

TRANSFORMATIVE PROCESS USING CRITICAL SYSTEMIC INTERVENTION IN BANTEN PROVINCE, INDONESIA

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Abstract

This paper documents engagement with the community aimed at supporting social and environmental justice. A coastal community provides insights into the impacts of climate change where mangroves are under threat (resulting in storm surges) and where the downstream effects of inorganic fertilizers, plastic, and other debris impact marine life. Transformative potential lies in engaging coastal communities together with Universitas Sultan Ageng Tirtayasa and Universitas Padjadjaran to protect marine life, beaches, and mangroves – supporting a local circular green economy that sustains seaweeds, fish, and crustaceans, as well as ecotourism along the Cidurian–Cisadane river banks. In other areas, the pressure to make ends meet during and after the COVID-19 pandemic has been acutely felt by women and young people. Indebtedness to loan sharks during COVID-19, when small enterprises suffered, has placed additional pressure on vulnerable groups struggling to survive. This critical ethnography for transformative praxis argues that local communities should participate in multifaceted solutions to address the social and economic factors impacting coastal environments. The study offers practical insights into Banten’s coastal community dynamics with reference to climate change and the implications of “business-as-usual”. It contributes to discussions on developing a local circular green economy (with potential for ecotourism) and highlights how the pandemic’s economic pressures on women and youth call for inclusive, networked governance solutions.

Keywords: community; governance; policy; systemic intervention; development, narratives

Introduction

Water insecurity in Indonesia is a systemic issue spanning social, ecological, and governance dimensions. It has been widely discussed in the literature (e.g., Widianingsih, 2020; Simbolon & McIntyre-Mills, 2019) in terms of habitat loss, water injustice, price gouging, and mismanagement under decentralized governance. In this paper, we examine problems associated with decentralized water mismanagement and the cost to the urban poor, drawing on case studies from Tarumajaya (an upstream highland community in West Java), Depok (an urban floodplain area in Greater Jakarta), and Banten’s coastal communities. The water governance issue requires policy networking instead of conflicting siloed approaches. Over the past decade, Indonesia has seen multiple natural disasters strike its small islands and coastal regions. For instance, the December 2018 eruption of Anak Krakatau volcano caused tsunami waves that directly hit Banten’s coast, affecting Pandeglang and Serang Regencies. Although regulations mandate spatial planning in coastal buffer zones, these rules are often disregarded (Daulat et al. 2018). Such events underscore the urgency of addressing water resilience and governance in both rural and urban contexts.

Literature Review

Effective water governance requires rethinking traditional approaches and integrating diverse perspectives. Our analysis is grounded in Critical Systems Thinking (CST), particularly boundary critique (Ulrich, 2005),

epistemic pluralism (Romm, 2001), systemic governance (McIntyre-Mills, 2006), transformative axiology (Flood & Jackson, 1991), and gender perspectives in transitional contexts (Corcoran-Nantes, 2005). These theoretical lenses inform our approach to analysing water governance by emphasizing inclusivity, multiple ways of knowing, and the importance of values and power dynamics in system change. Recognizing diverse ways of knowing is vital: for example, the Baduy indigenous community manages forests and water through inherited wisdom – prohibiting chemical use near water sources, separating river uses for bathing vs. drinking, and enforcing taboos that preserve ecosystem health. Such local wisdom is often marginalized in “modern” policy, yet it offers a model of regenerative, community-led governance. Integrating these indigenous practices into formal governance—by legally protecting indigenous rights, adopting Baduy-like water zoning, and including indigenous leaders in decision-making—could enhance sustainability and equity.

Critical Systemic Approach

This study employs a critical systemic approach and includes ethnography and mixed-methods. Our aim was not only to understand the complexity of Banten’s water governance system, but also to engage with it in ways could help to bring about change. We followed three key design principles inspired by CST.

Firstly, we intentionally sought out perspectives from those at the margins – for example, subsistence fisherwomen, informal water sellers, and indigenous Baduy community members – to challenge the dominant boundaries that often include only officials and engineers. By expanding the boundary of inquiry (‘Boundary Critique’), we ensured that traditionally excluded voices informed our understanding of the problem.

Secondly, we used mixed methods and data sources to integrate diverse knowledge systems. We conducted 35 narrative interviews across three regions (Tarumajaya in West Java, and Pandeglang and Lebak in Banten) with community leaders, women, and local traders; we facilitated focus group discussions in collaboration with Universitas Sultan Ageng Tirtayasa (UNTIRTA) involving government officials, BUMDes managers, NGO activists, and informal workers; and we analysed secondary data (e.g., policy documents) and bibliometric results from over 1,000 journal articles on water governance (2018–2024) to situate local findings in broader trends. This pluralistic approach allowed technical, local, and academic insights to be considered side by side.

Rather than treating interviews and workshops as extractive data-gathering exercises, we approached them as dialogues asking, ‘What needs to change, for whom, and why?’. Making our transformative intent explicit encouraged participants to reflect on their own aspirations for change. This helped blur the line between research and intervention, as community members began formulating and acting on ideas (e.g., a women’s group lobbying for support of a recycling initiative) during the research process. The research process helped surface, legitimate, and refine an emerging community proposal. In one focus-group exchange, a young woman described her unsuccessful attempt to secure village backing for a recycling initiative, and the discussion shifted from blaming residents for poor waste discipline to recognising the lack of institutional support as the central barrier. The initiative therefore remained at the stage of community advocacy during the study, but the research helped make it more visible and discussable among village actors, officials, and university partners

In terms of data collection, we used a combination of qualitative techniques, supported by participatory tools. Narrative interviews provided in-depth personal stories and perspectives. For example, a village elder in an upland area recounted how the river he fished in as a youth is now “already dead” due to pollution, linking this ecological loss to social changes like the out-migration of youth. Women micro-entrepreneurs described a labyrinth of informal debt – how a bad fishing season or medical bill forces them to borrow

from rotating credit groups or loan sharks, creating anxiety that permeates their households. Such stories illuminate the human consequences of governance failures. We also conducted focus groups where stakeholders confronted divergent views. In one session, a local official in a coastal village initially blamed the community for ‘lack of discipline’ in waste management; after hearing a young woman describe her failed attempts to get village support for a recycling program, the official conceded that the lack of institutional backing was a real barrier. These moments of mutual learning are exactly what CST methods seek to provoke. Additionally, we utilized visual participatory methods: in boundary mapping workshops, villagers drew diagrams of their water system as they perceive it, and in “system drawing” exercises, we asked groups to sketch influences and feedback loops (who influences what in water management). These yielded rich insights into mental models – one group drew the national government as a large cloud raining regulations on tiny houses below (illustrating feelings of top-down pressure), while another drew the flow of money from fishermen to loan sharks as a leaky bucket. We obtained permission to reproduce simplified versions of some co-created diagrams as figures in this paper, as they informed our analysis.

Qualitative data (interview transcripts, field notes, workshop outputs) were coded thematically with an eye for systemic patterns and anomalies. We iteratively built a causal systems model of the situation, identifying key feedback loops, delays, and potential leverage points. We considered multiple future scenarios – business-as-usual (current trends continuing), incremental change (partial improvements, e.g. a new water supply project or policy tweak), and regenerative transformation (holistic systemic change toward sustainability and equity). By mapping quotes, observations, and community-drawn sketches onto these scenarios, we examined how different values and power dynamics played out under each. For instance, under business-as-usual we observed a reinforcing loop between environmental degradation and poverty; under incremental change, we saw that new projects (like a water treatment plant) might ease some symptoms but leave underlying inequities untouched; only under a transformative scenario did our analysis break the vicious cycles by altering power relations and institutional norms. Throughout, we reflected on how our own engagement might be influencing the system (reflexivity), consistent with CST’s emphasis on researcher accountability. The findings were then synthesized into a narrative that links context, systemic structure, and leverage points for change.

Discussion

Our findings paint a complex picture of water governance in Banten’s coastal communities, entangled with socio-economic vulnerabilities and environmental changes. The crisis is not merely about hydrology or infrastructure – it represents a systemic governance failure where social, political, ecological, and cultural threads are deeply interwoven. Below, we first outline the key challenges identified, then analyse systemic patterns (including feedback loops), and finally propose leverage points for transformative change.

Socio-Political Challenges

The local residents face ecological degradation, socio-economic inequality, governance fragmentation, and the gendered debt trap. These problem patterns generate pressure and demand for change. Rather than responding with ad-hoc technical fixes, the analysis deliberately passes through a critical systems lens: boundary critique, epistemic pluralism, and transformative axiology. In other words, we pause to ask whose perspectives are included, which knowledges are legitimised, and what values are driving decision-making.

Governance in Banten’s water sector is highly fragmented and often top-down. Decentralization was intended to empower local decision-making, but in practice it sometimes devolved into competition among agencies and power brokers. National bodies impose policies from the top, while provincial, district, and village authorities lack coordination and capacity to implement context-specific solutions. For instance,

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managing a single river might involve a Provincial Water Bureau, district public works offices, and even military task forces during floods – all operating under different mandates with minimal synergy. Village governments have formed local enterprises (BUMDes) to manage village wells or ecotourism sites, yet these efforts operate in silos, rarely integrated with higher-level plans.

Patronage politics further complicate matters: local elites may capture resources (e.g. irrigation budgets or water contracts) for personal gain, leaving marginalized groups (landless farmers, fisherfolk, women's groups) with little influence. Such misalignment among stakeholders leads to neglect of critical issues like river pollution and watershed protection. Community voices – especially those of women, indigenous people, and informal water users – remain peripheral in decision-making, as power and knowledge are concentrated at the top.

Grounded interventions by researchers

In this section, the researchers are Riswanda, I. Widianingsih, and Janet J. McIntyre-Mills. Janet J. McIntyre-Mills is included here in conversation with the research team.

Rather than positioning ourselves as outside observers, we used the research process itself as a critical systemic intervention. First, we deliberately widened the boundary of participation by including actors who are usually excluded from water governance discussions, including subsistence fisherwomen, informal water sellers, women micro-entrepreneurs, local traders, and Baduy community members, instead of relying only on officials and technical experts. Second, we created dialogic spaces in which these groups could speak directly with government actors, BUMDes managers, NGO activists, and university partners through narrative interviews, focus groups, and participatory workshops. Third, we used boundary-mapping and system-drawing exercises so that participants could represent the water system in their own terms, including the power relations, debt flows, and institutional pressures shaping everyday life. In this sense, the intervention was not only analytical but political: it changed who was heard, what counted as relevant knowledge, and how the problem was framed.

This process generated concrete shifts in understanding during the study itself. In one focus group, for example, a local official initially framed waste problems as a matter of community indiscipline; after hearing a young woman explain that her recycling initiative had failed because she could not secure village backing, the discussion shifted toward the absence of institutional support as the real barrier. Likewise, by treating interviews and workshops as spaces for asking 'what needs to change, for whom, and why?', the study enabled participants to move from recounting hardship to identifying leverage points for action. We therefore do not claim that the research itself established a full recycling enterprise or solved the governance problem directly. The more defensible claim is that the authors intervened by restructuring participation, surfacing marginalized knowledge, facilitating cross-stakeholder learning, and helping reframe problems from 'community failure' to 'systemic and institutional failure'.

interventions and community engagements emerging from the action research

The action-research contribution of this study lies in identifying and strengthening concrete forms of community engagement that can interrupt business-as-usual dynamics. One example is the village-scale water treatment site, where a local water manager met with university outreach volunteers, including women and young people, to discuss improvements to a community-built filtration system. This was a practical form of participatory governance: discussion took place at the point of service delivery, around infrastructure built in response to gaps left by the formal system. A second example is women's informal governance work in coastal villages, where PKK and Posyandu (community health service) actors keep records on household wellbeing, child nutrition, and small loans used to avoid predatory lenders. These practices already function as community governance infrastructure and can be strengthened through formal recognition, budget support, and integration into village planning.

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The study also points to feasible systemic interventions that build directly on these observed engagements. These include village-backed women-led recycling or waste-sorting initiatives; composting or maggot-based organic waste projects linked to training and safeguards; regular canal-side or riverbank forums where residents, women water managers, informal workers, and officials negotiate responsibilities for waste, drainage, and repair; and stronger collaboration between village governments, BUMDes (village owned enterprise), universities, and community groups in managing wells, ecotourism, and local livelihoods. In the coastal case, such interventions could be linked to circular-economy activities such as community recycling, paid mangrove restoration, micro-cooperatives for fisherfolk and traders, and locally managed ecotourism. The significance of these examples is that they show how action research can move beyond critique: not by imposing a solution from outside, but by making visible the community practices, relationships, and institutional supports through which more just and regenerative water governance can actually be built. Several grounded examples were documented in a women's ledger work as informal governance, composting or maggot-style waste practice, canal-side dialogue, Baduy stewardship, a village water-tank meeting with university outreach volunteers, and the Situ Gelam public consultation material. Those scenes are the empirical bridge between critical reflection and transformative engagement.

The authors can credibly say that they undertook a critical systemic intervention in process, even if they should not yet claim sole responsibility for a fully institutionalised local programme. The research team clearly widened the boundary of participation by deliberately including actors usually left outside technical water governance frames, such as fisherwomen, informal workers, young traders, and Baduy knowledge-holders. The team also facilitated focus groups and workshop-style dialogues with officials, BUMDes-related actors (village owned enterprises), NGOs, and community participants; used participatory boundary-mapping and system-drawing tools; and treated inquiry as a dialogic process in which participants asked what needed to change, for whom, and why. That is already a real intervention in the systemic sense, because it altered who could contribute to problem definition and what forms of knowledge could enter discussion.

The intervention generated changes in learning and recognition. The current draft already reports a moment in which an official shifted from blaming the community for poor waste discipline to recognising the institutional barriers faced by a young woman trying to secure support for a recycling initiative. The uploaded narrative also contains community-level participatory scenes that substantiate this broader claim, namely women's groups performing record-keeping and accountability functions, canal-side discussion framed as a governance turning point, local-university interaction at a village water-treatment site, and a formal public consultation process around Situ Gelam. In critical systems terms, those are not incidental anecdotes. They are evidence of boundary challenge, mutual learning, and the opening of deliberative space. For instance, women's recycling group already existed and the researchers helped it gain visibility. The researchers convened the meeting in which the idea was sharpened.

First intervention involved village-level water and waste forum. The paper already argues for multi-stakeholder dialogue. Village governments can convene a regular *musyawarah* (community group discussion)-style forum, BUMDes can bring service and enterprise concerns, women's groups and *Posyandu/PKK* (health community service) cadres can bring household-level evidence, district agencies can respond on infrastructure and waste, and river-basin actors such as BBWS Ciliwung Cisadane can align *situ* and river management. This is reasonable in the Indonesian governance context because village law gives villages authority in governance, development, community development, and empowerment. BUMDes has a formal legal basis. *Posyandu* is a participatory village or *kelurahan* institution; and official river agencies already work with other state actors on river and *situ* maintenance.

Second intervention involved a women-led circular-economy pilot. Village governments seed-fund the pilot through village planning and budget channels, BUMDes or a women's cooperative manages the operational unit, *PKK* and *Posyandu* cadres mobilise households and maintain records, district

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environmental offices provide equipment and market linkage, and partner universities — especially Universitas Sultan Ageng Tirtayasa and Universitas Padjadjaran— provide training, student outreach, and monitoring. The activity itself is named: waste-bank collection, composting, maggot processing for organics, eco-bricks, or fish-processing by-product reuse. Indonesian regulations already treat waste banks as community-, business-, and/or local-government-managed 3R and circular-economy facilities, while national officials continue to emphasise that their success depends on deeper community participation.

Third intervention involved a community water-system co-management arrangement. The system-level challenge is not only building small facilities, but sustaining them through tariffs, management, maintenance, community participation, and village-government support. The programme as community-based rural water service, and Indonesian studies of community-based systems show that functionality depends on management arrangements, payment systems, and follow-up support from village and local actors. The paper moves from ‘a village built its own system’ to ‘the case shows why co-management and maintenance institutions matter’.

Fourth intervention included upstream-downstream stewardship pact linking pollution, flood risk, mangroves, and livelihoods. The draft already discusses fragmented governance and coastal vulnerability, and the uploaded narrative already points to Baduy stewardship and to the need for forums that connect upstream and downstream actors. The practical intervention is to bring together indigenous leaders, coastal fishers, village governments, district environmental officers, and river-basin actors to agree on spring protection, riverbank monitoring, waste reduction, and mangrove restoration priorities. That is conceptually strong because Baduy customary governance offers a documented model of forest and water protection, while recent Indonesian evidence shows that mangrove loss directly harms fishery household incomes and that waste leakage to sea is shaped by local waste systems and hydrology rather than by ‘littering’ alone.

Participatory action research cycle was developed to underline that each intervention was, organised as a repeating cycle of joint diagnosis, small pilot, monitoring, public review, and redesign. The Indonesian evidence on water-system functionality and waste-bank participation both shows that interventions do not sustain themselves through infrastructure or enthusiasm alone. The cycle tracks diversity of participants, service reliability, waste diverted, debt pressure, and livelihood effects, then feeds those results back into the next forum.

Participatory Engagement

The research team widened the boundary of participation by deliberately including actors usually excluded from technical water governance frames, including fisherwomen, informal workers, young traders, and Baduy knowledge-holders. Working with local university partners, the team convened focus groups and participatory boundary-mapping sessions in which participants drew water flows, waste pathways, debt relations, and institutional bottlenecks from their own standpoint. These sessions were used as feedback spaces rather than extractive interviews: participants compared interpretations, identified who was excluded from current governance, and named immediate actions that could be pursued through village forums, BUMDes, and local service providers. During this process, women participants sharpened a proposal for village-backed support for a recycling or waste-management initiative, while officials were prompted to reconsider earlier assumptions that waste problems were simply a matter of household discipline. The intervention therefore lay not only in analysis, but in reconfiguring who could define the problem, what knowledge counted, and how community claims entered discussion with authorities.

Village governments are not absent from this system, but their role is uneven and often too narrow. In practice, village authorities can convene deliberative meetings, allocate village funds, issue village decrees, recognise and support community institutions, and use BUMDes as an organisational vehicle for service provision or local enterprise. In the cases discussed here, villages have supported activities such as wells,

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small water systems, women's community work, and local enterprise initiatives, yet these efforts often remain weakly connected to district agencies, river-basin management, and longer-term ecosystem protection. The analytical point is therefore not that village governments do nothing, but that their role as conveners, co-funders, and institutional anchors for community-led action remains under-realised.

In this paper, the responsible actors should be named explicitly. Village governments can initiate the proposal through village deliberation and seed funding; BUMDes or a women's cooperative can manage the enterprise; PKK and Posyandu-linked cadres can mobilise households and maintain participation records; district environmental offices can provide equipment, training, and market-access support; and university partners can provide technical assistance, student outreach, and monitoring. Rather than invoking a generic 'hub', the paper should describe a practical pilot: a women-led waste-bank, composting, maggot-processing, eco-brick, or fish-processing by-product initiative linked to household segregation, local clean-up, and modest income generation. This would show how a circular-economy intervention can simultaneously reduce pollution, strengthen women's economic agency, and create a more durable community role in environmental governance.

The group involved in this project include: Provincial and district water agencies, village governments, BUMDes managers, women's groups, indigenous leaders, river-basin authorities, and partner universities need to shift the dominant problem representation from 'scarcity' to 'misdirected systems'. That reframing matters because it changes the unit of intervention: instead of focusing only on new supply infrastructure, these actors are required to address affordability, pollution control, watershed stewardship, and the distribution of decision-making power. In other words, the issue is not only how much water exists, but how governance allocates risk, voice, cost, and ecological harm.

In short, the engagement reported in this study was not limited to interviews. It included cross-stakeholder focus groups, participatory boundary-mapping and system-drawing exercises, dialogic feedback sessions, observation of community water-site discussions with local managers and university volunteers, and attention to formal consultation processes around situ revitalisation. These engagements mattered not only as methods of data collection, but as occasions in which community members and officials encountered each other's accounts, challenged narrow problem framings, and began to identify practical pathways for action.

- A) What the authors actually did using a critical systemic interventionist approach? The paper can credibly claim that the authors made four real interventions in the research process:
1. Authors changed who counted as a legitimate participant in the inquiry. The authors did not study only officials and technical actors. They deliberately included subsistence fisherwomen, informal water sellers, Baduy community members, local traders, women, and community leaders. That is a real critical-systemic intervention, because it widened the boundary of the system and brought excluded voices into problem definition.
 2. Authors created dialogic spaces where conflicting actors had to listen to one another. The authors conducted 35 narrative interviews and facilitated focus groups with officials, BUMDes managers, NGO activists, informal workers, and university partners. They explicitly framed these encounters around the question, "*What needs to change, for whom, and why?*" This is more than data collection: it is structured boundary critique and mutual learning.
 3. Authors used participatory tools to let communities analyse the system themselves. The authors did boundary-mapping workshops and system-drawing exercises in which villagers drew water flows, institutional pressures, and debt relations. These co-produced diagrams then informed the paper's analysis. So the authors did not merely interpret the system for the community; they enabled the community to represent the system in its own terms.
 4. Authors produced shifts in problem framing during the field process. The clearest concrete example is the focus group where an official first blamed the community for

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poor waste discipline, but after hearing a young woman explain her failed attempts to get support for a recycling initiative, the official acknowledged that lack of institutional backing was the real barrier. That is an actual change generated through the research process: a shift from blaming residents to recognizing governance failure.

The authors' actual intervention was not that they directly built infrastructure or launched a full program; it was that they restructured participation, surfaced marginalized knowledge, enabled joint system diagnosis, and shifted some actors' understanding of where the problem lay. During the research, women were already lobbying for support, and the authors helped make that barrier visible in cross-stakeholder discussion. Authors facilitated and documented this emerging initiative.

Our critical systemic intervention lay in widening participation, facilitating cross-stakeholder dialogue, using participatory mapping and system-drawing tools, and creating reflexive spaces in which community members and officials could jointly reframe waste, water, and livelihood problems. The research did not itself establish a full recycling enterprise; rather, it helped surface, legitimize, and sharpen community-led proposals that were already emerging.

B) Interventions / community engagements that can make a difference?

1. A village water co-management meeting at the water tank. This is one of the strongest concrete examples in the narrative. At the village water treatment site, a local water manager sat with university outreach volunteers, including women and youth, to discuss improvements to a community-built water system. This should be presented as a real model of action research: site-based discussion, joint diagnosis, technical support, and community voice at the point of service delivery. At the community water tank, action research took the form of on-site co-analysis: local managers, university outreach volunteers, and community members jointly reviewed the functioning of a village-scale filtration system, discussed gaps left by formal service provision, and identified practical improvements. This was not only a technical discussion but a participatory governance exercise in which women and youth were present as knowledge-holders, not merely end-users.
2. Formalizing women's informal governance work. The narrative gives a very concrete example: women's groups and cadres already keep records on child nutrition, attendance, and even micro-loan repayments. That is already governance work. A real intervention is to recognize this as part of village water and livelihood governance, fund it, and link it to village decision-making. A practical intervention is to formalize women's ledger work as community governance infrastructure. PKK (community health service) and Posyandu-style record-keeping can be linked to village funds, debt prevention, health monitoring, and household water security planning, so that women's existing administrative labour becomes an acknowledged input into policy rather than invisible care work.
3. A women-led recycling / waste pilot backed by village support. The evidence shows that a young woman had tried to get village support for a recycling program and failed. That is exactly the kind of blocked community initiative the paper should turn into a concrete systemic intervention. The authors should specify who does what: women's group proposes and manages; village government allocates support; BUMDes or cooperative handles operations; university/NGO partners provide training.

A concrete intervention was a village-backed women's recycling pilot: a women's group organizes collection and sorting, the village government provides seed support and formal recognition, BUMDes or a cooperative manages operations and market links, and university partners assist with training and

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monitoring. This proposal grows directly out of field encounters in which women identified lack of institutional backing—not lack of motivation—as the key barrier.

5. A canal-side or river-side standing forum. The narrative explicitly frames canal-side dialogue as a leverage point: residents, women water-managers, informal workers, and officials negotiating rules, responsibilities, and repair. This is exactly the kind of participatory intervention that shows action research leading to governance change.

Another intervention was a standing canal or river forum in which residents, informal workers, women managing household water, and local officials meet regularly at the site itself to identify dumping points, clarify responsibilities, monitor repairs, and negotiate practical rules. The point is to move governance from distant administration to place-based collective stewardship.

6. Baduy-informed watershed stewardship. The Baduy case should not remain only a cultural example; it can be framed as a concrete governance intervention. The narrative already proposes regular forums bringing together government officials, farmers, fishers, women's associations, and Baduy leaders, plus formal recognition of customary rules protecting water.

A further systemic intervention was a Baduy-informed watershed stewardship forum, combining customary ecological knowledge with formal planning. This would involve indigenous leaders, local farmers and fishers, women's groups, and government agencies in setting rules for pollution prevention, riverbank protection, and upstream–downstream accountability.

The authors' actual critical systemic intervention was procedural and political rather than infrastructural: they widened participation to include marginalized actors, facilitated cross-stakeholder dialogue, used participatory mapping and system-drawing, and created moments of mutual learning that reframed problems from 'community failure' to 'institutional failure'. Authors helped surface and legitimate an emerging community proposal. The paper shows concrete action-research interventions already visible in the case material: site-based co-management meetings at the village water tank; formal recognition of women's ledger work as governance infrastructure; a village-backed women-led recycling pilot; regular canal-side forums for joint problem-solving; and Baduy-informed watershed stewardship forums linking customary and formal governance.

Ecological and Cultural Challenges of coastal livelihoods

Discussion related to disaster prone areas seems to have been dominated discourse on Banten coastal community dynamics. The influence of the dialogue to Marine ecosystem and human activity is noteworthy (Bayhaqi, Jantama, Iswari 2021). Fishery, farming, tourism and such interconnected socio-economic activities are affected. Throughout the past ten years, Indonesia has seen multiple natural disasters strike its small islands and coastal regions. The Anak Krakatau Volcano's activity in December 2018 caused tsunami waves to directly strike the coastal region of Banten Province, encompassing the Regencies of Pandeglang and Serang. Central and local rules and regulations require regional and spatial planning in coastal buffer zones, but it is occasionally disregarded (Daulat et.al 2018). Banten, a coastal province in Indonesia, illustrates the complex socio-political, ecological, and cultural challenges of water and river governance in a developing context. Rapid decentralisation after 1998 gave local governments more authority over resources, yet this shift has not resolved inequalities in water access. Instead, it introduced overlapping mandates and jurisdictional ambiguities among provincial agencies, district authorities, and village institutions. For example, public markets in places like Tarumajaya and parts of Banten collect fees for sanitation but fail to enforce environmental regulations, leading to polluted waterways that harm public health and marine biodiversity. These governance gaps are intertwined with socio-economic pressures.

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Coastal communities face declining fish catches due to reef and mangrove degradation, while upstream deforestation and sand mining cause river sedimentation and flooding downstream. Culturally, water holds deep significance — Indigenous groups such as the Baduy manage forests and springs through customary laws — yet formal policies often overlook these local wisdoms. The result is a contradiction, namely abundant rainfall and rivers, but unequal access to clean water; rich cultural stewardship traditions, but technocratic management regimes that marginalize local voices.

Context of Water and River Governance Challenges in Banten



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Photos taken by authors. Scenes from Banten showing riverbank settlement bordering degraded waterways, highlighting the interconnected challenges of pollution, precarious housing and fragmented water governance

A narrative from a fishing village in Pandeglang and some semi-urban areas in Tangerang exemplifies these dynamics. Fish traders are mostly female and they start their day at 3 am to buy fish at the auction. By dawn, she must also collect clean water for her family because the nearby river is contaminated by upstream factory runoff.

Many rural and semi urban areas apply piped water system, but intermittent supply and brackish intrusion force families to purchase jerrycans of potable water from private vendors at high prices. Indeed, some low-income households in Banten spend up to 200,000 rupiah (over 10% of their monthly income) on clean water. This burden falls largely on some female fish traders living in the area, who juggle caregiving with informal work in the coastal economy. When cash is short, they turn to a local moneylender known as “Bang Emok” — a predatory lender charging exorbitant interest — because they lack collateral for bank loans. Many women in Banten’s coastal communities are trapped in similar cycles of informal debt, tied to their roles as unrecognized labourers and resource managers. Ecologically, the same village grapples with eroding coastlines; each monsoon, high tides flood homes, and women shoulder the extra labour of home repairs and securing freshwater amid the intrusion of saltwater.

Culturally, communities have adaptive knowledge (such as planting nipa palms to stabilize shorelines or performing rituals to call for rain), yet these practices receive little support or recognition in official programs. This narrative tapestry – of resource abundance coexisting with scarcity, of strong local agency constrained by weak governance – underscores that Banten’s water crisis is not merely about hydrology or infrastructure. It is about systemic governance failure in which social, political, ecological, and cultural threads are deeply entangled.

Socio-Political Challenges: The governance landscape in Banten is fragmented. National agencies impose policies top-down, while district and village governments often lack coordination and capacity to implement context-specific solutions. Decentralization was intended to empower local decision-making, but in practice it sometimes devolved into competition among agencies and power brokers. For instance, water resource management might involve a Provincial Water Bureau, district public works offices, and even military taskforces during emergencies – all operating on different mandates. Village governments have formed enterprises (BUMDes) to manage village wells or ecotourism sites, yet they operate in silos, rarely integrated with higher-level plans. Patronage politics also play a role: local elites may capture resources (such as irrigation budgets or water contracts) for personal or political gain, leaving marginalized groups (landless farmers, fisherfolk, women’s groups) with little influence. This misalignment among stakeholders leads to neglect of critical issues like river pollution and watershed protection.

Ecological and Cultural Challenges: Banten’s coastal and river ecosystems are under strain from human activity and climate change. Mangrove forests that once protected shorelines and nurtured fisheries have been cleared for shrimp ponds and settlements; rivers like Ciujung and Cidanau suffer from industrial effluents and sediment from upstream mines. Flooding and drought cycles are intensifying, yet responses remain reactive (e.g. emergency dredging by a military taskforce) rather than preventive and holistic.

Culturally, communities possess rich ecological knowledge – the Baduy people, for example, enforce strict prohibitions on river contamination within their territory, embodying a worldview where water is sacred. However, formal governance often draws boundaries that exclude such indigenous and spiritual perspectives. There is a disconnect between state-led development narratives (which prioritize economic growth, infrastructure, and revenue) and local cultural narratives (which emphasize harmony with nature and communal well-being). This disconnect represents a critical contradiction: policies promote

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commercial exploitation of water (e.g. bottled water concessions, industrial use) even as customary laws teach conservation and restraint. Gender norms further complicate the picture – in Banten’s coastal culture, women are central to managing household water and income but traditionally excluded from public decision arenas. Any governance reform must therefore reckon with not just technical and administrative aspects, but also these socio-cultural dimensions that influence whose knowledge counts and whose interests are served.

Banten’s coastal and river ecosystems are under severe strain from human activity and climate change. Mangrove forests that once protected shorelines and supported fisheries have been cleared for shrimp ponds and settlements. Rivers such as the Cijung and Cidanau suffer industrial effluents and sedimentation from upstream mining. Flood and drought cycles are intensifying, yet responses remain reactive (e.g. emergency dredging by a military task force) rather than preventive or holistic. Culturally, local communities possess rich ecological knowledge – for example, the Baduy people enforce strict prohibitions on contaminating rivers within their territory, reflecting a worldview where water is sacred. However, formal governance tends to exclude such indigenous and spiritual perspectives. There is a disconnect between state-led development narratives (which prioritize economic growth, infrastructure, and revenue) and local cultural narratives (which emphasize harmony with nature and communal well-being). This disconnect creates a moral contradiction: policies promote commercial exploitation of water (e.g. bottled water concessions, industrial use) even as customary laws teach conservation and restraint. Gender norms further complicate the picture – in Banten’s coastal culture, women are central to managing household water and incomes but are traditionally excluded from public decision forums. Any governance reform must therefore contend not only with technical and administrative issues, but also with these socio-cultural dimensions that determine whose knowledge counts and whose interests are served.

Figure 1 illustrates the fragmented stakeholder landscape underlying these challenges. It maps the key actors around Banten’s water system – central agencies setting policies, local governments tasked with on-the-ground management, the military often stepping in for disaster response, community-level players like BUMDes and cooperatives, indigenous communities like the Baduy, NGOs and researchers, private sector industries, and informal vendors reliant on water resources. Many relationships are weak or one-directional: local knowledge seldom flows upward, central policies often ignore local conditions, and private industries exploit resources with minimal community input. Critical voices (women, indigenous groups, informal settlers) remain at the periphery of decision-making. Such a stakeholder configuration all but guarantees misalignment – for example, the military’s ad-hoc interventions are disconnected from long-term community management, and village projects may conflict with private sector interests. In sum, these challenges amount to a tragedy of fragmentation: no single entity has both the mandate and the commitment to sustainably manage the water commons for the benefit of all.

Beyond Banten’s coastal areas, our broader research suggests that similar patterns – albeit manifested differently – occur in other regions. The highland communities upstream (e.g. Tarumajaya in West Java) and urban areas (like Depok in Jakarta’s vicinity) face their own water-related challenges that interlink with socio-economic conditions:

In Tarumajaya village, an upland watershed community, land and water access are at the crux of the problem. The majority of residents are landless or own only tiny plots; around 80% of villagers lack secure land tenure. Large entities such as state plantation companies and agribusinesses control most of the land. This leaves local people working as sharecroppers or laborers, and many live in poverty. According to one statistical assessment, Tarumajaya scores only 33.25 (out of 100) on the SDG metric for “No Hunger,” 39.10 for “Healthy and Prosperous Village,” and a very low 6.05 for “Infrastructure and Innovation” – reflecting severe deficits in wellbeing and services. Women in Tarumajaya have few livelihood options; some have resorted to renting out rooms for clandestine prostitution just to put food on the table. Indebtedness is rampant, with loan sharks (locally known as bank emok or shadow banks) exploiting the

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lack of formal financial access. This trap of poverty and debt drives some families to desperate measures, and local officials have acknowledged phenomena like covert sex work arising from economic need. On a positive note, there are grassroots initiatives (often led by women's groups and local activists) to create alternative incomes – for example, community-run coffee production and ecotourism in nearby forest hamlets – proving that locals can add value and steward the environment when empowered. However, these remain small-scale and often lack support.

In Depok, for comparison, a densely populated city just south of Jakarta, issues centre on urbanization and pollution. The Ciliwung River flows through Depok carrying trash and waste toward Jakarta Bay. Along Depok's riverbanks, many low-income families live in congested informal settlements. We observed that residents here often rely on illegal hookups for electricity and use river water freely for washing, as it's the only way to afford daily needs. They pay rent of only around Rp.400,000 per month (~USD 25) for shacks by the river, with no formal utilities. This precarious arrangement lets them survive on a few dollars a day, but at the cost of health and safety. The river in Depok is choked with plastic containers, sewage, and industrial effluent. Public markets and local authorities do little to prevent waste dumping – they collect stall fees but turn a blind eye to rubbish thrown into waterways. Consequently, garbage flows downstream through Depok and other Jakarta suburbs, contributing to the shocking statistic that Indonesia contributes ~70% of plastic waste at the bottom of the sea. The urban poor in Depok are stuck between unaffordable formal housing and unsafe informal living, and women often shoulder the burden of maintaining households in these conditions (finding water, managing food with limited means, etc.). The COVID-19 pandemic further strained these communities, but women's roles in family and community never diminished – many took on informal work like selling food or became neighbourhood organizers to cope. Yet their efforts receive little recognition or support.

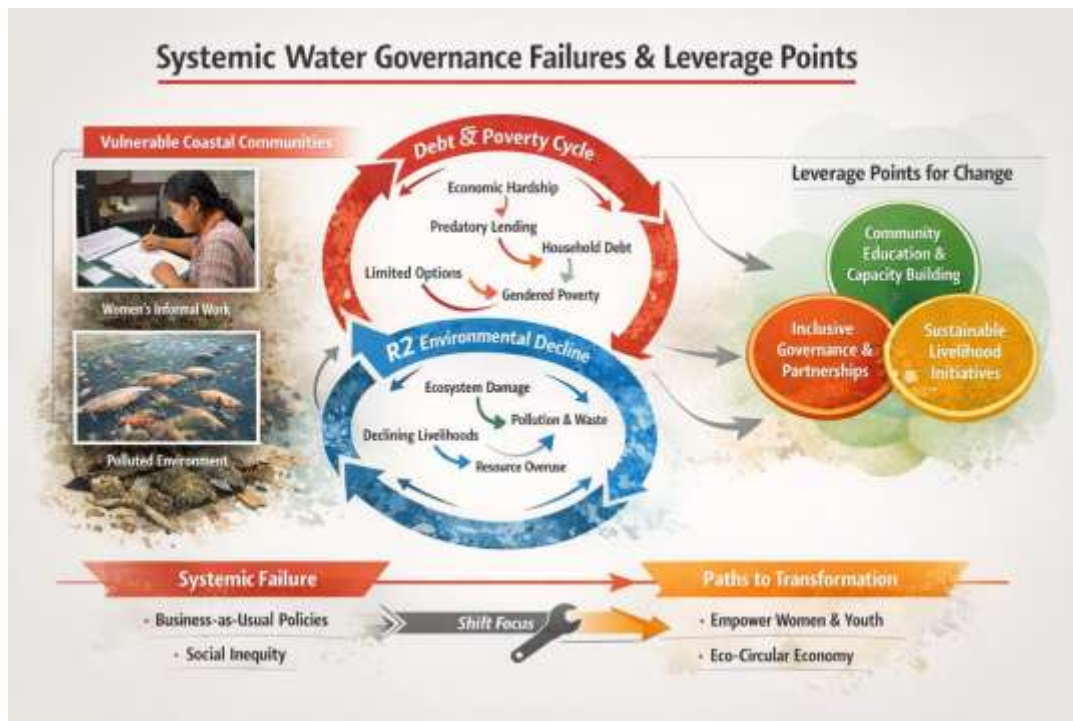
In Banten's coastal villages, like those in our core study area, the community depends on small-scale fishing, aquaculture (such as seaweed farming), and budding tourism. Environmental degradation directly threatens these livelihoods. Several fishermen noted that fish catches have declined drastically; if the sea becomes barren, businesses will suffer and women will struggle to feed their families. Villages are prone to flooding, especially as protective mangroves have been lost. The opportunity exists to turn these challenges into opportunities – e.g., developing eco-tourism focused on mangrove restoration or sustainable fisheries – but it requires coordinated effort and investment. Culturally, coastal communities in Banten have traditions of mutual aid and some (like those near Baduy areas) have inherited conservation practices, but external pressures often disrupt these.

The following figures present arguments about how social, economic, environmental and governance dynamics co-produce water insecurity and coastal vulnerability. The panels juxtapose (a) reinforcing feedback cycles, (b) a pathway from critique to action, and (c) a place-based comparison across Tarumajaya, Depok, and coastal communities in Banten, all within Indonesia. The figures reflect aim at illustrating gendered burdens under crisis, boundary critique and systemic governance, problem representation in water policy, cascading risks, and multispecies-focused stewardship and food–water security (McLaren et.al 2020). Ulrich (2005) frames this as boundary critique, that is explicitly surfacing the boundary judgements that determine (i) who is seen as the beneficiary, (ii) who holds decision-making power, (iii) what knowledge counts as valid, and (iv) whose lived consequences confer legitimacy. The panels also work with the logic of leverage points — not 'solutions' in isolation, but places where a small structural shift can redirect system behaviour. Meadows (in Yamamoto 2023) stresses that leverage points exist across levels (from parameters and flows through to goals and paradigms), and that many interventions fail because they target low-leverage symptoms while leaving high-leverage structures intact. McIntyre-Mills (2014) argues that a community of practice is not just a meeting or network, but a group that learns to do better through sustained interaction around shared concerns. In systemic terms, it is capacity for adaptive governance — how feedback is sensed, meaning is negotiated, and collective action is coordinated under uncertainty. The gendered dimension in the panels can be read through the 'triple burden lens. As McLaren et.al (2020) show

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how disasters and disease outbreaks intensify women's paid work, unpaid care, and community labour simultaneously, often without relieving existing responsibilities — a dynamic that helps explain why economic shocks can quickly translate into gendered poverty and constrained choices. This aligns with the argument that participatory democracy and systemic governance are needed to protect the commons and future wellbeing, including through Indigenous relational understandings of land and life (McIntyre-Mills 2014). Governance is positioned as biopolitical (shaping whose lives and whose environments are made secure), and therefore stewardship is the one that balances individual and collective needs in ways that protect living systems across generations.

Figure 1. Reinforcing circles of poverty and environmental decline (R2) and gendered debt (R1)



The figure above portrays failure as two coupled reinforcing cycles — one financial/social, one ecological — knotted together through inequality. The red cycle depicts the social machinery of impoverishment: economic hardship increases exposure to predatory lending, which deepens household debt, which entrenches gendered poverty, which narrows the set of ‘available options’, returning households to intensified hardship. Hardship is not merely a ‘state’, it is a reproducing structure. The loop implies path dependency: once a family is pulled into debt-servicing logic, the system begins to behave like a ratchet — it becomes harder to climb out because each coping step constrains the next. A gender-aware reading clarifies why “limited options” is not evenly distributed. Under crisis, women’s triple burden tends to expand (paid income generation, unpaid care, and community labour), leaving less time, mobility, and bargaining power to access safer credit, collective action spaces, or diversified livelihoods. In other words, the cycle is not only economic; it is time-poverty and power-poverty, made visible as ‘gendered poverty’ (McLaren et.al 2020).

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The blue cycle (Environmental Decline) shows how ecological stress reproduces itself: ecosystem damage and pollution/waste reduce livelihood reliability, pushing resource overuse, which further degrades ecosystems, continuing the downward spiral. In systems terms, the panel is signalling that environmental decline is not simply caused by ‘ignorance’. Instead, it is produced by structural incentives under scarcity and injustice. When livelihoods are already fragile, immediate extraction becomes a rational short-term move inside an irrational long-term system. The critique is in how the two cycles co-amplify. Debt pressure makes risky extraction more likely; ecological decline reduces livelihood returns, increasing financial stress and the appeal of high-cost credit. This is a classic coupled-reinforcing dynamic: a socio-economic loop accelerates an ecological loop, and vice versa. The result is not just ‘poverty plus pollution’, but a locked-in vulnerability regime — a system that generates the very conditions used to justify its continuation (‘business-as-usual’). How is the problem represented to be? If the problem is framed as ‘water scarcity’ alone, interventions will likely focus on supply augmentation or infrastructure. Simbolon and McIntyre-Mills (2019) argues that apparent scarcity often masks misdirected systems: water becomes commodified, provision functions are misused, and governance choices prioritise profit for some over common-good access and environmental maintenance. The ‘Systemic Failure’ arrow (business-as-usual policies, social inequity) is thus a boundary critique saying that ‘system; being criticised includes political-economic arrangements that normalise inequitable distribution and externalise harm. The ‘leverage points for change’ — community education/capacity, inclusive governance/partnerships, and sustainable livelihoods — can be read as attempts to intervene at structural levels (capabilities, decision rights, and livelihood design), not merely at symptom levels (clean-ups or emergency relief). Their placement to the right of the cycles matters. It frames these levers as countervailing feedback—mechanisms that can dampen or reverse reinforcing decline by changing how choices are made and resourced, who participates, and what economic activities are feasible.

The figure above is a story of method as much as of policy. It begins with a “Systemic Failure” list—ecological degradation, inequity and poverty, governance fragmentation, gendered debt traps—then pivots through a central ‘community of practice’ into ‘transformative Engagement’: co-designed policy platforms, partnerships integrating ecological and local knowledge, and inclusive networked governance. A critical systemic reading highlights that the pivot is not motivational rhetoric. it is about changing the system’s learning architecture. First, the figure implicitly applies boundary critique: system failure persists because decision-making boundaries are too narrow (fragmented governance), knowledge boundaries are policed (local/Indigenous knowledge marginalised or tokenised), and legitimacy boundaries exclude those most affected (gendered impacts treated as secondary). The view point of Ulrich (2005) is relevant here not as an academic add-on, but because it gives a disciplined way to interrogate these boundary choices — who benefits, who controls resources, what counts as evidence, and who bears consequences.

Figure 2. Reinforcing circles of critique and innovation (R3) and transformation (R4)



The above figure ‘Interconnected Contexts’ portrays three places as mutually implicated through material flows (water, waste, sediment), economic pressures, and governance decisions that do not respect administrative boundaries. In Tarumajaya, strengths include ‘local leadership’ and ‘waterwise traditional knowledge’, while a stated weakness is that indigenous wisdom seems to have been excluded from governance. The systemic message is that capability exists, but the formal system’s boundary judgements do not recognise it as legitimate knowledge or authority. This is a classic epistemic boundary problem, namely survivable practices are present, yet the governance system is not designed to learn from them at scale. In Depok, the panel foregrounds ‘garbage and sediment build-up’, ‘water theft and mismanagement’, and ‘river pollution, water scarcity’. Read systemically, these are not separate issues. They are the result of inadequate governance capacity and infrastructure to prevent leakage into waterways. This aligns with the ‘misdirected systems’ critique, that is when water and waste are governed through fragmented, profit-oriented or weakly accountable arrangements, the results manifest as both scarcity and pollution Simbolon and McIntyre-Mills (2019). In coastal Banten, ‘opportunities’ include eco-tourism growth if waste is controlled and some restored green buffer areas; ‘threats’ include unemployment, flood-linked poverty, and mangroves under threat with coastal erosion. The panel maps a risk cascade; namely upstream mismanagement amplifies downstream ecological degradation; ecological degradation reduces livelihood reliability; livelihood pressure increases vulnerability to hazards and to exploitative economic arrangements. Mangroves are widely documented as providing coastal protection services — reducing vulnerability to inundation and storm surge—while simultaneously being threatened by sea-level rise and other pressures. Indonesia’s mangroves are also globally significant carbon stores, and their conservation

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is argued to be a high-priority mitigation strategy (Murdiyarso et.al 2015). Empirically, recent work links mangrove loss with measurable declines in fishery household income in Indonesia, underscoring how ecosystem degradation translates into social welfare impacts. The World Bank (McLaren et.al 2020) has produced an Indonesia-wide assessment linking local waste management practices and hydrological conditions to marine plastic pollution, emphasising that governance and service delivery are central to the problem — not just individual littering. The third panel therefore functions as a systems-thinking corrective to siloed governance: it visually argues that place-based strengths and vulnerabilities only make sense when read as a connected watershed–coast system, shaped by decisions that travel across space as risks and externalities. This complements the idea of cascading risks and the need to work across boundaries rather than treating problems as isolated at municipal or sector level. What would need to change structurally for the depicted reinforcing cycles to become balancing (stabilising and regenerative) dynamics?

1. First, the following organisations, namely provincial and district water agencies, village governments, BUMDes managers, women’s groups, indigenous leaders, river-basin authorities, and partner universities need to shift the dominant problem representation from “scarcity” to “misdirected systems” need to shift the dominant problem representation from “scarcity” (as a naturalised shortage) to “misdirected systems” (as a politically produced outcome). Water can be commodified through governance choices, and that reframing is needed to treat water as a common good with constitutional and legitimacy implications (Simolon and McIntyre-Mills 2019). In practical terms, this reframing changes how success is measured, not volume delivered alone, but equitable access, affordability, ecological maintenance, and accountability.
2. Secondly the following organisations, namely provincial and district water agencies, village governments, BUMDes managers, women’s groups, indigenous leaders, river-basin authorities, and partner universities ought to institutionalise boundary critique as a governance routine, not an academic exercise ought to institutionalise boundary critique as a governance routine, not an academic exercise. Ulrich’s approach matters because it forces the system to repeatedly ask: who is benefitting, who decides, whose knowledge counts, and who carries the risks (Ulrich & Reynolds, 2019). In the panels, women, youth, local/Indigenous knowledge holders, and downstream communities (along with non-human species and habitats) are the stakeholders most likely to be excluded by default boundary settings.

Third, we should treat gendered burdens as system drivers, not ‘impacts’ (McLaren et.al 2020). The triple burden literature shows that crises amplify women’s responsibilities across paid work, unpaid care, and community labour, often without offsetting support. In the first and second panels, this is mirrored in the “gendered poverty” and “gendered debt traps” motifs: without gender-responsive design, governance reforms can inadvertently intensify unpaid labour, deepen time poverty, and weaken the very participation the system needs for transformation.

Fourth, build communities of practice as the system’s adaptive infrastructure. Wenger’s framing implies that sustained learning-in-action is how systems evolve competence: not through one-off consultation, but through ongoing participation and shared work. McIntyre-Mills, J., Wirawan, R. (2019) notes that it is important to redesigns how knowledge is produced, validated, and mobilised—aligning with cross-boundary research and governance approaches recommended for cascading, multi-domain risks.

Fifth, expand stewardship beyond human-centred utility to multispecies justice and long-horizon security. The biopolitics-and-food-security framing (McIntyre-Mills 2021) argues that governance operates as control across humans, other animals, and environments, and that stewardship of the commons requires balancing individual and collective needs to protect living systems across generations — supported by post-national or cross-boundary governance where risks exceed local jurisdiction. In the context of the third figure this could mean treating mangroves, fisheries, and waterway health not as “resources” to be exhausted, but as co-dependent life-support systems that also reduce hazard exposure and support

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livelihoods. Taken together, the three figures can be read as an argument for systemic governance as risk prevention: a shift from fragmented management and after-the-fact relief towards inclusive, learning-oriented institutions capable of redesigning incentives, recognising diverse knowledges, and protecting commons-based wellbeing

Suggested Pathways for Change

Having mapped the systemic issues, we now turn to solutions. Guided by CST and the community voices, we identified several leverage points – intervention pathways that target underlying structures rather than surface symptoms. These recommendations align with the five broad areas already summarized by our analysis (as illustrated earlier in our figures and discussion). Below, we discuss each proposed intervention, explaining how it addresses specific failures and how it aligns with principles of inclusivity, learning, and justice. Wherever possible, we draw connections to relevant literature and precedents to bolster the rationale.

Establish Multi-Stakeholder “Water Forums” for Collaborative Governance: To break out of the current fragmentation, all key actors need to be brought into ongoing dialogue and shared decision-making. We propose creating regular river basin or coastal zone forums that convene representatives from across the spectrum: national and local government agencies (across sectors), local communities (including women and indigenous representatives), private sector water users, and NGOs. Such forums would serve as platforms for boundary critique in practice – participants can openly share their perspectives and challenge each other’s assumptions and blind spots. For instance, a forum for a river basin in Banten could highlight upstream–downstream interdependencies: upstream factory owners might hear directly from downstream fisherfolk about pollution impacts, creating pressure for change that formal regulation alone failed to achieve. Studies by Widianingsih and colleagues support this kind of policy networking as an antidote to siloed governance. The idea also aligns with Midgley’s systemic intervention approach, which involves forming inclusive stakeholder groups to develop mutually acceptable ways forward. Crucially, these forums must not be mere “talk shops” – they need a mandate to influence actual policy (e.g., feeding into district development plans or provincial budgeting). To ensure effectiveness, the forums can use facilitated boundary critique exercises (drawing on Ulrich’s Critical Systems Heuristics) to make explicit whose values and interests are being prioritized and then expand the discussion to include marginalized concerns. By institutionalizing multi-stakeholder forums, governance can begin shifting from the current command-and-control model to a more participatory, networked model – building shared ownership of problems and co-creating solutions.

Integrate Gender-Responsive & Wellbeing Metrics into Planning: To rectify the narrow focus on GDP and infrastructure as measures of success, we recommend that Banten’s provincial and district governments adopt a set of wellbeing indicators (including gender-disaggregated metrics) as key performance measures for development. In practice, this means judging success by improvements in outcomes such as the proportion of households with affordable access to safe water, reduction in the time women spend collecting water, community health indices, or ecosystem health – rather than just economic output or number of projects built. This leverage point speaks to Flood’s idea of transformative axiology – it reorients the system’s values toward what truly matters for human and ecological flourishing. Changing the metrics can have profound systemic effects: once bureaucracies and politicians know they will be evaluated on wellbeing outcomes, their incentives change. For example, a district head who currently gets credit for constructing a water treatment plant might instead be judged on how many villagers actually gained reliable clean water from it. This would push officials to ensure infrastructure is functional and reaches the poorest, not just that it is built. Indonesia has some emerging moves in this direction (e.g., a national “Village SDGs” framework), and Banten could pioneer by explicitly incorporating gender and equity targets into its planning. Drawing on Norma Romm’s ideas, using pluralistic indicators is also a form of epistemic justice

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- it acknowledges that GDP growth is not the only truth and validates community-defined measures of welfare. Over time, if such wellbeing metrics prove their worth, they could help resolve the perceived trade-off between economic development and social equity by demonstrating that the two can be pursued together
- and that policies maximizing one at the expense of the other are counterproductive.

Recognize and Strengthen Informal & Indigenous Resource Management: Another powerful leverage point is to legitimize informal governance systems rather than ignore or suppress them. Much of the everyday water management and environmental stewardship in these communities is done through informal means – from indigenous practices like Baduy forest protection to women’s savings groups funding well repairs. Formally recognizing these contributions can transform adversarial relationships into collaborative ones. In practical terms, this means changes such as granting legal status or customary rights to indigenous communities over their ancestral forests and water sources, creating channels for community-based organizations (water user associations, women’s cooperatives) to have a voice in official planning, and reforming regulations that currently criminalize or exclude informal activities (for example, allowing community-managed micro water supply systems to operate under simple licenses instead of expecting them to become formal utilities). The rationale is that many local and indigenous practices are aligned with sustainability and equity – they are part of the solution rather than the problem. The Baduy’s strict conservation of spring catchments is a case in point, as is the tradition in some coastal villages of collectively maintaining mangrove belts as buffers (in areas where these traditions haven’t been eroded by outside pressures). By officially recognizing and supporting such efforts, the government can expand the boundary of the formal system to include what was previously outside of it.

Foster a Coastal Circular Economy & Women’s Livelihood Initiatives involving the following village governments, BUMDes or women’s corporatives, PKK and Posyandu (local community health service) linked cadres, district environmental offices and university partners. Economic insecurity drives many unsustainable behaviours, so providing regenerative livelihood options is key to breaking the vicious cycles. We propose establishing a “Coastal Circular Economy Hub” in Banten – a coalition or centre that incubates projects turning waste and environmental challenges into economic opportunities. For example, plastic waste collected from rivers could be processed by community enterprises into crafts or construction materials; water hyacinth overgrowth (a symptom of nutrient pollution) could be harvested to produce biogas or organic fertilizer; fish processing by-products could be composted or made into animal feed. Each of these, in isolation, exists as small pilot projects in some communities, but a coordinated hub can provide technical assistance, seed funding, and marketing support to scale them up and link them to markets. Importantly, we suggest these initiatives prioritize women’s participation and leadership. Women in coastal communities already practice small-scale entrepreneurship out of necessity (selling snacks, handicrafts, etc.). By supporting them to lead “green” businesses, we simultaneously empower them economically and tackle environmental issues. This directly addresses the heart of both feedback loops: it aligns economic incentives with ecological restoration (a circular economy, by definition, reduces waste and preserves resources) and provides women with safer financial opportunities (reducing reliance on loan sharks). For instance, a women’s group that turns coconuts and fish skin into organic soap can generate income and perhaps access a micro-grant or cooperative loan instead of a loan shark, thus building creditworthiness and skills while cleaning up waste. Over time, successful local enterprises increase community wealth and decrease dependence on exploitative practices like sand mining or predatory loans. The idea of a circular economy hub is relatively novel in this context, but it draws on both sustainability science and feminist economics (which emphasizes local cooperative models and valuing care work). In implementation, partnerships with NGOs and universities (some are already active in livelihood training in Banten) could provide necessary know-how.

Institutionalize Participatory Action Research (PAR) in Governance: Our final recommendation is more of a meta-level systemic change – embedding continual learning and adaptation into the governance process itself. We propose that local governments establish mechanisms (or dedicated units) for ongoing

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Participatory Action Research in policy-making. This means treating policies and interventions not as one-off fixes, but as hypotheses to be tested, monitored, and refined in collaboration with the community. A concrete example is the participatory budgeting experiments tried in some Indonesian cities, where citizens help set spending priorities; PAR would take this further by also involving citizens in evaluating and adjusting those initiatives. Given the uncertainties of climate change and socio-economic shifts, this adaptive governance approach is crucial – it counters the current tendency for plans to be static, siloed, and unresponsive to on-the-ground realities. Over time, institutionalizing PAR could shift the organizational culture of agencies to be humbler and more responsive – officials become more open to critique and focused on improvement rather than defending their turf. This directly tackles the earlier issue we noted of “rhetoric vs. practice”: making participation and reflection routine would narrow the gap between lofty policy language and actual implementation.

One might ask: are these changes realistic given the current political and economic context? CST reminds us to be mindful of feasibility and to consider incremental steps even as we envision ideals. Some recommendations, like establishing multi-stakeholder forums, could be implemented relatively quickly via Governor or Bupati (Regent) decrees – politically, these can be framed as efforts to “improve coordination” and thus gain support. Others, like overhauling metrics or legally recognizing informal systems, are more ambitious and may require higher-level policy change and time to demonstrate results. We suggest starting with pilot projects: for example, select one watershed in Banten to implement a combination of these leverage points in a coordinated way (essentially creating a “systemic innovation zone”). If that pilot shows tangible improvements – say water quality improves, local incomes rise, gender gaps in participation close – it can build momentum and public demand to expand similar approaches elsewhere. Building broad alliances will also be key: local civil society groups, forward-thinking officials, academics, and community leaders need to champion these ideas. Our research process itself tried to sow seeds for this by bringing stakeholders together in workshops, sharing findings back with them, and jointly formulating action plans. Indeed, some community participants have already begun lobbying their village heads using our findings as evidence for change. This underscores an important point: research can be an intervention in its own right, especially when guided by a critical, participatory ethos.

Adapting Indigenous Wisdom to Urban Water Governance

An important insight from our study is that solutions can often be found by bridging traditional wisdom and modern governance. In Banten, the Baduy indigenous community offers a living example of sustainable water management rooted in a holistic worldview. We asked: How might principles from the Baduy be adapted to benefit urban areas like Depok or Jakarta? The table below outlines a Critical Systems Thinking approach to this question, drawing on Baduy practices as inspiration and translating them into urban policy ideas.

Firstly, the paper argues that applying ‘boundary critique’ can be a way to redefine urban water governance. The Baduy draw clear physical and social boundaries around water sources (e.g. sacred springs, river zones) and strictly regulate access and use through customary law.

Urban boundary mapping can be used as participatory methods to identify and demarcate critical urban water source areas (springs, recharge zones, riverbanks) as protected zones. Community stewardship zones – establish areas managed by local urban communities, echoing the Baduy’s collective guardianship (e.g., neighbourhoods adopting sections of a river). Policy implication: Shift from fragmented, technocratic management to inclusive, neighbourhood-based stewardship. Marginalized groups (informal settlers, women) should be included in setting and enforcing these urban boundaries, much as Baduy inclusion prevents overuse.

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Secondly, the paper argues for integrating diverse knowledge systems. As a case in point, the Baduy rely on indigenous, experiential knowledge – observing spring flow, soil moisture, plant indicators – to manage water sustainably, and they prohibit chemical use near water sources.

Urban Adaptation: Blending knowledge – integrate local residents’ observations (signs of pollution, illegal dumping) with technical data (sensor readings for water quality) to inform city water management. Chemical-free zones – designate areas near urban water sources as “no chemical use” zones, inspired by Baduy prohibitions on using soap, detergents, or pesticides in rivers. Institutionalize channels for community reporting and local wisdom to shape monitoring and enforcement as a policy implication. For example, empower community watchdog groups to report pollution, and ensure government agencies respond collaboratively.

Thirdly, systemic intervention can be done by participatory, multi stakeholder engagement. Water management is participatory and ritualized in Baduy society, with regular community meetings and collective enforcement of rules. Adapting the Baduy principle, urban water forums – establish regular forums where city residents, local businesses, and authorities co-design rules for water use, mirroring Baduy communal decision-making. Ritual and social norms: develop urban campaigns that use social rituals or public commitments (e.g. annual “clean river days,” neighborhood water pledges) to reinforce collective responsibility for water, akin to Baduy ceremonies that bind the community. Policy implication: Move beyond top-down regulation to co-designed, community-driven interventions that encourage a sense of shared ownership over urban waterways.

Fourthly, the Baduy prioritize the wellbeing of the whole ecosystem and community over individual or short-term gains. They separate different river uses (bathing, washing, drinking) to prevent contamination and ensure fairness. This is about centering justice, wellbeing, and ecology. So, functional zoning of urban rivers can designate specific stretches of city rivers for different uses (recreation, irrigation, wildlife habitat, etc.) with clear signage and community oversight, echoing the Baduy separation of uses. Wellbeing metrics then develop urban water management indicators that centre on household water security, ecosystem health, and equitable access – not just volume of supply. Policy implication: Ensure urban water policies explicitly address the needs of the most vulnerable (e.g., informal settlers, low-income families). For instance, mandate that any new water infrastructure in a city has an equity impact assessment.

For case examples, the article recommends ‘Baduy-inspired urban pilot program scenario’, imagining a city district with a polluted river adopting a ‘Baduy-inspired’ stewardship model. In this pilot, residents map and protect key springs and riverbanks in their area (boundary setting). Then, community patrols monitor for chemical use and dumping, reporting issues to authorities (integrating local vigilance with formal enforcement). Local schools and religious groups hold annual “river blessing” ceremonies to instill shared values and celebrate progress (creating new urban rituals). City government supports the initiative by legally recognizing the community stewardship group and integrating their data/observations into city planning.

Expected Outcomes: Such a pilot could yield multiple wins: Improved water quality (through reduced pollution and habitat restoration), strengthened community cohesion and accountability (people feel proud and responsible for their stretch of river), and greater inclusion of marginalized voices in urban water governance (as the community group becomes an official stakeholder) . If successful, this model could be replicated in other districts, gradually creating a network of community co-managed urban waterways.

This exercise of adaptation demonstrates how principles from indigenous, rural contexts can inform urban governance in creative ways. By drawing on the Baduy case through a CST lens, we bridge a gap between traditional wisdom and modern policy. Crucially, it shows that many solutions for urban sustainability may lie in reclaiming ethical and holistic approaches that modern systems have lost. As one observer put it: “The

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Baduy tribe's zoning system is a testament to their deep understanding of living in harmony with nature. As we grapple with climate change and environmental degradation, there is much to learn from their sustainable practices and respect for nature." Indeed, creating more regenerative urban water systems may depend as much on changing mindsets and values as on deploying new technologies.

Conclusion and Recommendations

In reviewing the water and livelihood challenges of Banten's coastal communities (and comparing them with Tarumajaya and Depok) through a Critical Systems Thinking lens, we have illustrated how deeply intertwined factors of ecology, economy, gender, and governance create a complex "mess" (to use Ackoff's term) that resists simple fixes. However, by applying CST principles – expanding boundaries to include marginalized voices, embracing epistemic pluralism, centering transformative values of justice and wellbeing, and designing systemic interventions – we not only gained a clearer understanding of this mess, but also identified leverage points to transform it. Our narrative analysis grounded technical issues in the lived realities of coastal and upland villagers, revealing stories of marginalization but also of resilience and local ingenuity. By sharpening our theoretical arguments with insights from thinkers like McIntyre-Mills, Romm, Flood, Midgley, and Corcoran-Nantes, we linked these local narratives to global conversations about governance, knowledge, and empowerment. This allowed us to recognize patterns such as the reinforcing loops of poverty and environmental degradation, and the contradictions between policy ideals and implementation, which are not unique to Banten but echo in many post-decentralization societies facing sustainability challenges.

The interventions we propose form an integrative strategy aimed at systemic change. They seek to redraw the boundaries of who is involved in governance (bringing in women, indigenous groups, informal sectors as legitimate actors), redefine what success means (shifting from infrastructure and profit metrics to wellbeing and sustainability), and reconfigure relationships among system components (moving from siloed, top-down control to collaborative, networked governance that can learn and adapt). Together, these changes represent a shift from a mechanistic model of governance – where policies are static and stakeholders are parts of a machine – to an organic, learning model of governance – where the system can evolve, self-correct, and continually improve its fit with the environment and people's needs. Such a paradigm shift is essential in the face of climate uncertainty and social change.

Crucially, our research process itself tried to embody the values of reflexivity and inclusion we advocate. As researchers, we remained conscious of our role in the system: by engaging participants in mutual learning (through feedback sessions, collaborative mapping, and joint reflection on findings), we attempted to practice the very principles – like boundary expansion and participatory decision-making – that we suggest for governance. In this sense, the project blurs the line between study and intervention. It contributes to academic discourse by offering a concrete case where critical systems ideas inform practice, and where practice in turn refines those ideas. On a practical level, the work has already begun to inform local action, as evidenced by stakeholders taking up recommendations.

Moving forward, the hope is that these insights will support policymakers, community leaders, and activists in Indonesia and beyond to foster more equitable, sustainable, and adaptive water governance. The challenges are indeed complex, but as we have shown, the tools to address them – inclusive forums, new metrics, community empowerment, circular economies, and learning-oriented institutions – are within reach. The task is to weave them together in a way that honours the rich tapestry of human and ecological values at stake. By doing so, even regions on the frontline of climate change and inequality, like Banten's coasts or Jakarta's fringes, can move from critique of the status quo to transformative engagement and co-creation of a better future.

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