Official Journal of the World Water Council
Water Policy

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Water Policy Vol 00 No 0, 1 doi: 10.2166/wp.2026.185

Designing a multi-stakeholder platform to advance sustainable groundwater management: case study of Jaffna Peninsula in Sri Lanka

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ABSTRACT

Worldwide, aquifer management faces anthropogenic and climatic, social, and groundwater challenges. The Jaffna Peninsula in northern Sri Lanka exemplifies these issues, including overextraction, unregulated pumping, pollution, inadequate financing, and weak governance. Viewing groundwater as a private resource has driven exploitation, with most users prioritizing short-term gain over sustainability. To address them, a multi-stakeholder platform (MSP) was established to manage groundwater. Using stakeholder mapping, consultations, and participatory workshops, the case study offers insights on formulating an MSP for groundwater governance in a polycentric, and cross-sectoral institutional context. It underscores the need for inclusive processes to address power disparities and capacity limitations while adhering to procedural guidelines. Promoting adaptive learning is essential to MSP's influence, including evaluating outcomes, revising stakeholder engagement strategies, and committing to viability. The MSP's first responsibility is to develop and implement a groundwater management policy for the Jaffna Peninsula. Initial experiences indicate that the MSP's deliberative, inclusive, and accountable governance process and mindset have emerged. Although improved groundwater conditions are yet to materialize, a coherent policy, a first for the Peninsula, would be a step forward. Insights, experiences, and lessons from this MSP's design and operationalization contribute to a growing experience with MSPs in the Global South.

Key words: Adaptive learning, Groundwater governance, Inclusive processes, Stakeholder engagement, Socio-hydrogeology, Sustainable development

HIGHLIGHTS

- Fragmented governance and private rights to extract groundwater have led to aquifer overexploitation and pollution in the Jaffna Peninsula.
- A multi-stakeholder platform (MSP) with formal authority was co-developed with stakeholders to generate a more data-driven, representative and collaborative governance culture.
- Inclusive, rule-based deliberation can help minimize power imbalances and provides an important space for collective planning and action.
- Early experience suggests that MSPs can enable IWRM, stewardship, and PPPs, subject to adequate initial support and long-term sustainability arrangements, offering a replicable model.

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1. INTRODUCTION

Groundwater governance faces significant global challenges because existing governance arrangements are inefficient and struggle to manage the inherently complex, polycentric nature of this critical resource. The global context reveals that many regions are experiencing severe groundwater depletion and contamination, underscoring the need for more robust governance structures (Megdal 2018) that better account for the distributed nature of actors regulating and using this resource (Ostrom 2010; Emerson & Nabatchi 2015). Current governance frameworks often fail to adequately account for the unique characteristics of groundwater, such as its hydrotechnical complexity and invisibility, common-pool resource characteristics, slow recharge rate, and its essential role in various ecological and human systems (Foster & Chilton 2003; Ostrom 2010; Gleeson *et al*. 2020). Traditional top-down, state-centered governance approaches have proven largely ineffective, mainly because of weak monitoring, enforcement, and political will (Molle & Closas 2019); as a result, they often fail to address these challenges. Effective groundwater governance is essential to address issues such as declining aquifer levels, pollution, and inequitable access (Closas & Villholth 2019).

Water governance in Sri Lanka, particularly in the Jaffna Peninsula, is a multifaceted issue that reflects many of the global challenges in groundwater governance, especially in the Global South. Overextraction, unregulated pumping, pollution, and fragmented governance mechanisms pose significant challenges to sustainable groundwater management in the Jaffna Peninsula. Competition, rather than cooperation, characterizes the behavior of different water use sectors (irrigation, drinking, industrial needs, and environmental requirements), leading to a lack of coherent planning, poor compliance with existing regulations, and unregulated land use practices that threaten the sustainability of groundwater resources. With no major water supply schemes or perennial rivers, groundwater is the primary source of domestic, agricultural, and drinking water, as well as ecosystem services. Sustainable groundwater management thus takes on an existential meaning for the people of the Jaffna Peninsula. Anthropogenic activities, including sand, limestone, and clay mining; waste dumping; wastewater inflows; improper sewage management; seawater intrusion; excessive and inappropriate use of agrochemicals; and industrial effluents, are adversely affecting the groundwater environment. Saltwater intrusion affects about 32.8% of the land and 45% of the paddy fields, underscoring a major challenge to sustaining agricultural activities (Gopalakrishnan & Kumar 2021).

Historically, Sri Lanka is known for its ancient water management systems, dating back to the 4th century BCE. This system, which fell into disuse by the 13th century CE, was later revitalized during the 19th century under British colonial rule (Abeywardana *et al*. 2018). This ancient system consisted of numerous small tanks (rainwater storage) managed sustainably by local communities, reflecting long-standing community-based water governance. However, groundwater management in Sri Lanka is strongly influenced by the common law perception of groundwater as a private resource belonging to the landowner. This individualized treatment of groundwater undermines its management as a typical common-pool resource, as governance structures struggle to mitigate the short-term exploitative behavior of the majority of groundwater users at the expense of the long-term consequences of unregulated use and broader social needs. In other words, unrestricted open access has been the general rule in groundwater extraction. This is compounded by the fragmented institutional approach to groundwater management, where groundwater extraction for different purposes is regulated by different government entities, without an institutional mechanism for collaborative planning. Sri Lanka's overall groundwater management is still evolving, with a need for a shift towards collaborative management strategies. Safeguarding groundwater sources through technological innovations and increased stakeholder awareness is vital to improving water quality and ensuring sustainable resource management (Villholth & Rajasooriyar 2010).

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A significant challenge in sustainably managing groundwater resources in the Jaffna Peninsula is the lack of data on the temporal and spatial variability of groundwater availability and quality. Although some agencies collect data, they do not share it, and no common platform supports real-time planning. Furthermore, information on groundwater use and abstraction across sectors, including bulk water users, is limited. Limited knowledge and awareness among water users about these invisible underground water resources and associated issues undermines their commitment to protecting and conserving them.

This paper presents experiences and insights from establishing a Multi-Stakeholder Platform (MSP) for groundwater governance in the Jaffna Peninsula as an institutional space that facilitates collaborative analysis, planning, and action toward more integrated, sustainable, and equitable groundwater governance. The goal is to reach consensus on the inherent risks associated with the use of groundwater as a common pool resource and to develop more integrated management strategies by emphasizing the need for cooperation over sectoral competition to ensure the sustainable use of Jaffna Peninsula's groundwater resources. In essence, a key goal is to cultivate a sense of a shared challenge among the various regulatory agencies involved in managing Jaffna's groundwater resources. This shift in mindset is considered crucial to the MSP's success, given how it balances competing water uses and users will determine the future of the Peninsula's groundwater resources and wider development.

By describing and reflecting on the establishment and functioning of the MSP, this paper contributes insights into how many of the challenges to groundwater governance recognized in the global groundwater literature may be addressed, with contributions of conceptual and methodological insights to the global discourse on groundwater governance and water governance more broadly given the polycentric nature of surface and groundwater management arrangements.

2. RESEARCH OBJECTIVES

The major objective of the paper is to contribute insights into the utility of, and the establishment and operation of, a Multi-Stakeholder Platform (MSP) for common pool resource management, especially in relation to groundwater resources in polycentric resource governance contexts. Since effective institutional development is rooted in process, we first detail the approach employed to develop and implement the MSP for groundwater governance in the Jaffna Peninsula. We outline the MSP structure and its logic; the strategic steps taken to engage diverse stakeholders, including central and provincial government agencies, academia, civil society, and technical experts, in co-designing the MSP for MSP member buy-in; and how the MSP has performed thus far in terms of consensus building around key groundwater governance challenges, collaborative decision-making, and decision implementation. We then share lessons and practical experiences gained throughout this process, reflecting on existing experiences from similar contexts, thereby contributing to the growing body of knowledge, especially on sustainable groundwater governance. Since building sustainable MSPs is a multi-year process, the insights shared in this paper are primarily related to MSP establishment and operationalization, since actual groundwater management outcomes will require more time to materialize following critical enabling conditions such as improved communication, cross-sectoral consensus on challenges and solutions emerge and materialize into a consensus-based groundwater management plan and implementation roadmap.

3. MATERIALS AND METHODS

3.1. Study area: hydrogeology and groundwater conditions

The Jaffna Peninsula exhibits unique hydrogeological characteristics and groundwater conditions. Geology is predominantly composed of Miocene limestone and recent sand deposits, forming two principal types of

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aquifers: limestone and sand-dune aquifers. The major aquifers are located in Valikamam, Thenmaradchchi, and Vadamaradchchi areas in the peninsula. The karstic limestone aquifer is highly permeable and porous. This aquifer is one of the richest and most extensively utilized groundwater resources in the country. A thin layer of freshwater lens floats atop the denser saltwater within the aquifer. The water table is generally shallow, ranging from 1 to 10 m below ground level. Dug wells are common for domestic and agricultural use throughout the Jaffna district, but most new wells coming into existence are tube wells.

Rainfall received during the northeast monsoon season contributes to the recharge of aquifers. Approximately 80% of the annual rainfall occurs between October and December. The recharged volume diminishes throughout the remainder of the aquifers in the Jaffna Peninsula, which are also recharged by two saltwater lagoons, Vadamaradchchi and Upparu, covering 87.1 and 34.7 km^2, respectively (Mikunthan *et al.* 2013). Studies show that 30 to 50% of the rainfall received in the peninsula is recharged to groundwater (Balendran *et al.* 1968; Kuganesan & Sivakumar 2015). Due to the dense network of caverns, fractures, and fissures, the entire peninsula is susceptible to seawater intrusion, yet it supports the accumulation of freshwater mounds in the central part of the land units (Kodituwakku 2009). The highly channeled nature of the aquifer also leads to 15–50% annual recharge being lost to the sea as subsurface flow (Balendran *et al.* 1968; Kuganesan & Sivakumar 2015). Current water extraction trends have created a significant imbalance between draw-off and replenishment (Panabokke 2007). Intensive recycling of well water for agriculture and increased agrochemical use have also exerted stress on groundwater quality.

Figures 1 and 2 illustrate the area map of the Jaffna Peninsula, describing the temperature, rainfall, and elevation. Although there has been no notable alteration in seasonal rainfall patterns, the increasing intensity of storms within seasons in recent years has raised concerns regarding their potential adverse effects on agricultural practices and yields. The intrusion of saltwater into freshwater sources further intensifies water scarcity and poses challenges to traditional agricultural practices. Further research indicates a 1.4-fold increase in soil salinity in the peninsula's coastal lowlands, leading to land abandonment and reduced crop productivity (Gopalakrishnan & Kumar 2021).

3.2. Conceptual framework

Water is increasingly recognized as a critical nexus connecting various sectors and actors, underscoring the complexity of managing this vital resource, given that decision-making is polycentric. Groundwater, in particular, presents a unique challenge due to its invisible nature, which often leads to its undervaluation, poor monitoring, and mismanagement. A leading rationale for the MSP is that a fundamental condition for effective groundwater management in a polycentric context requires a structural mechanism that brings together diverse stakeholders across sectors and scales to collaboratively address water scarcity challenges, whether economic or physical. Collaboration among stakeholders is especially beneficial when diverse stakeholders share common interests but have distinct concerns and varying options for involvement (Conrad *et al.* 2018). To this end, the MSP brings together diverse stakeholders, including government agencies, local communities, private sector entities, academia and non-governmental organizations, in an attempt to facilitate the integration of multiple perspectives, interests, and values, fostering a more comprehensive understanding among diverse stakeholders of water issues within a defined hydrological boundary (Saleth & Dinar 2004; Pahl-wostl 2009; Norman *et al.* 2013). By promoting communication and coordination among formal institutions, informal groups, public and private entities, and local communities, MSPs can help manage competing water claims and build coalitions that support more sustainable groundwater governance. Experience with MSPs contributes to the theoretical discourse on groundwater governance innovation by presenting it not merely as an administrative tool but as a

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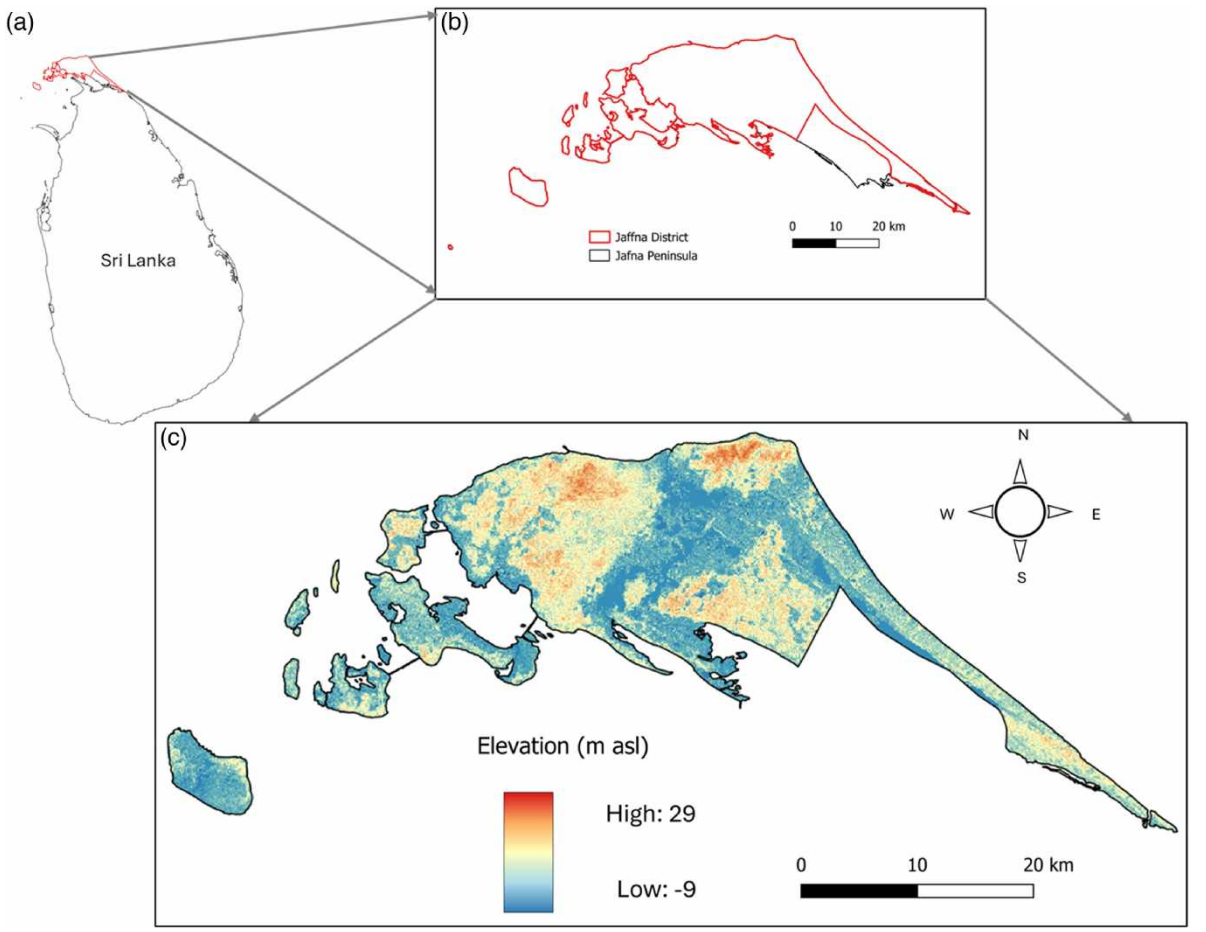

Fig. 1 | (a) Study area location in Sri Lanka, (b) Jaffna District boundary in the Jaffna Peninsula, and (c) Elevation in meters (amsl) of Jaffna District. Source: Prepared by authors using data available at https://earthexplorer.usgs.gov/.

collaborative knowledge framework that integrates socio-hydrogeological methodologies to generate a more enabling environment for managing multi-faceted resources.

MSPs serve as mechanisms to address critical institutional gaps by enabling dialogue, consensus-building, and joint decision-making processes that reflect the complexity of groundwater governance. Noting that traditional, top-down groundwater governance often fails due to the 'invisible' nature of the resource and entrenched epistemic authority (Mukherji & Shah 2005; Foster & van der Gun 2016; Global Groundwater Governance Project 2016), this MSP approach posits that governance innovation occurs through the intentional bridging of horizontal (collaborative) and vertical (hierarchical) integration. This approach not only supports equitable allocation and sustainable use of water resources but also strengthens social capital and trust among actors with diverse stakes in water management. This means strengthening core principles of good governance such as legitimacy and transparency in decision-making; accountability of both users and institutions; policy coherence across sectors; capacity and finance for monitoring, enforcement, and planning; inclusiveness and attention to power asymmetries, gender, and marginalized groups; and flexibility and encouragement of innovation and local experimentation (World Bank 2010; OECD 2015).

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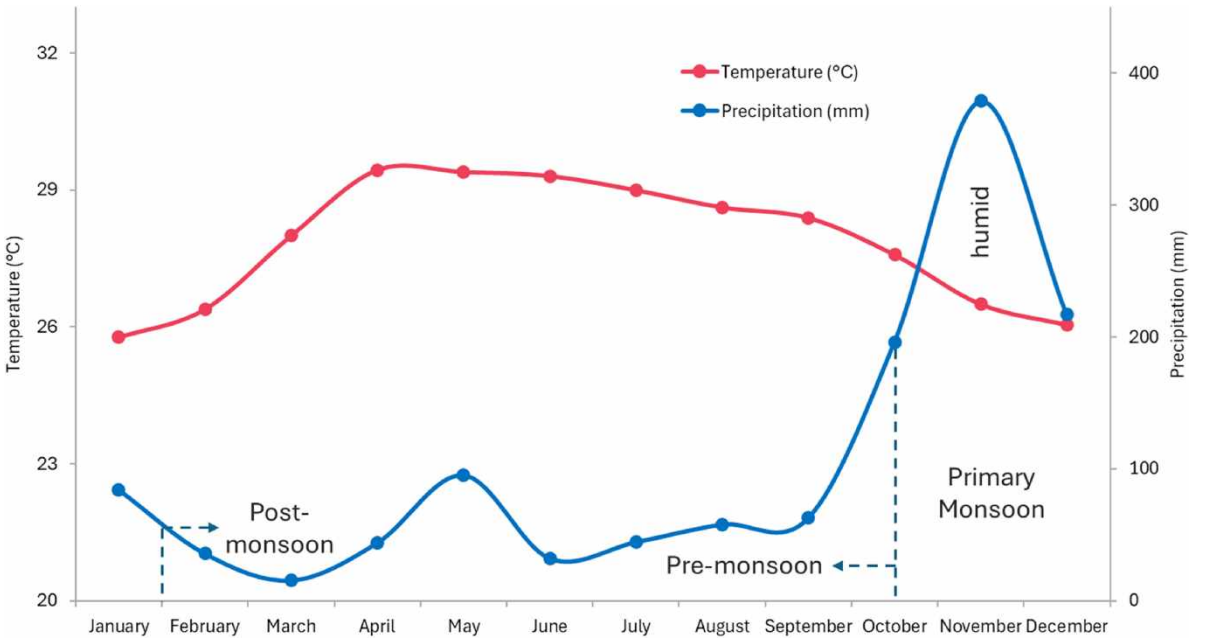

Fig. 2 | Ombrothermic diagram with temperature and precipitation of Jaffna District. Source: Prepared by authors using the data available at https://developers.google.com/earth-engine/datasets/catalog/ECMWF_ERA5_LAND_DAILY_AGGR and https://developers.google.com/earth-engine/datasets/catalog/UCSB-CHC_CHIRPS_V3_DAILY_SAT.

Another key element of the MSP is the integration of social dimensions into hydrogeological research, thereby ensuring the incorporation of local needs, environmental concerns, and economic development into decision-making. As noted by Tringali *et al.* (2017), socio-hydrogeological methodologies are effective in integrating social appraisal with scientific investigations to identify groundwater issues and promote science-based management. This is important for bridging communication gaps among water authorities, scientists, and the community, fostering a shared understanding of the resource and management challenges, and thereby enhancing collaborative efforts for groundwater sustainability. This would include co-producing rules and solutions between government regulators and community and private sector water users, increasing the MSP's legitimacy and reducing transaction costs associated with compliance (Llamas & Martínez-Santos 2005; Meinzen-Dick 2007; Villholth & Giordano 2020). This also connects with another crucial element of governance: addressing equity and social justice as both a goal and a condition for success, given the criticality of groundwater, especially in the Jaffna Peninsula, and the asymmetries in water access between and within water users (Boelens *et al*. 2014; Villholth & Giordano 2020). Participatory approaches will also strengthen local governance by incorporating local knowledge and wisdom, enabling governance systems to be tailored to local contexts (Fessahaye *et al*. 2025).

The effectiveness of the multi-stakeholder approach in sustainable water management has been substantiated through interventions in numerous river and groundwater basins (Conrad *et al*. 2018; Dobbin 2020; Salamanca-Cano & Durán-Díaz 2023). MSPs are effective for groundwater management because they foster shared decision-making and incorporate diverse perspectives and expertise. Such platforms have facilitated sustainable water governance, equitable resource distribution, and resilience to environmental and socio-economic

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challenges, as evidenced in many countries. For example, Elshall *et al.* (2020) reported that participatory processes, collaborative modeling, and social learning are necessary for developing sustainable groundwater management policies that account for co-evolving interactions between human and ecological systems. Collaborative governance also offers a better representation for disadvantaged communities, promoting equitable and sustainable policy development (Dobbin & Lubell 2019).

Consequently, by strengthening governance capacity among key stakeholders, the MSP in the Jaffna Peninsula helps resolve conflicts, build adaptive capacity, and promote integrated water resource management, which is essential for addressing the multifaceted challenges of water scarcity, pollution, and competing sectoral demands. By leveraging existing power hierarchies, such as the joint leadership of the Provincial Chief Secretary and the District Secretary, the framework transforms theoretical participatory knowledge into legally binding, consensus-based policy, thereby offering a novel conceptual model that can be replicated to address complex common-pool resource dilemmas in the Global South.

3.3. Data and information

We used a consultative, qualitative methodology to gather the required data and information and build buy-in for establishing the MSP. Once the MSP was created, we used in-person observation and formal minutes to understand actor behavior, attitudinal change, the nature of decisions, and how they are acted upon. This approach began by mapping the MSP's primary and secondary stakeholders, understanding their roles and responsibilities in establishing a collaborative governance framework, and ultimately evaluating the incentives and organizational models needed for a sustainable governance arrangement. Participants for the stakeholder consultations were selected through a targeted, purposive approach aimed at capturing individuals and entities with direct or indirect stakes in groundwater utilization and governance. The stakeholders, who have a direct or indirect stake in the management of groundwater resources, were invited to consultations. These included representatives from central and provincial government agencies, the private sector, civil society, and academia, prioritized based on their level of influence, expertise, and relevance to the platform's goals.

The process included three structured consultations and one validation meeting to develop the MSP structure and operational mechanism. We systematically recorded responses and qualitative data from breakout groups and discussions through comprehensive meeting minutes and the drafting of procedural documents. We analyzed the qualitative information using thematic grouping and triangulation, and cross-checked findings from the larger participatory workshops against key informant interviews with strategic stakeholders representing different water-use sectors, such as the Irrigation Department, the Department of Agriculture, and the National Water Supply and Drainage Board. To validate the analysis, the drafted MSP documents detailing objectives and structures were circulated among stakeholders to solicit written feedback, refined accordingly, and subjected to a final validation at the concluding stakeholders' meeting. After the MSP was established, its dynamics, working practices, and decision-making processes were observed across four meetings conducted between 2025 and mid-2026. The observation focused on patterns of participation and interaction among members; how agenda items and evidence were introduced, discussed, and negotiated; the influence of institutional mandates and leadership on deliberations; how disagreements were managed, and consensus was reached; and how responsibilities, timelines, and follow-up actions were assigned.

4. ESTABLISHING THE MULTI-STAKEHOLDER PLATFORM IN JAFFNA PENINSULA: STRUCTURE AND PROCESS

The key elements of the approach adopted include defining clear objectives, identifying and mapping relevant stakeholders, establishing effective communication channels, listing short- and long-term activities, and building

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trust and transparency. Additionally, a successful MSP also requires a framework for conflict resolution and a mechanism for monitoring and evaluation. Effective integration is contingent upon political will, leadership, transparency, and stakeholder participation, as evidenced in many countries (Olsen *et al.* 2014).

Figure 3 illustrates the current groundwater governance structure and the key stakeholders responsible for managing activities within the water sector in the Jaffna Peninsula, each with direct or indirect stakes in groundwater utilization and governance. These agencies operate in isolation, lacking coordination and collaboration in the absence of a formal mechanism to promote a unified governance framework grounded in a shared understanding of the nature of the resources, risks, priorities, and solutions. Formulating agreements regarding collaboration methodologies, frequency, decision-making processes, and participant engagement is essential for transforming a shared vision into actionable outcomes.

The proposal to establish an MSP emerged from stakeholder consultations, highlighting a shared recognition of a gap in the existing institutional framework. Whilst Sri Lanka's governance structure has been decentralized for several decades, this has not fostered the collaborative spaces at sub-national scales needed for multi-sectoral collaboration. According to Glass *et al.* (2023), such collaboration is necessary to address complex challenges.

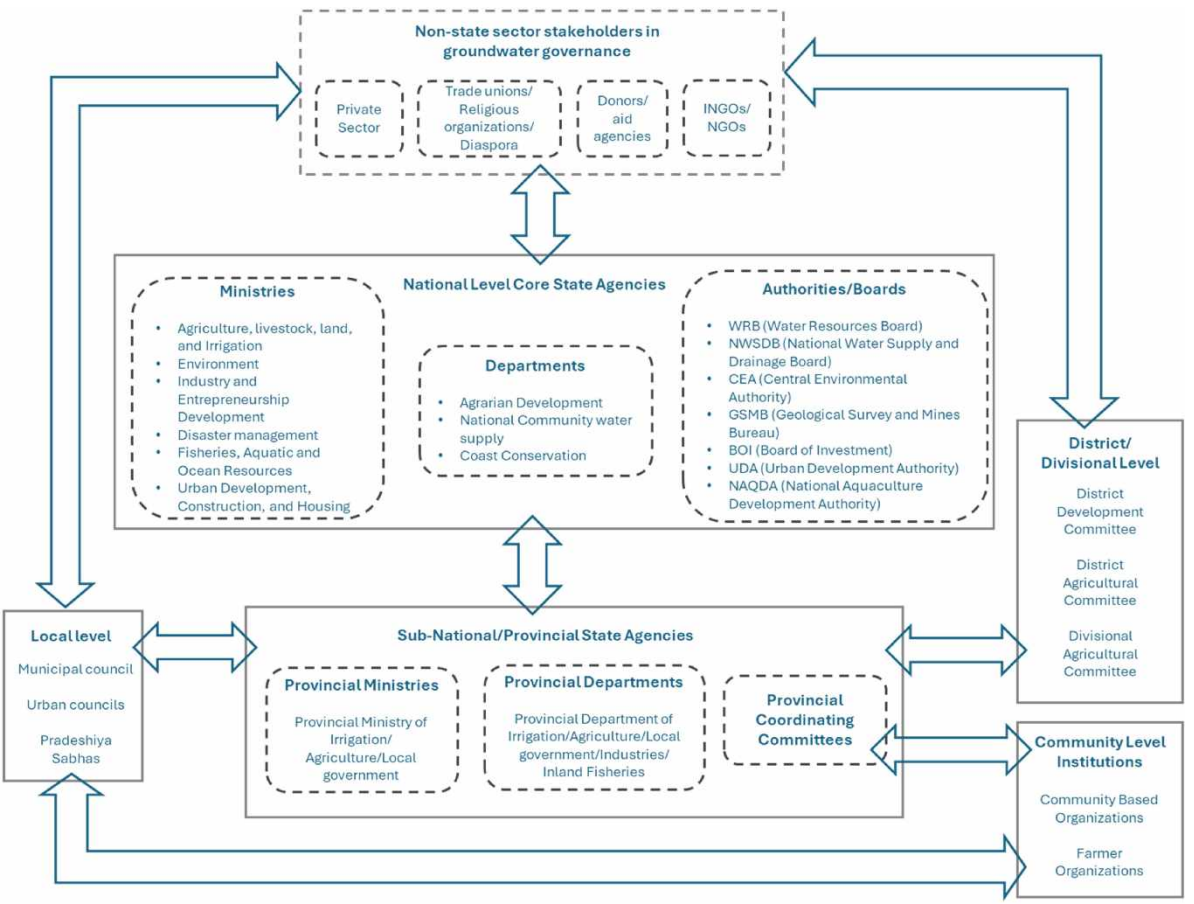

Fig. 3 | Current polycentric and siloed governance structure for groundwater management in Jaffna District.

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The MSP was viewed as a potential avenue to fill this key institutional gap, serving as a mechanism for generating cross-sectoral perspectives that facilitate consensus-based coordination, allowing stakeholders from different sectors to engage in discussions, negotiations, joint planning, resource mobilization, and plan actioning. Following stakeholder consultations and key informant interviews, the project team prepared an outline of the MSP's structure (Figure 4), institutional arrangements, and operational procedures, and validated it at a stakeholders' meeting. Supplementary Sections 1 and 2 provide the rationale for including various groups of actors within the context of the prevailing administrative structure, along with their diverse mandates, particularly those directly related to water or water end-user sectors.

4.1. Defining objectives and scope

Establishing clear objectives for the platform is essential, as it is important to recognize that various stakeholders may have differing expectations (Warner 2006). The primary purpose of the MSP is to establish a cohesive governance framework that facilitates information and data exchange, fosters open dialogue, supports collaborative decision-making, and promotes joint action towards a common goal.

The specific objectives of the MSP are;

i. Promote a shared understanding of the nature of groundwater resources in Jaffna and the existing threats to their sustainable use.
ii. Prepare an overall vision for groundwater management shared by all stakeholders.

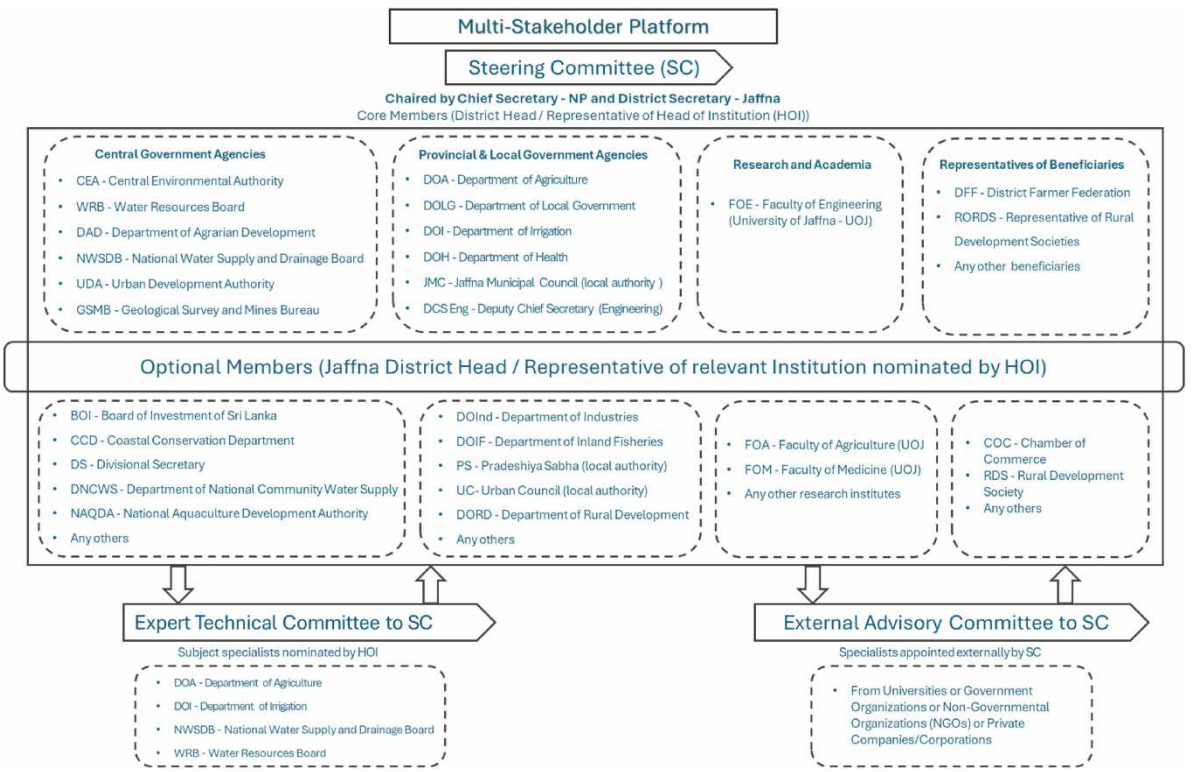

Fig. 4 | Multi-Stakeholder Platform (MSP) Structure established for collaborative groundwater management in the Jaffna Peninsula.

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iii. Develop strategies and strengthen coordination between water sector agencies and other stakeholder groups to put this vision into practice.
iv. Establish a centralized database for sharing data for real-time decision-making and related development activities.
v. Facilitate the collaborative development and execution of policies, regulations, and bylaws.
vi. Establish a transparent system to issue permits for bulk water extraction for commercial purposes, industrial requirements, building construction in groundwater-sensitive areas, sand mining, establishing vehicle service stations, dumping garbage, and other industrial pollutants.
vii. Prepare a robust work plan to raise awareness of groundwater management and promote best practices for managing the quantity and quality of groundwater.
viii. Foster trust and coherence among stakeholders and avoid overlapping and duplication of efforts.

4.2. Identifying and mapping relevant stakeholders and building consensus among MSP members

One of the primary challenges in structuring and operationalizing the MSP was bringing diverse stakeholders into a unified platform, as these stakeholders traditionally operate within their respective mandates to achieve institutional targets. There could be tension between stakeholder participation and traditional epistemic authority, which often confronts entrenched power structures that seek to maintain scientific and institutional autonomy, as noted by Esguerra & Van Der Hel (2020). During the consultation, participants recognized that one underlying cause of institutional conflict is a lack of vertical integration, often resulting from one-way communication between authorities and the exclusion of local stakeholders from planning processes. Knüppe & Pahl-Wostl (2011) observed that effective groundwater governance requires connectivity across administrative levels and the involvement of non-governmental stakeholders in decision-making and planning.

The consultations were designed to ensure genuine inclusivity by acknowledging and addressing diverse needs and power imbalances within the governance landscape, while balancing traditional power structures with the need for inclusive, participatory approaches. Such frameworks can potentially transform governance by encouraging more equitable collaboration and decision-making, ultimately contributing to more sustainable outcomes. A joint leadership position for the MSP was agreed, co-chaired by the provincial administrative head (Provincial Chief Secretary) and the district administrative head (District Secretary). This arrangement leverages existing power hierarchies within the wider political economy, providing the authority needed to mobilize all relevant agencies and make legally valid decisions. Such frameworks have the potential to transform governance by fostering more equitable collaboration and decision-making, ultimately contributing to more sustainable outcomes.

Considering these insights, the initial consultation was conducted to inform stakeholders about the issues and challenges associated with sustainable groundwater management. Discussions subsequently followed this in breakout groups. Breakout sessions focused on the theme 'How can a Multi-stakeholder Platform (MSP) be utilized to foster interagency collaboration and ensure more integrated groundwater management across the Jaffna Peninsula?' The specific discussion questions were: i) what key stakeholders should be included in the MSP; ii) what roles and responsibilities can each party play to enhance collaboration in groundwater management efforts; iii) What specific mechanisms and processes can the MSP implement to facilitate effective communication, knowledge sharing, and decision-making among diverse stakeholders involved in groundwater management; iv) How can the MSP assess and measure the impact of its collaborative efforts on groundwater management practices and policies in the Jaffna Peninsula to ensure continuous improvement and accountability; and v) what should be the key focus areas for the MSP to drive effective decision-making.

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The consultation identified stakeholders for the MSP, including representatives from the central government, provincial government, private sector, representatives of local NGOs and the end users and academia, all of whom exert influence on groundwater management or have an interest in groundwater use. The stakeholders have been further categorized into core and optional members of the current MSP, with their respective roles and responsibilities delineated. The major challenges highlighted from the discussion include a lack of comprehensive groundwater management policy and institutional arrangement, lack of baseline and current water use data, absence of a mechanism to share available data, lack of shared understanding on groundwater issues, absence of a systemized arrangement for issuing permits for bulk extraction of water, especially water availability and variability, lack of adequate system to manage wastewater, sewerage, and municipal solid waste, no monitoring of borewells, and a complicated legal system. It was agreed that the importance of science-supported policies and the use of data-driven approaches to enhance informed decision-making was crucial.

The findings were analyzed and drafted to outline the objectives of the MSP, including its basic structure, leadership, key stakeholders, their roles and responsibilities, key activities to be performed in the short and long term, and the MSP's operational mechanism. The draft MSP document, detailing the structure and operational mechanism, was circulated among stakeholders including community representatives to obtain their written feedback and was also presented to them during the second consultation to solicit further input. Based on the feedback received, the draft was refined. The revised version was subsequently presented to the stakeholders for validation.

The reflections on stakeholder engagement and collective thinking indicate a shift in the perspectives and attitudes of the actors involved. This is evidenced by their agreement to operate within a coordinated apex arrangement under the current leadership, their willingness to share data and information, an increased openness to collaboration, and a broader understanding of challenges that affect multiple end-users and have various developmental implications.

4.3. Deciding the scope of activities of the MSP

Action plans for the utilization, conservation, and management of groundwater resources can be initiated promptly, as achieving a broad consensus through the MSP is feasible. One of the primary tasks of the MSP, as identified by the stakeholders, is to prepare a groundwater management policy for the Jaffna Peninsula to ensure long-term sustainability. Key considerations include identifying the entities responsible for drafting the policy document, whether they are specialized institutions with groundwater expertise or external consultants, among others. The process will entail defining the scope of consultation required before and after preparing the draft policy, securing approval, and establishing timelines to achieve these objectives. It is noted that an implementation action plan should be formulated through consultation with the central and provincial governments. To this extent, establishing a groundwater information management system for the Jaffna Peninsula will be crucial to enabling the MSP to use data effectively and enhance the sustainability of groundwater resources. Once operational, such a system facilitates the identification of resource risks and vulnerabilities. The proposed activities for the MSP to consider and implement in the short- and long-term are provided in Supplementary Section 1.

4.4. Establishing governance structure

Effective MSPs acknowledge the challenges associated with power asymmetries and strive to implement mechanisms that facilitate equitable decision-making and stakeholder representation (Faysse 2006). The governance structure and reporting mechanism were prepared based on agreements reached during extensive participatory stakeholder consultations. During these meetings, participants agreed on the basic structure, including

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leadership, key stakeholders, their roles and responsibilities, and the MSP operational mechanism. This process culminated in a three-tier governance framework comprising a Steering Committee (SC; the core body), an Expert Technical Committee (ETC; the technical advisory arm), and an External Advisory Committee (EAC; an informal collaborative body). Figure 4 illustrates the structure and the key players of the MSP who have a direct influence on groundwater use and management. The platform will be neutral with respect to sectoral interests.

The roles and responsibilities of each stakeholder group, as well as the overall governance of the platform, including operational procedures, were clearly defined through the formulation of terms of reference (ToR). These ToR incorporated explicit guidelines for decision-making, communication, and conflict resolution (Supplementary Sections 3 to 5). Each committee operates with explicitly defined roles and responsibilities, working collaboratively to achieve its intended objectives.

4.4.1. Steering committee (SC)

The SC serves as the principal committee with the highest authority within the MSP framework, tasked with overseeing matters related to groundwater in the Jaffna District. Its primary mandate is to ensure sustainable groundwater management by addressing emerging issues and meeting targets outlined in both long- and short-term plans, guided by a clear vision to preserve groundwater resources. The committee's functions include, but are not limited to, approving strategies; defining and attaining outcomes; monitoring risks, quality, and timelines; making policy and resource-related decisions; resolving conflicts; preparing an action plan for ongoing challenges; and implementing timely actions.

The SC is co-chaired by the Chief Secretary of the Northern Provincial Council (the administrative head of the provincial administration) and the District Secretary of Jaffna (the agent of the central government representing the district). The Chief Secretary may delegate responsibilities to a nominee with relevant knowledge and experience in the subject area and hold a significant position closely related to the subject matter.

The district heads of the key institutions that play a vital role and are directly involved in groundwater management in the Jaffna Peninsula are designated as core members of the SC (Figure 4). We considered government engagement to be key to MSP legitimacy and to enforcing agreements reached in negotiations. The district heads of other institutions with significant but specialized roles in groundwater management in the Jaffna Peninsula were designated as optional members of the SC (Figure 4). District heads have the authority to implement decisions, strategies, and plans across the decentralized administrative structure while safeguarding the functional logics of different actors. They participate in SC meetings as needed to consult, deliberate, resolve issues, or support decision-making on specific matters, and to take actions at the discretion of the SC Chairs, in consultation with the core members.

If an institution assigned either core or optional membership in the SC lacks a designated district head, the institution's head will be requested to nominate an appropriate officer to serve as a core or optional member, as applicable, to represent the institution within the district. The rationale for selecting the members of the MSP is described in Supplementary Section 2. The agreed governance arrangement enables both vertical and horizontal integrations, as well as public participation.

The design of MSP meetings should account for the time constraints of participating sectors, organizations, and individuals. It has been agreed that SC meetings will be held quarterly, ideally on a predetermined day and time within a specified week, enabling members to allocate time in advance for this significant engagement. However, special meetings may be convened at the chair's discretion when urgent matters require attention. Meeting invitations will include a clear agenda, a progress report based on the minutes of the previous meeting, and ongoing issues, to help members attend well prepared. Attendance is strongly encouraged, and members

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should avoid absence. In unavoidable circumstances, the absent member must inform the chair in advance and arrange a suitable representative to ensure the meeting proceeds smoothly and decisions can be made without disruption.

The primary purposes of SC meetings are to discuss the progress of activities, share information, decide on water allocation issues, review policies and bylaws prepared by the agencies, and avoid duplication of efforts. The MSP has prepared and adopted a set of terms of reference to support effective operations and decision-making. The platform should also include a mechanism to collect regular feedback from water users.

The MSP shall designate a suitable member of the Steering Committee to serve as the SC Secretary, responsible for coordinating all MSP activities and ensuring timely follow-up. The drafted ToR for the SC is provided in Supplementary Section 3.

4.4.2. Expert technical committee (ETC)

The ETC serves as the technical advisory committee, responsible for supporting the SC in making technically sound decisions on groundwater issues in the district. Its core duty is to promote the application of technical standards in groundwater management, both in responding to emerging concerns and pursuing the goals outlined in the short- and long-term plans. This work is guided by a clear vision for the sustainable protection of Jaffna's groundwater resources. When needed, the ETC assists the SC in a range of functions, including but not limited to:

i. Developing and approving strategic plans;
ii. Defining objectives and ensuring their achievement;
iii. Overseeing risk management, quality assurance, and timelines;
iv. Contributing to policy and resource-related decisions;
v. Taking timely, technically informed actions to address ongoing challenges.

Technical Experts from key institutions that play a crucial role and are directly involved in groundwater management in the Jaffna District will be nominated by the respective department heads and appointed by the SC as members of the ETC (Figure 4). Upon the SC's request, the ETC shall convene to deliberate on the referred matters and make every effort to reach a unanimous decision. The ETC adopts an integrated approach that transcends sector-specific interests while ensuring that no critical technical aspects are compromised to arrive at the most technically feasible solution. Technical experts act as a single committee, collaboratively advancing the shared objectives of sustainable groundwater management.

In instances where a unanimous decision is unattainable, the ETC's report must explicitly articulate the divergent opinions of sectoral experts, accompanied by the rationale underpinning each perspective. This enables the SC to address the issue by either consulting the EAC or pursuing an appropriate alternative course of action. If the ETC determines that further input from a specific sectoral expert is required to devise a more appropriate technical solution, it may request that the SC appoint that expert to collaborate with the ETC on that occasion. If the ETC determines that the issue is exceptionally complex, beyond its expertise, or exceeds its mandate, it shall inform the SC, enabling the SC to appoint an EAC member to provide necessary guidance and develop an appropriate solution. The ToR developed for the ETC is provided in Supplementary Section 4.

4.4.3. External advisory committee (EAC)

The EAC is tasked with assisting the SC and ETC in anticipating developments in the scientific domain pertinent to groundwater potential and addressing community needs. Additionally, the EAC serves as a watchdog, alerting the SC and ETC when their actions deviate from the MSP's objectives or negatively affect the public interest. The EAC consists of six members, four of whom are academics with expertise in groundwater hydrology,

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environmental science (specializing in groundwater systems), sociology (with experience in groundwater management), and climate change. These members are nominated by the Vice Chancellor of the local university (University of Jaffna). The fifth member is a representative of the NGO Council of Jaffna, recognized for strong community engagement and a comprehensive understanding of groundwater-related issues in the region. The SC is to identify and appoint the sixth member from the civil society. The member should be a well-respected individual from the local community, widely acknowledged for their indigenous knowledge, clear vision for groundwater enhancement, and profound understanding of the groundwater challenges specific to the Jaffna Peninsula. The local community members and a local NGO representative raise the voices of local groundwater users and vulnerable communities in the decision-making process.

The SC is responsible for ensuring that the EAC receives all pertinent information regarding the MSP's activities and performance. This includes copies of complaints or requests submitted during SC meetings, ETC reports, SC meeting minutes outlining decisions, and progress reports indicating performance levels. Such information should be disseminated transparently to keep the EAC well-informed and enable it to provide appropriate guidance. The SC shall seek the EAC's assistance not only for expert advice on matters that fall outside the ETC's area of expertise or beyond its mandate but also to gain further clarity on the ETC's views and recommendations by obtaining a second opinion. The EAC shall, either upon request from the SC or on its own initiative, offer guidance, advice, strategic direction, and continuous feedback on the activities of both the SC and the ETC, ensuring alignment with the MSP's vision, goals, and objectives.

Although the SC is not mandated to adopt or implement all recommendations from the EAC, it is strongly advised to give due consideration to the EAC's insights and, where appropriate, integrate them to the fullest extent possible in consultation with the ETC. The ToR developed for the EAC is provided in Supplementary Section 5.

4.5. Building trust and transparency

Trust-building is foundational to successful MSPs, particularly initiatives that bring diverse actors together. Institutional frameworks can facilitate cooperation, reduce transaction costs, and promote innovation (Thiele *et al.* 2011). Dynamic engagement practices help navigate trust dynamics, transforming negative emotions into positive interactions (Jansen & Kalas 2020). During MSP development, transparent information sharing and healthy dialogue among stakeholders were encouraged. It was ensured that all stakeholders' responses were heard and valued. To build trust among stakeholders, mechanisms were adopted to ensure accountability and address potential conflicts of interest. As Salamanca-Cano & Durán-Díaz (2023) emphasize, transparent decision-making processes and follow-up mechanisms are necessary to provide comprehensive engagement throughout all phases of governance.

4.6. Facilitating collaboration and knowledge sharing

The MSP promotes sharing data, information, best practices, research findings, lessons learned, and innovations, thereby encouraging effective stakeholder engagement. Strengthening stakeholders' adaptive learning capacity is critical to creating a lasting impact. Avenues for stakeholders to interact and facilitate joint learning from each other's experiences and perspectives include organizing workshops, meetings, and online forums. The process fosters trust, supports shared understanding of groundwater systems, and helps find balanced solutions, while empowering participants to manage future change (Scholz & Steiner 2015; Eden *et al.* 2016). Additionally, knowledge sharing contributes to pooling resources and enhancing the capabilities necessary to effectively address complex problems (Cao & Tao 2025).

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4.7. Ensuring sustainability

To ensure sustainability, it is imperative to transform ideas into actionable strategies and execute them effectively at the operational level, accompanied by a robust monitoring and evaluation mechanism (M&E) to track the platform's progress. Continuous monitoring and evaluation of activities are essential to ensure that initiatives remain aligned with objectives and can adapt to evolving circumstances. This also facilitates revisiting and realigning goals based on learned experiences and emerging insights (Kusters *et al*. 2017). Moreover, it is evident that such multi-stakeholder processes require time to establish and mature, deliver the desired outcomes, and be sustained through tailored, continuous facilitation and engagement to sustain motivation. Success is not determined by the number of participants, but by fostering ownership, commitment, and adaptability among all stakeholders. This extends beyond the temporal confines of projects, thereby enabling the potential for sustained, meaningful change over time.

To ensure continued stakeholder engagement and sustainability, the MSP has included the identification and documentation of both short- and long-term activities to be executed by the platform. By bringing together all key agencies, the platform is expected to streamline public investment priorities more effectively than isolated, ad hoc actions in the past. The operation of agencies together through the MSP, with coordinated actions, builds greater donor confidence. It is also committed to maintaining open and transparent communication regarding its activities, progress, and challenges. Regular updates are to be disseminated to all stakeholders through meeting reports and knowledge-sharing events, thereby fostering trust among stakeholders. The MSP may require an annual report on the groundwater status of the Jaffna Peninsula to enable informed decision-making on groundwater management during droughts and in response to the impacts of climate change, seawater intrusion, and contamination.

It is important to emphasize the need for sustainable funding and regulatory reforms to ensure the MSP's continuous operation. Activities through MSP, with stronger stakeholder collaboration, lead to more efficient resource use. In this intervention, the approach adopted was to empower local stakeholders to assume ownership of the platform and its activities, while integrating the platform's initiatives into existing policies and institutions. The arrangement for co-chairing the MSP by the heads of provincial and district administrations enhances the MSP's decision-making authority concerning financial allocations within the annual budgetary process.

Achieving long-term objectives is also contingent upon sustained political will, reliable financial commitment, and an inclusive, participatory approach. Therefore, it is imperative to establish a definitive strategy for financing the MSP's operational costs to ensure a timely commitment to the process. Because both central and provincial authorities oversee water management in the Jaffna Peninsula, the Northern Provincial Administration and the district administration in theory are jointly responsible for ensuring the initiative's sustainability. This includes securing and allocating the necessary funding for the continued operation of the MSP. Whether these transpires will depend partly on the outcomes the MSP can generate and how this influences the cost-benefit perception amongst the administrative leadership.

5. ACHIEVEMENTS OF THE MSP GOVERNANCE MODEL

Evidence of stakeholder engagement and cooperation is demonstrated through various sources, including consultation records, written stakeholder feedback, validated MSP documents, agreements on a three-tier structure and terms of reference drafted for their operation, and formal meeting minutes. In addition, formal minutes of four MSP meetings held between 2025 and mid-2026 document institutional outputs, specific decisions, assigned follow-up actions, and initiatives under development. The principal institutional outputs were the

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formation of the Steering Committee (SC), Expert Technical Committee (ETC), and External Advisory Committee (EAC), together with the development and adoption of terms of reference for their operation. The meeting outcomes reported below therefore concern governance processes and early implementation steps; changes in groundwater quantity, quality, or use have not yet been measured.

Across four meetings held over nine months between 2025 and mid-2026, the MSP moved beyond general dialogue to record specific governance decisions, assigned responsibilities, and implementation steps. The documented outcomes concern regulation, pollution control, technical assessment, data management, and policy development. These are institutional and process-level results; effects on groundwater quantity and quality have not yet been measured.

The MSP identified weak enforcement of the Water Resources Board's authority over tube well drilling, especially in vulnerable island areas. In response, the Chief Secretary of Northern Province instructed the Commissioner of Local Government (CLG), Jaffna, to notify all local authorities to issue business registrations for tube-well-drilling companies only to WRB-registered firms, thereby creating an administrative barrier against unauthorized operators while pursuing legislative solutions. The MSP also adopted a resolution prohibiting private reverse-osmosis (RO) plants from discharging effluents into public drains or onto land, which threatens groundwater quality and requires safe disposal arrangements. The group enacted a binding resolution prohibiting RO plant wastewater from entering public drainage, requiring safe disposal mechanisms. The meetings further called for local authority enforcement and public awareness on the risks of unregulated extraction.

Concerns were also raised about the increase in high-rise construction in the Jaffna Peninsula, focusing on safety, geological suitability, and regulatory frameworks. Participants emphasized that new high-rise buildings need stricter oversight because of the region's limestone substructure, the fragile groundwater geology, and the shallow lens of fresh groundwater floating above a deeper saline aquifer trapped within highly permeable Miocene limestone. Over the past decade, questions have emerged about the approval criteria for many high-rise structures, despite limited geotechnical or hydrogeological data. It was agreed to seek clarification from the National Building Research Organization (NBRO) regarding approval criteria and safety assessments. As a follow-up action, they also proposed collaboration with the Faculty of Engineering, University of Jaffna, to develop geotechnical evidence and safety benchmarks.

Further, to facilitate evidence-based policy and address groundwater challenges, the MSP proposed a multidisciplinary expert team to assess groundwater quality and quantity regularly, focusing initially on islands and other areas exposed to high salinity and contamination risks. The proposal establishes a technical direction for strengthening the evidence base for improving groundwater governance, enabling targeted interventions, and boosting public confidence in water sources.

Recognizing data's crucial role in sustainable groundwater governance, the MSP deliberated on systematic water quality monitoring, data sharing, and regulatory enforcement. It was agreed that entities extracting groundwater for commercial or industrial purposes must conduct mandatory water testing for specific quality parameters every six months to protect public health and identify risks of salinity or contamination. A centralized data management system is being developed to support data collection, monitoring, visualization, and inter-agency access, enabling informed decision-making. The Irrigation Engineer, Jaffna, has been designated to oversee the Data Management System (DMS) for the Northern Provincial Council.

The MSP is working with a consultant to prepare the first groundwater management policy for the Jaffna Peninsula. Dialogs and exchanges of information and ideas that took place in past MSPs were instrumental in generating the willingness across its members to formulate a dedicated policy. The draft policy will be reviewed at the next MSP meeting. This addresses a major policy gap that prevented more collaborative groundwater governance. Articulating a clear, comprehensive policy and committing to collaborative groundwater

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management will provide the policy directives needed to support transforming groundwater governance and further legitimizing the MSP as the central institutional mechanism enabling integrated governance solutions. The progress made by the MSP also secured its formal legal authority by integrating it into the Provincial Council's statutory framework through the enactment of appropriate statutes and circulars, ensuring sustainability and legitimacy. The MSP's outcomes in a short period indicate that it has served as a forum for policy dialogue, fostering mutual understanding and broader support among diverse stakeholders. These governance process outcomes show that previously disparate and often competing actors have built consensus, begun developing a groundwater policy for Jaffna, and taken regulatory decisions. Whether these institutional changes improve groundwater quantity or quality remains to be measured.

The MSP established in the Jaffna Peninsula operates as a coordination and decision-making mechanism embedded within Sri Lanka's existing decentralized governance system, rather than as a separate institution. It links central-government mandates, provincial legislative and administrative authority, district-level implementation, and technical expertise through a three-tier structure. It is this combination and coordination of existing mandates operating at different administrative scales and aspects of groundwater governance that is the MSP's core strength. Open communication helped build common understanding and reduce conflict. The SC converts shared analysis into coordinated policy and administrative decisions; the ETC supplies technical evidence; and the EAC provides independent scientific and community-focused oversight. The MSP coordinates how those powers are exercised, fills gaps in inter-agency collaboration, and supports the development of provincial policies, statutes, regulations, bylaws, and administrative circulars needed for integrated groundwater governance. District heads of key institutions serve as core or optional Steering Committee members because they have the authority to implement decisions locally.

6. OPPORTUNITIES AND CHALLENGES IN OPERATIONALIZATION OF MSP FOR GROUNDWATER DEVELOPMENT

The problems of overuse and destruction of natural resources are diverse and involve many biophysical, economic, and social variables, making it difficult to find a single solution; each situation requires its own diagnosis and its own solution (Ostrom 1990; Ostrom *et al*. 2007). The making of several administrative decisions and the development of a groundwater Policy for the Peninsula suggest the need for effective governance of groundwater resources in the Jaffna Peninsula through an MSP to foster collaboration among government agencies, local communities, non-governmental organizations, and private-sector players. For instance, California's formation of multilevel collaborative governance structures for groundwater management enabled broad stakeholder engagement and local decision autonomy, balancing regional sustainability goals with user independence (Conrad *et al*. 2018). However, it has been recognized that addressing the existing political economy driving sector-based governance remains challenging. Therefore, supporting the MSP until the benefits of collaborative governance are apparent and milestones in behavior change amongst key actors are observed is essential.

The highly permeable limestone aquifers of Jaffna, coupled with a limited understanding of groundwater flows, necessitate a collaborative, science-based governance approach to safeguard the fragile freshwater aquifer. Given that groundwater exists as a thin freshwater lens above saline water, it is crucial to prioritize and regulate abstraction, license wells and drillers, monitor pumping activities, and designate groundwater-sensitive areas for effective resource management. The heavy reliance on groundwater for drinking, agriculture, industry, and ecosystems underscores the need for an inclusive platform that balances competing demands, coordinates water allocation, establishes a shared database, and develops a comprehensive groundwater management policy for the peninsula. Therefore, stakeholders have been entrusted with collective governance to focus on groundwater

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monitoring, abstraction management, pollution control, aquifer protection, and conservation of traditional water sources, in addition to their mandated responsibilities.

The MSP plays a vital role in addressing both the opportunities and challenges surrounding groundwater development in the Jaffna district. The main opportunity in operationalizing MSP is to build consensus on the importance of cooperation by enhancing knowledge and information management of groundwater conditions, drivers, and solutions (Figure 5). Timely data visualization can inform decisions and raise awareness of groundwater issues, and any resulting changes in practices or groundwater conditions will require future evaluation. Another opportunity is a collaborative leadership approach that encourages diverse stakeholder engagement. By bringing together different perspectives, deliberations, and decisions in the MSP, it appears the MSP is laying the groundwork for systematic, collaborative, and innovative solutions to groundwater challenges. Further, incorporating inputs from local communities and stakeholder groups ensures that the governance framework reflects the needs and priorities of the people most affected by groundwater issues. Dobbin (2020) emphasized that MSPs can potentially address inequities in access, especially among small, low-income, or rural communities historically marginalized in water resource management. The participatory approach strengthens community ownership and compliance with groundwater management policies (Figure 5).

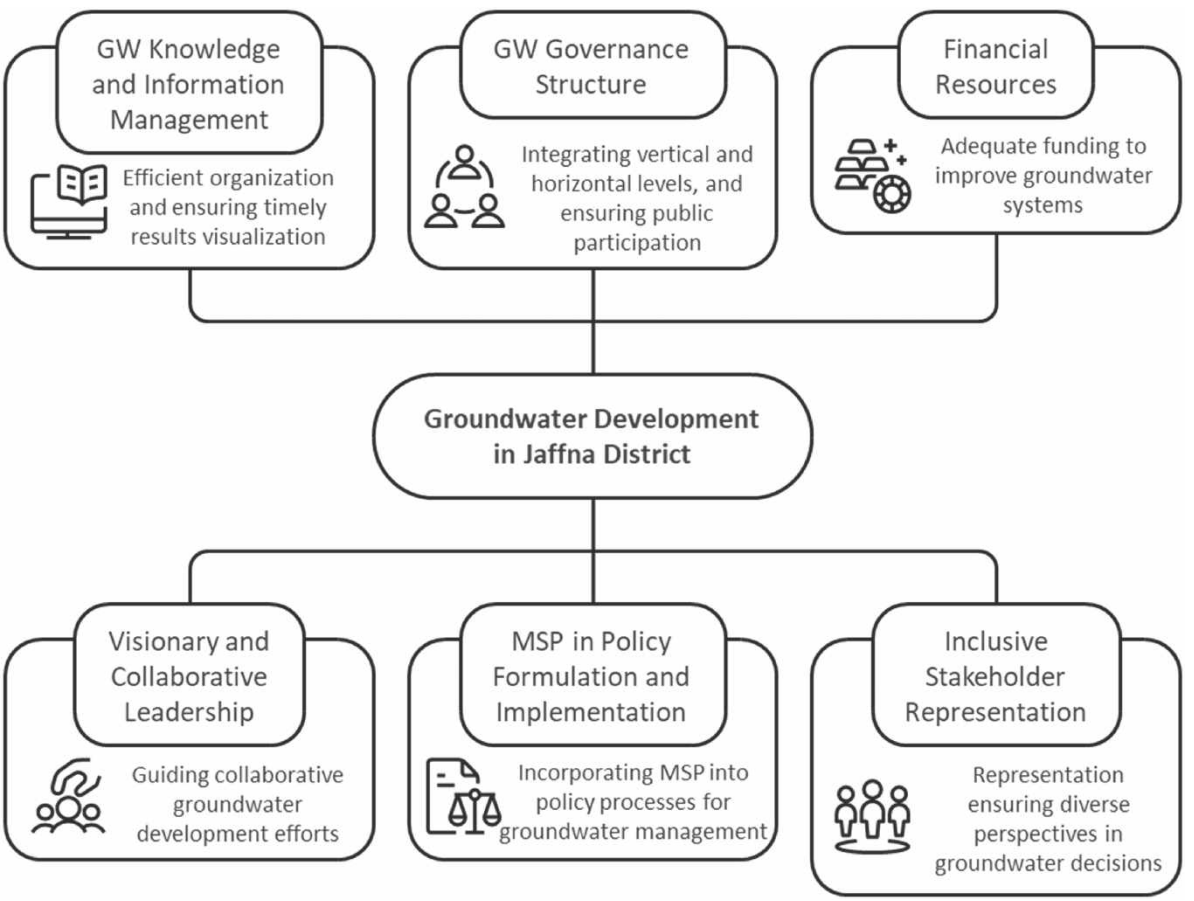

Fig. 5 | Challenges and opportunities for MSP in groundwater governance in Jaffna District.

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As Warner (2005) notes, MSPs do not form spontaneously; they require strong leadership with the authority to drive the forum and support from an external facilitator to convene and sustain the platform. This holds true in this case as well, with the International Water Management Institute (IWMI) serving as the facilitator in the initial MSP meetings. As Hamel (2000) suggests, for the MSP to be sustainable, it requires immediate successes to maintain momentum. Incorporating an action component prevented the MSP in the Jaffna Peninsula from stagnating in mere discussion, ensuring that participants remained engaged as the discussions moved from problem analysis to planning of solutions. Thus, initial experiences indicate that the MSP has created a deliberative, inclusive, and accountable response to deficiencies in groundwater governance in the Peninsula; its effects on groundwater conditions are too early to measure.

There will be many future challenges in operationalizing the MSP, not least the complexity in balancing authority and collaboration among stakeholders, particularly when interests and power dynamics vary within a deeply fragmented governance history and culture. Another challenge would be policy implementation; translating MSP discussions into tangible action points can encounter bureaucratic hurdles. A gap between policy formulation and implementation may require ongoing coordination and stakeholder support. An equally critical challenge is accessing adequate financial resources to improve groundwater systems in Jaffna. The MSP will need to prioritize strategies to mobilize funding, including government budgets, donor assistance, and private investment. Because the MSP represents a more coherent collective than the disjointed governance landscape of the past, it could offer a considerable advantage in approaching government and donors with a single voice and a shared vision for how Jaffna Peninsula's critical groundwater resources should be governed.

The MSP emphasizes inclusive governance, adaptive learning, and institutional coordination. The innovative aspects of this MSP's design and implementation include a collaborative leadership arrangement between central and provincial administrations, an agreement for legal integration into provincial statutory frameworks, and a three-tier inclusive governance structure. Stakeholder engagement within MSPs is often heavily front-loaded during policy formulation but diminishes during implementation and follow-up. This superficial engagement undermines platform effectiveness by failing to consolidate stakeholder ownership and ongoing collaboration (Salamanca-Cano & Durán-Díaz 2023). Additionally, challenges related to equity, data, institutional fragmentation, and sustained engagement continue to limit effectiveness. Overcoming these failures requires deliberate attention to power dynamics, robust data systems, adaptive governance, and ensuring continuous, genuine participation across all stakeholder groups.

The literature on multi-stakeholder platforms for groundwater governance presents a nuanced picture. While conventional governance approaches often fail due to narrow focus, institutional fragmentation, and power imbalances, the MSP established in Jaffna shows promising institutional and process-level developments in inclusivity, adaptiveness, and coordination. Success hinges on recognizing groundwater governance as a socio-political process, fostering genuine stakeholder participation, and deploying appropriate governance tools and institutional arrangements. Bridging the gap between technical and social dimensions and investing in capacity building and governance innovation are pivotal to realizing sustainable and equitable groundwater governance (Closas & Villholth 2019; Adanma & Ogunbiyi 2024; Khajavigodellou *et al.* 2026).

The MSP is expected to remain functional beyond initial project support through several mechanisms. The joint leadership of the MSP by provincial and district administrations, embedded into existing governance structures, ensures local institutional ownership. Incorporating the MSP into provincial statutes, regulations, bylaws, and administrative circulars is intended to confer formal authority and legitimacy. The Northern provincial administration and district administration are tasked with securing operational funding through annual budgets. The collective authority of the MSP also facilitates the attraction of government funding, donor support, and private investment. Furthermore, ongoing data sharing, joint planning, transparent reporting, and visible early

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actions are intended to sustain participation and trust and strengthen the business case for the provincial and district administrations to allocate operational funding from their annual budgets.

For policymakers, practitioners, and researchers seeking actionable implications for scaling and replication to implement similar collaborative governance frameworks in other fragile or water-scarce regions, this study provides several actionable guidelines:

- Decentralized governance alone may not result in integrated natural resources governance since the resulting sub-national structures tend to operate vertically within sectoral silos, with sparse attention to the need for cross-sectoral coordination in the face of challenges that are often multi-dimensional. This means that current decentralized governance approaches fail to account for the polycentric nature of Natural Resources Management decision-making, which involves multiple administrative scales, sectors, and resource users. An MSP-based approach, if implemented thoughtfully, can overcome this fundamental structural weakness by converting the vertical system into a matrix that facilitates both vertical and horizontal cooperation.
- Rather than creating an entirely external body, practitioners should anchor the MSP within existing stakeholder mandates, whilst concurrently using the MSP's structure and dialogues to bridge power asymmetries. This reflects the balance needed between appointing high-level government officials (e.g., provincial and district administrative heads) as co-chairs to ensure the platform's collaborative decisions have the legal authority needed for enforcement, and avoiding pre-existing differences in influence among these actors creeping into the MSP. The key lies in building consensus through collective consideration of data and shared interests.
- Managing power asymmetries and sector-specific biases can also be supported by structuring the MSP into distinct functional tiers that create an internal balancing mechanism. In this MSP, the structure includes an SC for overarching policy development, a dedicated ETC for establishing scientific standards, and an EAC to serve as a community watchdog for inclusive, transparent, and technically sound decision-making.
- To maintain momentum and legitimacy, newly formed platforms must rapidly transition from dialogue to action, addressing visible, localized issues. Early interventions, such as strictly regulating local tubewell drillers or halting specific industrial pollution discharges, build confidence and show skeptical stakeholders the platform's effectiveness.
- MSPs must leverage the significant advancement in governance capacity they represent for secure, sustainable funding by using its multi-actor strength to access and utilize state funds more efficiently and explore opportunities to formulate and present a coherent resource management plan and costed implementation plan to external donors. Using MSP's considerable convening power, given the collective authority of its membership, will be key. The opportunity to do so in the Sri Lanka context has recently expanded with the adoption of Provincial Climate Adaptation Plans, which grant provincial governments greater autonomy to develop and implement more context-appropriate actions, which the MSP must take advantage of. Similarly, MSPs in other countries must make the scanning of structural and funding landscapes a core strategic activity.

7. CONCLUSIONS AND WAY FORWARD

Groundwater aquifers and their management in the Jaffna Peninsula are uniquely complex because of their inherent vulnerability and scarcity, further exacerbated by rising demand across sectors in the absence of surface water resources. To address these challenges, several technical priorities have been identified, including expanding groundwater monitoring sites for real-time data collection, implementing data-driven tools such as groundwater information systems, community-based monitoring initiatives, and using mobile applications and digital platforms to raise awareness and disseminate data. To fully realize the benefits of these technical

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interventions, an institutional framework such as the Multi-Stakeholder Platform (MSP) is essential since most interventions require multi-actor collaboration for which no platform exists.

An evolving collaborative groundwater model in the Jaffna Peninsula through an MSP draws on diverse theoretical and empirical content from the global literature on the specific challenges of groundwater governance and common-pool resources more broadly. The experiences from this process suggest that MSPs can provide an institutional framework for advancing sustainable groundwater governance, although environmental outcomes require longer-term measurement. Especially at smaller geographical and population scales, such as the Jaffna Peninsula, MSPs can implement Integrated Water Resources Management by reconciling diverse stakeholders, promoting water stewardship, and fostering Public-Private-Civil Society Partnerships to manage and develop groundwater resources. In fragile groundwater environments like the Jaffna Peninsula, proactive governance is crucial to prevent issues. Frameworks should include structured stages for inclusive, transparent decision-making. Simplicity is key: clear communication and symmetrical dialogue that value all stakeholders' concerns and knowledge, build trust, reduce conflict, and strengthen governance legitimacy.

It positions actors and institutions as key forces that both respond to the governance context and can instigate change within it. The multifaceted approach adopted to establish the MSP facilitated effective management of power imbalances among agencies with a stake in groundwater management by integrating governance reforms, conflict-resolution strategies, and inclusive participation from all stakeholders, ensuring every voice is heard and considered in the decision-making process. The approach adopted emphasizes empowering local stakeholders to assume ownership of the platform and integrating initiatives into existing policies and institutions.

The evidence available at this stage supports conclusions about institutional and process-level changes, while how these changes translate into confirmed improvements in groundwater quantity, quality, or usage will be tracked as plans are made and actioned. Documentation from consultation, validated governance records, meeting minutes, and observations from four MSP meetings indicate that the platform has successfully established a three-tier governance structure, adopted terms of reference, enabled inter-agency deliberation and information sharing, and generated coordinated decisions and initial implementation actions. In a context marked by sectoral silos, the willingness of these same actors to participate in an MSP is itself an achievement. That these actors now, as an MSP, are preparing to develop a single unified Groundwater Management Plan is another barometer for the extent to which a shared governance culture has emerged. The present impact is best characterized as enhanced governance capacity, inter-agency collaboration, and coordination. Effects on groundwater management practices and biophysical conditions remain speculative and necessitate systematic monitoring and longer-term evaluation.

The insights, experiences, and lessons from the MSP may inform collaborative governance processes in other regions of the Global South, subject to aquifer types, recharge processes, data availability, or degrees of administrative decentralization that will shape the particular structure of an MSP in each context.

Furthermore, the success of MSPs in promoting sustainable groundwater governance may inspire policymakers to incorporate this approach into broader water resource management strategies, thereby leading to more effective and equitable water policies. As the MSP evolves, it can address complex groundwater challenges through collaborative, negotiated, and scientifically informed processes while attracting greater support from government and non-governmental organizations.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

Mohamed Aheeyar – Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Validation, Visualization, Writing – original draft. **Mahesh Jampani** – Data curation, Formal analysis, Investigation, Resources, Validation, Visualization, Writing – review and editing. **Sanjiv De Silva** – Investigation,

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Validation, Writing – review and editing. **Somasuntharam Shanmuhanathan** – Investigation, Resources, Validation, Writing – review and editing. **Dilmi Sithara Gamage** – Data curation, Visualization, Writing – review and editing.

ACKNOWLEDGEMENTS AND FUNDING

This work was funded by the United Kingdom's Foreign, Commonwealth and Development Office (FCDO) under the Climate Action for a Resilient Asia (CARA) program, through the British High Commission in Sri Lanka. The project aimed at developing sustainable groundwater management in the Jaffna Peninsula, Sri Lanka. The authors thank Dr Lal Mutuwatte, Dr Karthikeyan Matheswaran, and Dr Nishadi Eriyagama for their contributions to the project, and Mr Dimuthu Malalgoda for project coordination.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

In writing this manuscript, we have relied upon the use of Microsoft Word's built-in Editor, Grammarly, and Paperpal to improve its readability and check grammatical consistency. These tools apparently employ AI-based algorithms to perform these tasks. After using these tools, the authors reviewed and edited the content and take full responsibility for the content of the publication.

ETHICAL APPROVAL

The study did not collect personal information and qualified for the minimal risk exemption, in accordance with Section 45 CFR 46.101(b) of the US Federal Policy for the Protection of Human Subjects, as verified by IWMI's Institutional Review Board (IRB).

DECLARATION OF COMPETING INTERESTS

All authors of this study declare that they have no conflict of interest, and none of the authors is financially or non-financially involved with the organizations being studied in this article.

DATA AVAILABILITY STATEMENT

Data cannot be made publicly available; readers should contact the corresponding author for details.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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First received 19 May 2026; Accepted in revised form 2 November 2026; Available online 19 November 2026

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