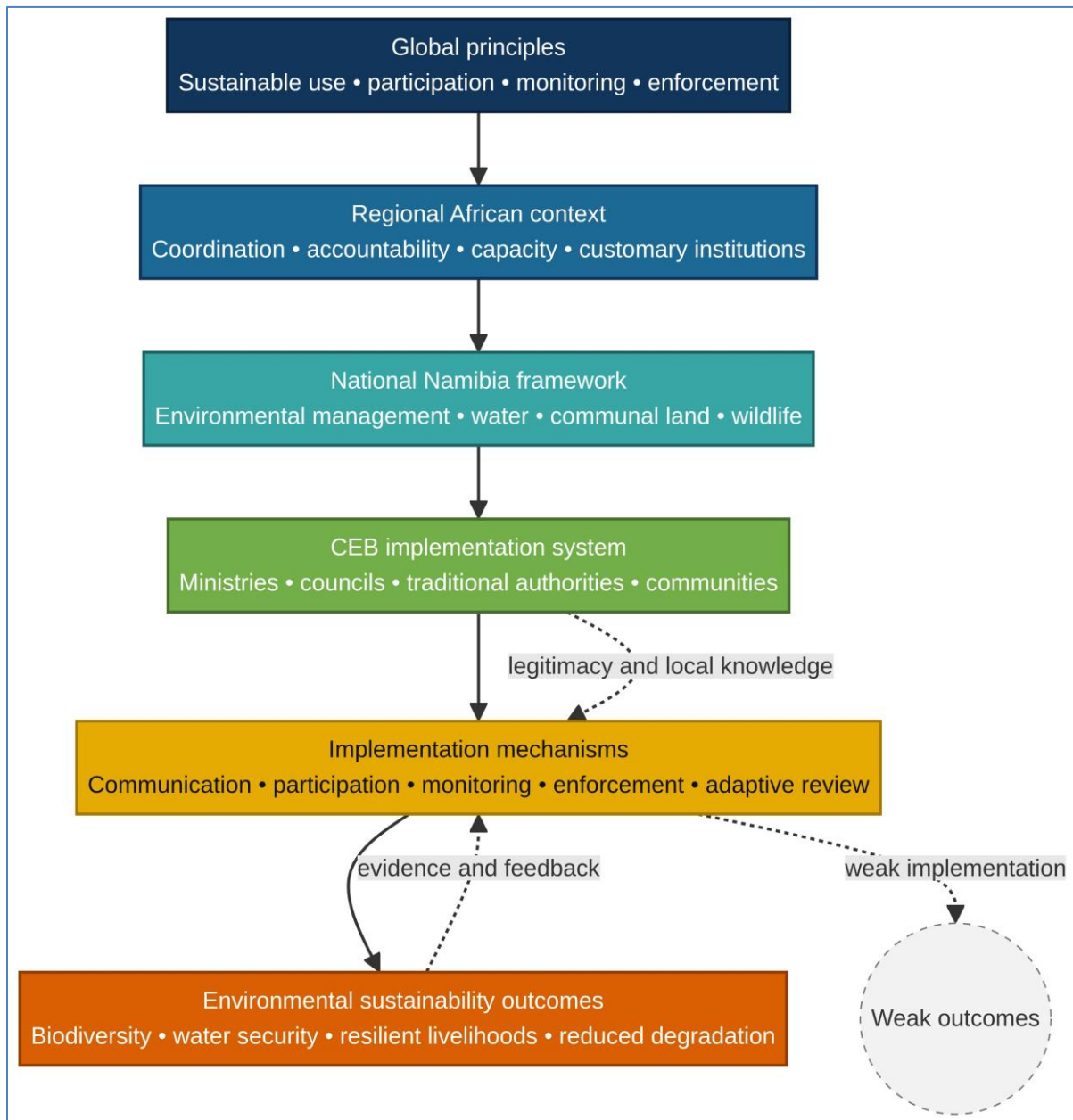


Figure 1. Global-regional-national funnel and CEB implementation framework.

. Methodology

2.1 Research design and setting

This study used an interpretivist qualitative approach and a case study design. This design was appropriate because the research questions concerned how stakeholders understand legislation, how rules are implemented, and how institutional and community practices shape the environmental outcomes. The case was the Namibian portion of the CEB, including the Iishana, Niipele, Olushandja, and Tsumeb sub-basins, and the administrative regions of Oshana, Ohangwena, Omusati, and Oshikoto.

The CEB is a transboundary socio-ecological system shared by Namibia and Angola. The Namibian study area is characterised by seasonal surface water flows, ephemeral channels, recurrent flooding and drought, high dependence on communal land and natural resources, and multiple overlapping governance structures. These features make it unsuitable for an analysis based solely on statutory texts. Consequently, this study examined formal legislation, along with the perceptions and experiences of actors who implement, interpret, or live under the rules.

2.2 Participants and data sources

This thesis reports a census-oriented population of 90 stakeholders identified through institutional mapping. Participants included representatives of line ministries, regional councils, local authorities, traditional authorities, non-governmental and civil-society organisations, academic and research institutions, and community members involved in subsistence farming and local resource use. The thesis also describes purposive and snowballing procedures to ensure that participants possessed relevant knowledge of NRM governance.

Data were generated through semi-structured interviews, focus group discussions, direct observation, and documentary reviews. The interview and focus group components examined the perceived purpose of the legislation, its effectiveness, community responses, enforcement, institutional responsibilities, implementation challenges, and possible improvements. Documentary analysis considered relevant Namibian legislation and regional environmental governance instruments. Combining these sources enabled triangulation between formal provisions, institutional accounts, and community experiences.

2.3 Sampling clarification and participant composition

The thesis reports 90 stakeholders in institutional mapping and census description, while its demographic table displays a smaller subset of named participants. This article uses the 90-person figure only for describing the

reported stakeholder composition and does not treat it as a statistical-sample estimate. The composition is institutionally weighted toward line ministries and regional councils; therefore, community perspectives are interpreted cautiously and in conjunction with the thesis's triangulated evidence.

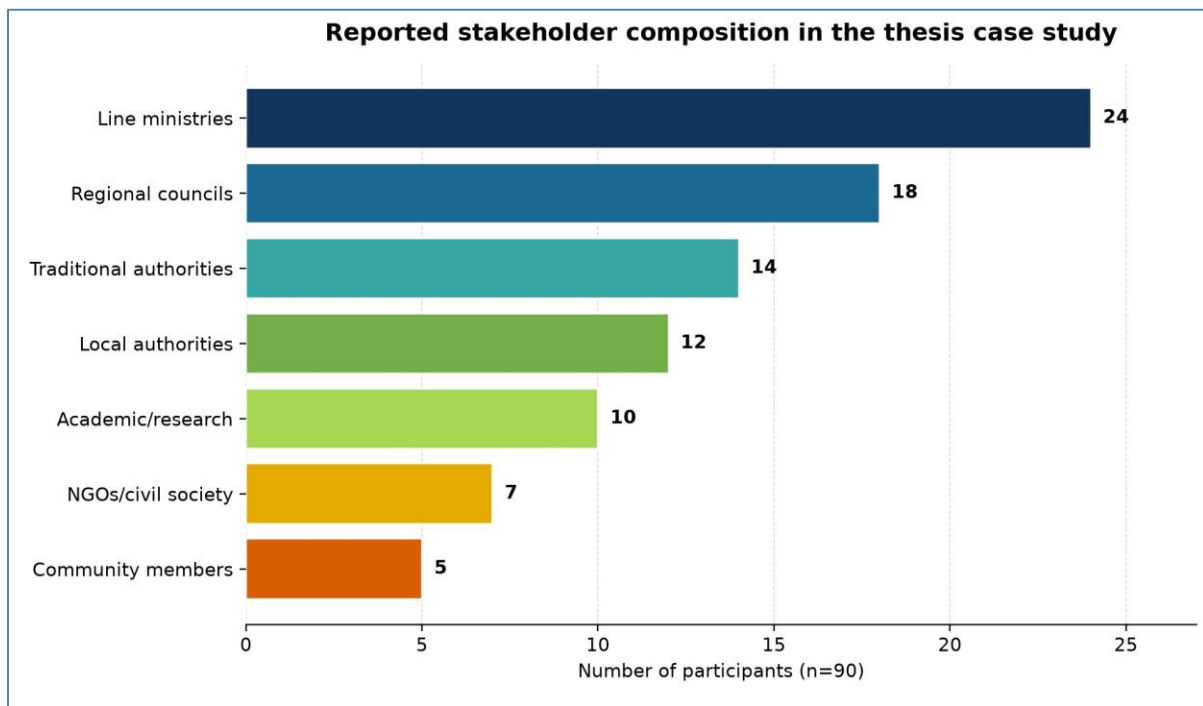


Figure 2. Reported stakeholder composition in the case study.

2.4 Data analysis and trustworthiness

The data were analysed thematically through systematic coding and interpretation. For this article, the analysis was restricted to findings relevant to the first two objectives of the study. Objective 1 was represented by themes concerning the role of NRM legislation. Objective 2 was represented by themes concerning

monitoring and evaluation, stakeholder engagement, capacity building, enforcement and compliance, and adaptive management. The analysis also considered the reported strengths and weaknesses across these themes.

This thesis reports several trustworthiness procedures, including triangulation, member validation, peer debriefing,

prolonged engagement, transparent documentation, and inter-coder verification. Ethical procedures included institutional approval, informed consent, confidentiality, anonymity, and the right to withdraw from the study. The findings are interpretive and context specific. These should not be read as statistical estimates of compliance or ecological change across the entire basin. Instead, they explain how key stakeholders understand the relationship between the legislation and sustainability.

2.5 Analytical framework

The analytical framework combined three levels of analysis. The first level was the role of legislation, including regulations, conservation, livelihood support, environmental-risk reduction, and water management. The second level was effectiveness, understood as the extent to which legal intent is translated into awareness, behaviour, institutional action, compliance and environmental protection. The third level was implementation conditions, including capacity, coordination, participation, monitoring, enforcement, legitimacy, and adaptation issues.

This framework treats effectiveness as a process, rather than a single outcome. A

law may be effective in establishing authority but ineffective in changing behaviour. This may improve awareness, but remains weakly enforced. This may protect one resource while increasing livelihood pressure elsewhere. Therefore, the analysis distinguishes between legislative strengths and implementation weaknesses.

This study interprets implementation as a chain of legal design, institutional assignment, communication, resource allocation, monitoring, enforcement, and environmental or livelihood responses. A weakness at any stage can disrupt the chain. This process interpretation guided the comparison between stakeholder perceptions, documentary evidence, and recent scholarship.

3. Results

3.1 Overview of the objective-linked themes

The first major result was that participants generally understood NRM legislation as a framework for balancing ecological protection with human use and development. The legislation was not described as a set of prohibitions. It was also understood as a mechanism for allocating responsibilities, guiding land and water use, protecting biodiversity,

reducing environmental risks, and establishing accountability.

The thesis identified five connected roles under Objective 1: protection of diverse ecosystems and wildlife, promotion of sustainable development and poverty alleviation, response to environmental challenges, promotion of biodiversity

conservation, and promotion of sustainable water management. Objective 2 generated five effectiveness dimensions: monitoring and evaluation, stakeholder engagement, capacity building, enforcement and compliance, and adaptive management.

Table 1. Objective-linked roles and implementation conditions are identified in this thesis.

Objective-linked theme	Evidence reported in the thesis	Environmental-sustainability implication
Regulation and protection	Rules govern land use, water use, harvesting, mining, grazing, wildlife, and environmental protection in the area.	It reduces uncontrolled exploitation and creates a basis for accountability.
Sustainable development and livelihoods	Legislation is expected to permit resource-dependent livelihoods within the sustainable limits.	Aligns conservation with poverty reduction, but restrictions may create resistance when alternatives are absent.
Biodiversity and ecosystem protection	Participants referred to wetlands, habitats, vegetation, wildlife, veld fires, poaching and habitat loss.	It maintains ecological functions and reduces degradation.
Sustainable water management	Water rules are associated with conservation awareness, allocation, protection, and monitoring.	Supports water security for households, agriculture, livestock and ecosystems.

Monitoring and evaluation	Participants proposed indicators such as water quality, soil erosion, deforestation, biodiversity and overgrazing.	Environmental effects are made visible, and adaptive management is supported.
Participation and customary governance	Communities and traditional authorities are viewed as sources of knowledge, legitimacy, and local monitoring.	Ownership and compliance are strengthened when roles are clear and inclusive.
Capacity and enforcement	Weak staffing, resources, technical capacity, and enforcement have been repeatedly reported.	It determines whether formal legal provisions lead to practical outcomes.

3.2 Regulation and protection of ecosystems and wildlife

Participants reported that legislation regulates the collection and use of natural resources and establishes restrictions on activities that may cause land deterioration, water scarcity, habitat loss, and a decline in biodiversity. Particular importance was attached to fragile wetlands, seasonal water systems, wildlife habitats and communal land. The legal framework was therefore seen as a means of controlling agricultural expansion, sand mining, infrastructure development, uncontrolled fires, deforestation, poaching, and other forms of pressure.

A traditional leader explained that land-use rules were communicated to residents because agricultural clearing, mining, and infrastructure development could remove vegetation and fragment habitats in the area. The thesis also records local structures that conduct awareness activities and engage communities in veld fires and land management. These accounts indicate that statutory provisions are mediated through traditional and local governance arrangements rather than directly reaching communities from the central government.

This result is significant for two reasons. First, it confirms that stakeholders attribute a direct environmental role to the legislation. Law is expected to establish limits around activities that may damage ecosystems. Second, it demonstrates that the law operates through social institutions. A restriction becomes meaningful when local leaders, officials, and residents understand, communicate, and support its enforcement.

3.3 Sustainable development, livelihoods, and environmental pressures

Participants also viewed NRM legislation as a tool for promoting sustainable development and addressing environmental challenges in the region. The desired outcome was not conservation that excluded people from resources. Rather, it was a form of regulated use that allowed livelihoods to continue without exhausting the ecological base on which they depend.

This objective generated significant tension. Some restrictions were experienced as necessary for conservation, while others were seen as The CEB case challenges the narrow distinction between conservation and development. Environmental sustainability depends on ecological protection and social viability. If conservation rules impose costs on already vulnerable households without providing participation, information, alternative income, or benefit sharing, they may deepen resistance. Conversely, when sustainable use is understood as

threats to subsistence and income. A community participant described restrictions on harvesting mopane worms as unfair because the activity provided food and money for school materials, and argued that prohibitions without livelihood alternatives could encourage illegal harvesting and other prohibited activities). This result shows that compliance is influenced by livelihood realities. Where legislation limits a resource without addressing dependence on that resource, the rule may be formally valid, but socially fragile.

protecting the resource base that supports livelihoods, legislation can become a mechanism of collective stewardship.

3.4 Sustainable water management

Water management was a prominent expression of legislative roles. Participants linked water rules to household use, irrigation, livestock, ecological needs, water quality, and the need to monitor water abstraction. Some respondents

viewed water regulations positively because they encouraged careful use. A farmer's reported observation that regulations had made users think twice before using water for irrigation illustrates how the law can influence everyday resource behaviour when its purpose is understood.

The thesis findings are consistent with Salom and Khumalo's (2022) study of community-managed rural water supply in Ohangwena. Both studies suggest that water governance depends on more than formal decentralisation. It requires functional committees, trained personnel, leadership, technical support, coordination, and resources for maintenance and monitoring. In the CEB, water-use regulations encouraged users to think more carefully about irrigation and conservation.

Neutral and negative assessments focused on the distance between legislation on paper and its implementation in practice. Respondents reported uncertainty regarding which rules applied, limited public knowledge of the content of the legislation, irregular monitoring, inadequate enforcement, and insufficient institutional capacity. The thesis records a government official's observation that the country has robust

water legislation has a dual role in the CEB. It establishes formal authority over water resources, and its success depends on local management capacity and institutional support.

3.5 Perceived effectiveness: positive, neutral, and negative assessments

The second objective produced three broad assessments of legislative effectiveness: positive, neutral, and negative assessments. Positive assessments referred to improved awareness of water conservation, greater community involvement in conservation activities, and the existence of a legal basis for protecting resources. Some participants believed that

legislation on paper but often lacks the resources and capacity to enforce it (Nghihalwa, 2026, p. 264).

Therefore, the findings do not support the simple conclusion that NRM legislation is effective or ineffective. Effectiveness is conditional in nature. Laws provide authority and direction, but outcomes vary according to whether the rules are communicated, monitored, enforced, accepted, and adapted.

3.6 Strengths of the legislative framework

Four strengths emerged from the thesis. First, legislation provides formal recognition that natural resources must be managed for long-term public and ecological interest. Second, the framework covers multiple dimensions of sustainability, including land, water, biodiversity, wildlife, communal resources and environmental protection. Third, the framework creates institutional roles for ministries, councils, traditional authorities and other stakeholders. Fourth, it provides a basis for monitoring compliance

assessment, sanctions, and accountability.

The participatory potential of the legislation was another strength. Participants argued that communities possess knowledge of seasonal water and land use practices, resource availability, environmental change, and local violations. They also indicated that communities are more likely to respect rules when consulted and when their knowledge and needs are considered. The existence of traditional governance structures was viewed as an opportunity to connect formal law with locally recognised authorities.

Table 2. Strengths of NRM legislation and conditions that limit their practical value.

Legislative strength	How it appears in the CEB case	Limitation requiring attention
Formal authority	Laws define public environmental interests and resource use responsibilities.	Authority is weakened when mandates overlap or when enforcement is irregular.
Broad substantive coverage	Land, water, biodiversity, wildlife, and environmental protection were also addressed.	Sectoral coverage may be fragmented across institutions.
Conservation and sustainable-use orientation	Rules seek to protect ecosystems while	Restrictions may conflict with livelihoods when

	permitting their controlled use.	alternatives are not available.
Participatory potential	Communities and traditional authorities can support awareness, local monitoring and compliance.	Participation may become consultative rather than decision-making in nature.
Accountability basis	Monitoring, sanctions, and compliance responsibilities are legally enforceable.	Limited staff, resources, data, and follow-up reduce deterrence.
Adaptation potential	Rules can be reviewed as environmental conditions change.	Static implementation and weak feedback can render rules less relevant.

3.7 Weaknesses and implementation constraints

The principal weaknesses were not described as the absence of legislation. These are weaknesses of the implementation. The first is weak enforcement and compliance monitoring. Participants referred to illegal water extraction, unregulated grazing, deforestation, poaching, and other forms of unlawful water use. One participant summarised the problem directly: “Laws alone are not enough; without enforcement, they cannot protect our environment”

The second weakness is the limited institutional capacity. Respondents identified shortages in personnel,

technical expertise, funding, equipment, and monitoring infrastructure. Third, there is fragmented coordination among institutions with overlapping responsibilities. Fourth, there was low awareness and limited access to understandable information. Participants suggested that complex legal language and inadequate communication contributed to confusion and noncompliance. The thesis specifically recommends translating NRM legislation and related information into Oshiwambo and using locally accessible educational approaches to this end.

The fifth weakness was insufficient meaningful participation. Although consultation was recognised as important,

participants indicated that decision-making could remain top-down. This concern corresponds with the Namibia-specific findings of Shaamhula et al. (2024), who reported that disaster-risk implementation in the CEB was incomplete and that affected rural communities had a limited voice in risk-reduction deliberations.

The sixth weakness was the inadequate adaptation. Participants argued that environmental conditions change due to drought, flooding, population growth, land-use change, and climate variability. Static rules that are not reviewed in light of ecological and social evidence may become difficult to enforce or poorly suited to the present conditions.

3.8 Conditions for improved effectiveness

The thesis identified five conditions that would improve effectiveness: stronger monitoring and evaluation, meaningful stakeholder engagement, capacity building, consistent enforcement and compliance, and adaptive management. Participants proposed using indicators such as changes in biodiversity, soil erosion, deforestation, water quality, overgrazing, and visible changes in land and water management practices. They

also recommended community participation in the monitoring and reporting of violations.

The findings indicate that collaboration is most effective when it combines government authority, local knowledge, traditional leadership, civil society support, and community ownership. This is consistent with Salom and Khumalo's (2022) finding that governance, leadership, training, community involvement, coordination, and institutional support are critical to rural water management in northern Namibia.

3.9 Contextual triangulation: ecological variability and institutional vulnerability

Thesis themes acquire additional significance when read alongside recent CEB environmental evidence. The basin is not a stable setting in which a single rule can be mechanically applied. Hamunyela et al. (2022) showed that inundation varies sharply across years and that areas with relatively infrequent flooding may experience severe losses during extreme events. This supports the thesis finding that monitoring, land-use awareness, and adaptive management are essential rather than optional additions to the legislation.

Groundwater evidence is equally important. Bäumle et al. (2024) demonstrated that deep freshwater aquifers contain complex mixtures of groundwater of different ages and salinities. This implies that water sustainability cannot be assessed solely based on visible surface water or short-term availability. Rules concerning abstraction, water quality, infrastructure, and settlement should be informed by hydrogeological evidence and precautionary measures. The thesis participants' emphasis on sustainable water management reflects a system in which both seasonal surface processes and long-term groundwater processes are important.

Contextual evidence also clarifies why institutional weaknesses can have cumulative effects. When flood information is not linked to land-use decisions, groundwater knowledge is not connected to permits, or community observations are not incorporated into official monitoring, legislation becomes fragmented across ecological scales. The thesis findings on coordination, capacity, and monitoring should therefore be understood as constraints on the basin's ability to respond to variability, not merely as administrative inconveniences.

4. Discussion

4.1 Legislation as an enabling institution

The first objective demonstrates that the NRM legislation plays an enabling role. It defines environmental values, assigns responsibilities, and creates a public basis for the regulation of resource use. This result is consistent with Cordonier Segger and Schrijver (2021), who argue that the law can catalyse sustainable natural resource management across multiple levels, especially where it supports participation, transparency, monitoring, reporting, and collaborative regimes.

However, the CEB findings also show that legislation is an enabling institution rather than an autonomous environmental intervention. Its role is mediated by institutions that interpret and enforce it and by communities whose activities it regulates. This explains why the same legal framework can produce conservation gains in one location and resistance or noncompliance in another. A law that is clear, legitimate, communicated, and supported may guide the behaviour of the people. A law that is unknown, under-enforced, or perceived as threatening subsistence may have little practical effect on the community.

4.2 The implementation gap in regional perspective

The second objective's findings strongly parallel those of the southern African governance literature. Falayi et al. (2021) identified coordination, accountability, capacity, skills, and resources as recurring challenges. Each appears in CEB evidence. Therefore, the basin's problems are not isolated or purely local. This reflects a wider regional pattern in which environmental governance institutions are asked to manage complex social-ecological systems without sufficient authority, resources, data, or coordination.

Oteng-Abayie et al. (2022) provide quantitative regional support for the importance of high-quality regulation. Their findings show that better environmental regulatory quality is associated with better environmental sustainability in sub-Saharan Africa, but they also emphasise rigorous implementation. The CEB case adds qualitative details to this relationship. Regulatory quality is experienced through communication, staffing, monitoring, enforcement, local legitimacy, and availability of livelihood alternatives. These are the mechanisms through which formal rules become environmental outcomes.

Capacity is not only a technical issue. It includes personnel and equipment, as well as institutional authority, clear mandates, reliable budgets, data systems, legal literacy, and cross-sector coordination.

4.3 Customary authorities and legal pluralism

The thesis findings place traditional authorities at the centre of land governance, awareness, conflict management, and local enforcement. This is consistent with Schwaiger et al. (2024), who found that customary authorities commonly manage, support, and enforce environmental regulations. Their contribution is particularly relevant in rural settings, where local leaders have social legitimacy and knowledge that state agencies may not possess.

Nevertheless, the CEB case requires institutional clarity. Traditional authorities should not be treated as informal extensions of the state or as automatically sustainable actors. Their authority should be clearly connected to statutory mandates, community accountability, gender and social inclusion, transparent decision-making and environmental indicators. Schwaiger et al. (2024) warn that unclear legal relationships between customary authorities and the state are

associated with poor governance outcomes. The practical implication for the CEB is a co-governance arrangement in which statutory and customary roles are complementary, documented and reviewable.

Legal pluralism can be a strength when it combines various forms of knowledge and authority. This can be a weakness when the same resource is governed by contradictory rules or when responsibility is shifted between institutions. Therefore, the CEB requires mechanisms to resolve conflicts between statutory requirements, customary practices, regional decisions, and community livelihood needs. Such mechanisms should be accessible, transparent, and capable of producing written explanations and feedback.

4.4 Participation, legitimacy, and compliance

The thesis's evidence on mopane worm harvesting and other livelihood activities illustrates why compliance cannot be understood only as obedience to a legal command. People assess rules in relation to survival, fairness, procedural inclusion, and access to alternatives. When communities are excluded from decisions or receive only prohibitions without support, the legitimacy of the law

deteriorates. When they participate in designing, monitoring, and reviewing rules, compliance may become a shared responsibility.

This interpretation is supported by research on water governance in Namibia. Salom and Khumalo (2022) show that community management requires training, leadership, coordination, and institutional support. Decentralisation without these conditions can transfer responsibility without transferring the means to fulfil it. The same logic applies to the NRM legislation. Community participation should not mean that local people carry the burden of enforcement while state institutions remain under-resourced. This implies shared authority, information, capacity, and accountability.

Participation should also be assessed in terms of its depth. For the CEB, meaningful participation would allow communities and traditional authorities to influence risk interpretation, restrictions, monitoring priorities, indicator selection, and implementation review, without removing the state's protective responsibility.

4.5 Climate variability and adaptive legislation

The CEB's recurrent floods, droughts, changing rainfall patterns, and land use pressures make adaptive governance essential. Shaamhula et al. (2024) found that Efundja affects rural homes, harvests, livestock, mobility, and access to services, whereas the national disaster response remained partly reactive and top-down. The thesis similarly reports that stakeholders want laws and management practices that can respond to changing environmental conditions.

Adaptive legislation does not imply rules without standards. This means establishing periodic reviews, ecological thresholds, community feedback, monitoring indicators, and procedures for revising implementation when conditions change. In the CEB, adaptive management can link seasonal water observations, flood and drought information, vegetation and land degradation indicators, and community reports to decisions by basin institutions and regional authorities. Such a system would help shift governance from reactive enforcement to anticipatory management.

4.6 Monitoring and evaluation as the missing bridge

Monitoring and evaluation have emerged as a bridge between legal intent and sustainability outcomes. Participants proposed indicators such as biodiversity, soil erosion, deforestation, water quality, overgrazing, and observable changes in land and water management practices. These indicators are useful because they connect legal implementation to environmental conditions rather than measuring only activities such as the number of meetings held or inspections conducted.

A robust CEB monitoring system should combine institutional and community observations. Government agencies may provide technical measurements, permits, enforcement records, water information, and land use data. Communities can provide information on seasonal changes, illegal activities, access conditions, local conflicts, resource scarcity, and emerging risks. Traditional authorities may contribute to place-based knowledge and social coordination. The credibility of the system depends on agreed definitions, data validation, public reporting, and feedback on decisions.

Table 3 presents an indicator framework derived from the thesis findings. The indicators were not presented as

measured results. They are a submission-ready research and policy framework for future implementations and evaluations.

Table 3. Proposed indicators for assessing NRM legislation implementation in the CEB.

Implementation dimension	Proposed indicators	Possible evidence source	Responsible actors
Legal awareness	Proportion of stakeholders who can identify relevant rules, availability of Oshiwambo legal information, and number of outreach activities.	Short knowledge assessments, outreach records, and community feedback.	Line ministries, regional councils, traditional authorities, and NGOs.
Enforcement and compliance	Illegal abstraction, poaching, deforestation, unregulated grazing, and sand mining; response time; and case resolution were reported.	Inspection records, community reports, and enforcement registers.	Competent ministries, councils, traditional authorities, police, and justice institutions.
Water sustainability	Water quality, abstraction compliance, functionality of water points, seasonal availability, and user conflict were assessed.	Water monitoring, permits, and community water-point records.	Water authorities, local committees, regional councils, and communities.

Land and biodiversity	Vegetation loss, veld fires, habitat conversion, wildlife incidents, soil erosion, and restoration activities.	Remote sensing, field observation, local monitoring, and environmental assessments.	Environmental authorities, land boards, traditional authorities, and researchers.
Participation and legitimacy	Representation of women, youth, resource users, and traditional authorities and documented responses to community input.	Meeting records, participation audits, interviews, and grievance records.	All the implementing institutions.
Adaptive governance	Frequency of policy review; use of monitoring evidence; documented changes in rules or practices after feedback.	Review reports, management plans, and decision records.	Basin-level and national coordinating institutions.

4.7 Adaptive and transboundary basin governance

The combined evidence indicates that CEB requires adaptive governance rather than stronger command-and-control regulations. Adaptive governance does not imply the absence of rules. It is a

structured capacity to revise decisions when new ecological information, climate conditions, or livelihood effects are visible. Wyborn et al. (2023), examining water reform and climate change in Australia's Murray–Darling Basin, show that technically sophisticated governance can remain insufficient when it excludes justice, power, and First Nations'

participation. Their analysis is relevant to the CEB because it demonstrates that adaptive institutions must address who has the authority to define the problem, whose knowledge counts, and who bears the costs of reform.

For the CEB, adaptive governance links statutory decisions to seasonal flood information, groundwater evidence, local observations, and periodic livelihood assessments. Hamunyela et al. (2022) provided a spatial baseline for surface water variability, whereas Bäumle et al. (2024) demonstrated why groundwater decisions require a longer temporal horizon. Mapani et al. (2023) further showed that climate-resilient water management requires investment in storage, recharge, and water harvesting. These sources collectively support the thesis recommendation that monitoring and evaluation should be continuous and connected to decision-making.

The basin's transboundary character makes cooperation equally important. Mndzebele (2025) identifies information exchange, basin institutions, and capacity support as central to preventing conflict in the SADC region. For the CEB, this means that a national implementation strategy should include channels for Namibia–Angola communication, shared flood and

water information where feasible, compatible indicators, and procedures for resolving disputes. Transboundary cooperation should complement, rather than replace, local participation. Regional institutions can coordinate data and policy, whereas communities and traditional authorities contribute place-based knowledge and legitimacy.

This implies a multi-level implementation model. National ministries provide legal authority and technical standards. Regional and local institutions translate these standards into operational strategies. Traditional authorities and communities support communication, observation, conflict management and social accountability. Basin and transboundary institutions coordinate the shared ecological processes. Weakness at any level can undermine the entire system, which explains why the thesis participants repeatedly identified coordination and capacity as central concerns.

5. Recommendations: Practice and Future Research

5.1 Recommendations for practice

The combined evidence suggests that the environmental sustainability of CEB depends on five linked transitions. The first

is the transition from fragmented mandates to basin-level coordination. The second is the transition from legal awareness as a specialist activity to accessible public education in local languages. Third, there is a transition from enforcement centred mainly on punishment to compliance supported by incentives, alternatives, and legitimate participation. The fourth is the transition from occasional inspection to continuous state–community monitoring. The fifth is the transition from fixed implementation to adaptive learning.

These transitions do not require replacing the entire legislative frameworks. They require making the existing provisions operational. A practical implementation framework should therefore include clearly assigned institutional responsibilities, an inter-regional and transboundary coordination mechanism, trained enforcement and extension officers, community and traditional-authority monitoring teams, accessible legal information, a shared environmental indicator system, transparent reporting, and periodic review of rules against ecological and livelihood evidence.

First, implementation should begin with a mandate and an accountability map. Each priority rule should identify the institution

responsible for communication, permitting, monitoring, enforcement, reporting, and appeals. The map distinguishes the authority of ministries, regional councils, local authorities, traditional authorities, community committees, and basin institutions. This would address the overlapping authority problem documented in Namibia by Hebinck (2021), where disputes persist partly because institutions hold competing interpretations of land and grazing responsibilities. The map should be public, reviewed annually, and accompanied by procedures for resolving institutional disputes.

Second, enforcement should be credible, proportionate and socially intelligible. The lesson from Guo (2023) is that punitive inspections alone do not solve implementation gaps. Rules require a credible connection between violations, evidence, responsibility, and consequences. In the CEB, enforcement should combine education, warnings, restoration obligations, administrative sanctions, and prosecution for serious or repeated harms. Priority violations should be selected based on environmental risk and livelihood sensitivity, rather than political visibility alone. Case-tracking systems should record complaints,

inspections, decisions, and outcomes so that communities can see whether reports lead to action.

Third, water and land decisions should be based on evidence. Surface water maps, groundwater studies, community observations, and climate information should be used to inform settlement planning, abstraction rules, flood preparedness, and restoration priorities. The hydrogeological findings of Bäumle et al. (2024) caution against treating groundwater as an unlimited reserve, whereas Hamunyela et al. (2022) show why infrequent flooding can still create high risk. This evidence should be translated into accessible planning tools rather than remaining confined to technical agencies.

Fourth, participation should be designed as co-production rather than one-way

consultation. Communities and traditional authorities should help identify environmental indicators, define local monitoring routes, interpret seasonal evidence, and review the effects of these restrictions. Participation should include women, youth, resource users, and marginalised households. Gotyi and Handi (2025) show that formal programs and culturally embedded voluntary practices can complement each other. In the CEB, this supports combining government-supported programs with locally meaningful stewardship practices rather than treating informal action as outside the legal system.

Table 4 translates these implications into a staged-implementation agenda. This is intended as a policy implication of the research, not as a claim that these actions have already been implemented.

Priority	Immediate action	Medium-term action	Intended sustainability outcome
Institutional coordination	Map mandates and identify overlaps.	Establish basin coordination and reporting mechanisms linked to relevant Namibian and	More coherent decisions and reduced duplication are required.

		transboundary institutions.	
Legal communication	Prepare plain-language and Oshiwambo information on the priority rules.	Institutionalise continuous environmental legal literacy programmes.	Higher awareness and more legitimate compliance are also required.
Community and customary participation	Communities and traditional authorities should be included in monitoring priorities.	Establish documented co-governance procedures with safeguards for accountability and inclusivity.	Stronger ownership, local knowledge integration, and social legitimacy are also required.
Enforcement capacity	Identify priority violations and response responsibilities of the relevant parties.	It is important to provide personnel, equipment, training, budgets, and transparent case tracking.	More credible deterrence and reduced unlawful resource use.
Monitoring and evaluation	Agree on a small set of environmental and governance indicators.	Integrate technical, community, and traditional observations into periodic public reviews.	Evidence-based adaptation and visible environmental impacts.
Livelihood compatibility	Livelihood dependence should be assessed before imposing restrictions.	Supporting sustainable alternatives, benefit-sharing, and restoration-based livelihoods.	This reduces the conflict between conservation and household survival.

Climate adaptation	Flood and drought scenarios should be included in local implementation plans.	Review rules and management practices using seasonal and long-term evidence.	Greater resilience to ecological and climate variability is required.
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Table 4. Staged implementation agenda for strengthening NRM legislation in the CEB. Source: Author's synthesis of findings.

5.2 Recommendations for future research

Future research should evaluate whether the proposed implementation measures produce measurable environmental and social benefits. Longitudinal research should combine biodiversity, water quality, land degradation, enforcement, and livelihood indicators. Household surveys can assess legal awareness, perceived legitimacy, compliance, distributional effects, and participation across the four Namibian regions. Comparative research across the Namibian and Angolan sides would clarify how transboundary institutions and different administrative arrangements influence policy implementation. Further work should examine how CUVECOM and national institutions coordinate basin governance and how customary knowledge can be incorporated without weakening accountability or inclusion.

This study has three limitations that should be addressed in future research. It is a qualitative case study of the Namibian side of a transboundary basin, relying on thesis-reported accounts rather than independent measures of ecological trends or compliance, and its stakeholder composition is institutionally weighted. These limitations do not diminish the value of the thematic findings but indicate the need for mixed-method and longitudinal designs.

Future research should also test the proposed implementation chain at the level of specific laws, and locations. A comparative design could examine whether the Environmental Management Act, Water Resources Management Act, and Communal Land Reform Act produce different outcomes because of differences in institutional mandates, public awareness, enforcement resources, and resource dependence. Such research

should distinguish outputs, such as meetings and inspections, from outcomes, such as reduced illegal abstraction, improved water quality, reduced habitat loss, and increased livelihood resilience.

Participatory action research would be valuable for developing Oshiwambo legal literacy materials, community monitoring protocols, and locally relevant indicators. Remote sensing and hydrogeological monitoring can be combined with household and institutional data to explain how flood variability, groundwater conditions, land-use change, and governance responses interact. Finally, cross-border research should examine how Namibia and Angola exchange information, coordinate flood and water management, and involve basin communities in decisions that affect shared ecological processes.

6. Conclusion

This study examined the role and effectiveness of NRM legislation in the Cuvelai–Etosha Basin using two objectives from the underlying thesis. The findings show that legislation plays an essential role in regulating resource use, protecting ecosystems and wildlife, promoting sustainable development, addressing environmental pressures,

conserving biodiversity, and guiding water management. The legislative framework's principal strengths are its formal authority, broad environmental scope, recognition of public interests, and potential to connect state institutions to traditional authorities and local communities.

Its effectiveness is conditional and inconsistent. Stakeholders identified positive effects, such as rules improving water conservation awareness, supporting collaborative initiatives, or providing a basis for protection. They also identified an implementation gap caused by weak enforcement, limited capacity, inadequate monitoring, fragmented coordination, low awareness, livelihood pressures, insufficient participation, and poor adaptation to changing conditions. These weaknesses are consistent with recent global, African, and Namibian studies.

The central conclusion is that environmental sustainability in CEB will not be secured by legislation alone. The priority is to strengthen the institutional, social, and informational conditions that allow the legislation to operate. Namibia should connect national NRM laws to coordinated basin governance, clarify the roles of statutory and customary authorities, provide resources for decentralised implementation,

communicate rules in locally meaningful forms, involve communities in monitoring and review, and use measurable environmental indicators to assess impact. Such reforms would convert legal authority into practical environmental stewardship while recognising that the CEB's ecological future and community livelihoods are interdependent.

Declarations

Ethics approval and consent to participate: The underlying thesis reports institutional ethical approval, informed consent, confidentiality, anonymity, and the right to withdraw from the study. This study used thesis-derived findings and did not introduce new participant data.

Consent for publication:

Not applicable to the new data collection. Any direct quotations reproduced from the thesis are subject to the permissions and consent conditions governing the original study. Availability of data and materials:

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