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Policy analysis for transformations in water governance: exploring the case of water allocation and rights in Indonesia

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ABSTRACT

This article examines how policy analysis can support transformations in water governance and management, especially under contested situations. Transformations aim to achieve deep and widespread change toward a more sustainable future. In response to pressing water challenges, transformations may be required within water allocation and rights systems, which are practiced in diverse frameworks across the globe. However, processes of transformation can be highly contested due to the varying knowledge, values, interests, and power relations that exist among involved actors. Research on navigating these contested transformations is limited; however, the field of policy analysis has long developed concepts and tools for addressing contested problems. Accordingly, we propose a framework comprising policy analysis activities to support navigating contestations across transformation approaches. We illustrate the usefulness of this framework through a case study of water allocation and rights in Indonesia. This analysis highlights that a diverse range of policy analysis activities have been undertaken across the three different transformation approaches, each of which exhibits contestation. However, policy analysis activities that support community-led transformations appear more limited, suggesting an important area of untapped potential in this and other water transformation contexts.

Key words: Contestation, Indonesia, Policy analysis, Transformations, Water allocation, Water rights

HIGHLIGHTS

- An analytical framework encompassing policy analysis for contested transformations across political structures, management processes, and grassroots actions is developed.
- Contestations and classical policy analysis activities are identified within water allocation and rights transformations in Indonesia.
- Policy analysis activities aimed at democratizing the transformation process and supporting more emancipatory, enabling transformation are underutilized.

1. INTRODUCTION

Transformations to sustainability are emerging topics on the agenda of future development. Transformations call for fundamental, deep, and radical changes that extend beyond incremental adjustment (Smith & Ely 2015). The emphasis on radical transformations is largely grounded in the argument that current development trajectories are subject to lock-ins and that small and superficial changes are no longer effective. Addressing the root causes

of environmental problems is seen as a means of breaking free from unsustainable trajectories. This requires shifts in prevailing development paradigms, such as the growth, consumption-dependency, and the capitalistic economic model (Feola 2020; Scoones *et al.* 2020), and over-reliance on the command-and-control approach in environmental governance (Zwarteveen *et al.* 2021).

Transformations are also relevant to water governance and management (Pahl-Wostl 2017; van der Voorn 2023). For example, human development has significantly disrupted the natural water cycle. Industrialization, agriculture, and urbanization continue to consume water significantly while also contributing to widespread contamination of water bodies (Bowman *et al.* 2023; Richardson *et al.* 2023). The water sector is also among the most affected by climate change due to altered meteorological patterns (UNEP 2023). As a result, many countries have been implementing policy reforms and new ways of sharing their scarce water, for instance by introducing (new) permitting systems, market instruments, and/or environmental flow provisions (e.g., Hellegers & Leflaive 2015; Bosch *et al.* 2021). More recently, changes in climatic conditions, growing demands, and heightened environmental concerns have put existing water allocation and rights arrangements under pressure, stimulating even more countries to transform their existing systems more sustainably. However, water allocation and rights reforms are often highly contested because people are competing for limited or over-allocated water for their own interests (Suhardiman 2014; Hellegers & Leflaive 2015).

Contestations and resistance are known to characterize sustainability transformations more generally (Köhler *et al.* 2019; Patterson & Paterson 2026). Although contestation may have negative connotations for some, transformation scholars argue that these should be embraced as a fundamental part of transformation processes. Rather than being avoided, contestations provide opportunities to foster relationships grounded in equity and fairness and to balance the distribution of social and environmental costs and benefits (Temper *et al.* 2018; Patterson & Paterson 2026). Currently, however, there remains a gap in the transformation literature regarding how to navigate contestations effectively (Temper *et al.* 2018; Patterson & Paterson 2026). The formulation of prescriptive guidance for transformation processes and finding a practical approach toward radical change remain a key endeavor (Termeer *et al.* 2024).

More recently, policy analysis has been identified by transformation and transition scholars as a promising discipline to support the further development of the field (Wittmayer *et al.* 2021). Policy analysis itself is a discipline that emerged in the mid-20th century to support and inform the decision-making process of public policy. For decades, policy analysts have been working on practical approaches, methods, and tools to deal with policy problems, including so-called wicked problems: problems characterized by contestation and uncertainty (Rittel & Webber 1973; Wildavsky 1979; Thissen *et al.* 2013; Enserink *et al.* 2022).

In this article, we address the question of how the policy analysis discipline can be leveraged to support transformations, particularly navigating the contestation involved. We focus on Indonesia's water allocation and rights system as an example. Section 2 describes the research methods, and Sections 3–5 present the results. We close the article with a final discussion.

2. METHODS

We addressed the research question by following a deductive reasoning approach, beginning with a review of the relevant literature, formulating an analytical framework, and testing its application in a real-world transformation case study. Our review of sustainability transformation scholarship drew from Western scientific literature, including socio-ecological transformations, sustainability transitions, and sustainability pathways theories, which have been influential in shaping sustainability transformation knowledge and theory (Patterson *et al.* 2017; Lam *et al.* 2020). In parallel, we reviewed the policy analysis literature, which embraced the ideals of deliberative democracy, participation, and collective action, which some have termed a *new*

development in public policy analysis (Thissen *et al.* 2013). By integrating insights from these two scientific fields, we formulated an analytical framework comprising a range of policy analysis activities designed to support the sustainability transformation agenda, particularly in navigating the contestation across transformation approaches.

We then applied the framework to a case study of Indonesia's water allocation and rights system, intending to illustrate its practical usefulness in supporting ongoing and future sustainability transformations. Accordingly, we examined what forms of contestation remain and what policy analysis activities have been undertaken to date. This approach also responds to calls for transformation research to move beyond theoretical debate and toward actively demonstrating and supporting transformations in practice (Wittmayer *et al.* 2021; Bentz *et al.* 2022). The analysis of current contestations was primarily undertaken from the perspective of national and regional water management authorities, whom the first and second authors met and interviewed during a mission between 15 and 24 May 2023. Meanwhile, the policy analysis activities that were undertaken were examined using secondary sources, including academic literature and policy documents published from the late 1990s (a period marked by the popularization of IWRM and the post-*Suharto Reformasi*) and onward, which remain relevant to the contemporary policy context. These secondary sources also helped us triangulate the analysis of primary data. A more detailed explanation of the case study's analysis is provided in the supplementary material.

3. SUSTAINABILITY TRANSFORMATIONS AND POLICY ANALYSIS LITERATURE

3.1. Sustainability transformation approaches

Transformation scholars argue that contemporary societal change must be deep and radical, transcending existing structures of power, knowledge, and institutions (Smith & Ely 2015; Chaffin *et al.* 2016). Such transformations require a fundamental shift in societal values and belief systems by prioritizing ecological sustainability and equitable development as the main principles. This entails rethinking how we as a society produce and consume, challenging the dominant paradigm of economic growth, and correcting global development relationships (Scoones *et al.* 2015; Gram-Hanssen *et al.* 2022). While we often approach change through incremental learning, adaptive, or deliberate processes, including a focus on the role of technology and innovations, these approaches have largely failed to redirect us from an unsustainable trajectory (Westley *et al.* 2011; Scoones *et al.* 2015).

Establishing such radical transformations requires an integrative approach that combines distinct strategies (Werbeloff *et al.* 2016; Scoones *et al.* 2020). For example, the transformation of urban stormwater management in Australian cities has been driven by a combination of the cultural shift toward waterway protection, institutional reforms including the implementation of Water Sensitive Urban Design policies, and innovative practices that integrate ecological and social functions into stormwater infrastructure (Werbeloff *et al.* 2016). Therefore, transformations must shift all elements and encompass social structures, institutional systems, and community actions.

First, transformations should have a *structural* component: They should shift the current societal structures – political, economic, and cultural systems – into prioritizing ecological sustainability and equitable development (Scoones *et al.* 2020). In this context, transformations must elevate alternative ideologies, such as decolonizing science and international development relationships, counter-capitalist economics models, and caring-based environmental governance frameworks, that can challenge the dominant unsustainable regime (Feola 2020; Zwarteveen *et al.* 2021; Gram-Hanssen *et al.* 2022). Such elevation can be pursued through deeper research, facilitating discourse and public debate, and mass social mobilization (Scoones *et al.* 2020). Historically,

ideological shifts have been observed to drive large-scale societal changes, such as the influence of Karl Marx's alternative economic theories (Scoones *et al.* 2020).

Next, transformations should strategically steer systems toward sustainability goals using strategic interventions and institutional mechanisms (Werbeloff *et al.* 2016; Scoones *et al.* 2020). This type of approach, which can be called *systemic* transformation, involves mobilizing regulatory frameworks, economic instruments, and technological innovations to drive change at a systemic level (Scoones *et al.* 2020). This method has been the most extensively studied and follows a similar pattern to the transitions approach, which focuses on innovation, learning, and adaptability in shifting systems toward sustainability (Scoones *et al.* 2020; Patterson & Paterson 2026).

Lastly, transformations can emerge from grassroots actions driven by individuals and communities (Werbeloff *et al.* 2016; Scoones *et al.* 2020). This *enabling* approach prioritizes public empowerment, encouraging bottom-up change through social innovation, local initiatives, and activist movements (Scoones *et al.* 2020). By fostering community-led transformations, it highlights the agency of citizens in shaping sustainable futures.

3.2. Contested nature of transformations

A transformation to sustainability takes place in a multi-actor environment (Köhler *et al.* 2019). Multi-actor refers to systems where multiple actors who hold diverse values, interests, and resources or power are involved. Therefore, no single actor can impose their preferred solution unilaterally (Enserink *et al.* 2022). Transformations impact actors unevenly, with some benefitting while others may incur losses (Patterson *et al.* 2017). Additionally, actors adopt different framings, such as temporal or spatial, that shape how they perceive and prioritize problems and solutions (Vreudenhil *et al.* 2010; Facer 2024). Temporal framing reflects the time horizon actors consider, while spatial framing defines the geographical scale of their concern (Vreudenhil *et al.* 2010; Facer 2024). These are vital to sustainability, for instance, temporal framing influences how actors account for the rights of future generations (Wewerinke-Singh *et al.* 2023). Furthermore, the varying types and degrees of power among actors affect their ability to influence transformation outcomes (Avelino & Wittmayer 2016). Together, these factors make sustainability transformations an inherently contested process.

Contestations can be found in different kinds of transformations. *Structural transformations*, for example, are subject to contestation from competing sustainability narratives. No individual or group has complete knowledge, leading to the development of distinct ideologies that reflect their values and interests. Each of the narratives also provides internal logic, and they compete with one another (Leach *et al.* 2010). For example, some argue that sustainability transformations should establish a counter-capitalistic economic system (Feola 2020), adopt decoloniality perspectives (Gram-Hanssen *et al.* 2022), or caring-based environmental governance (Zwarteveen *et al.* 2021). These newly emerging ideologies, however, challenge the dominant and existing structures and power (Chaffin *et al.* 2016). Others argue that sustainability can and should be pursued within the existing structure, such as through market-based solutions, technological innovations, and command-and-control interventions as viable pathways to achieving sustainability (Mol & Janicke 2009; Araral 2014).

Contestation is also evident within *systemic transformations* that employ strategic interventions to achieve sustainability goals. For example, environmental policies as strategic means often face resistance due to conflict with economic policies, the failure to communicate objectives to key stakeholders, or the lack of sufficient incentives for executive agencies (Howes *et al.* 2017). They also often received backlash or strong negative reactions from the public (Patterson 2023). The implementing organizations themselves can be trapped in institutional inertia or the tendency to resist change (Suhardiman 2014). This can be driven by risk aversion owing to uncertain outcomes, path dependency, or sunk cost fallacy (Olsonoski & Gianoli 2024). Moreover, systemic

transformations that require learning and experimentation can be resource-intensive and may pose barriers for lower-income contexts (Alaerts & Kaspersma 2022).

Lastly, *enabling transformations* led by people and communities is often highly contested. These contestations may escalate into social movements or environmental activism (Temper *et al.* 2018; Godinez Madrigal *et al.* 2024). Communities may demand the redistribution of environmental resources or the sharing of environmental costs. For example, hydroelectric dams and battery technology are relevant aspects of the clean energy transition but constitute acute environmental impacts. Often, the environmental costs of these development projects focusing on renewable energy are borne by local communities residing in the impacted areas or downstream thereof (Rademaker *et al.* 2022). Therefore, such contestations are vital components of transformation (Temper *et al.* 2018).

Contestations across transformation approaches will likely meet in a policy arena for resolution. The contestations within structural transformations will determine the direction of sustainability policy (Machin 2015; Wijanto & Prathiwi Widyatmi 2020). In systemic transformations, contestation influences the success of policy implementation (Howes *et al.* 2017). In the enabling approach, it can manifest into demands for more acceptable and fairer policies (Temper *et al.* 2018; Međugorac & Schuitema 2023). Patterson & Paterson (2026) describe transformations as processes involving prolonged policy battles and settlement events. The relevance of contestations to policy processes highlights the importance of policy studies for supporting the transformation agenda.

3.3. Policy analysis

Policy analytic studies began to emerge in the 1950s, mainly aimed at enhancing decision-making processes. Policy analysis has since developed a wide range of analytical methods to assist policy-making and improve the quality of policies (Walker 2000; Enserink *et al.* 2022). It has also evolved from an initial focus on rational or positivist perspectives, emphasizing the use of scientific models, economic quantifications, or behavioral psychology. Modern policy analysis acknowledges complex reality and combines the rationalist perspective with others, such as constructivism, which focuses on the construction processes of policies, and interpretivism to help examine the actors' frame of thinking (Hermans & Thissen 2009). Interestingly, environmental issues are a focus of policy analytic studies (Yang *et al.* 2023). The intricate connection between natural and human systems has underscored the importance of examining social-ecological systems by applying diverse policy analysis methods (Slinger *et al.* 2022).

Policy analysis could contribute to the transformation agenda through action research – co-creating knowledge and policy recommendations with impacted communities – (Wittmayer *et al.* 2021) or by supporting the climate justice movement (Pollex 2024). However, policy analysis also recognizes how highly contested and unequal policy processes can be (Enserink *et al.* 2022; Cairney 2023). Public policies are developed using both rational information and information on emotional preferences (Enserink *et al.* 2022). Moreover, the policy process is dynamic. For instance, individuals or organizations form coalitions based on shared values or interests and compete for policy change (Sabatier 1988). This suggests that policy analysis could be valuable in supporting transformations, especially to help navigate the contestations involved.

With its diverse, yet rigorous development and use of methods, policy analysis is employed for multiple purposes, for example, to conduct independent research, to facilitate policy development processes, to design interventions, or even to provide strategic or political advice. Mayer *et al.* (2004, 2013) developed a hexagon model for policy analysis to structure the various roles, purposes, and activities associated with policy analysis. Their hexagon model distinguishes six archetypical policy analysis activities. The first, *research and analyze*, involves translating data into policy information using rational scientific methods. This activity does not

necessarily translate the results into a specific policy design or recommendation. The second, *design and recommend*, focuses on applying the available knowledge to develop policy recommendations or to create a comprehensive policy design. The third, *advise strategically*, helps clients or problem owners with the most effective strategy to achieve their goals or implement policies within a specific political constellation.

The next activity, *clarify values and arguments*, involves examining the values and arguments underpinning social and political debates. This process helps uncover the one-sided or limited nature of certain arguments or highlights blind spots, fostering a more robust and informed policy debate. The fifth activity, *democratize*, is not value-neutral but driven by an ethical objective. It seeks to address inequality by incorporating perspectives and opinions that are typically overlooked in policy-making and decision-making processes. Finally, the sixth activity, *mediate*, focuses on enhancing actors' understanding of their position, creating space for negotiations, compromises, and ideally, seeking win–win options.

These six archetypes of policy analysis activities may hold significant potential to support sustainability transformations, particularly in navigating the contestation involved. For example, activities such as *design and recommend*, *advise strategically*, and *mediate* can help the enabling transformation approach, elevating the issues associated with grassroots contestation into the policy domain and hopefully contributing to a more equitable system. We anticipate that all six types of activities could be integrated to support a more effective structural, systemic, and enabling approach to transformation.

4. ANALYTICAL FRAMEWORK OF POLICY ANALYSIS ACTIVITIES FOR CONTESTED TRANSFORMATIONS

Building on the literature review, we propose an analytical framework that illustrates how six archetypal policy analysis activities, when integrated, can support transformations in contested environments. First, we describe the relationship between contestations occurring within each type of transformation and how it can be related to the policy process. Second, we specify the focus of the six types of policy analysis activities that, when combined, have the potential to support each transformation approach. The proposed framework is presented in Table 1.

The framework aforementioned suggests that s*tructural* transformations are often contested through competing narratives and may shape policy direction. In this context, integrated policy analysis activities should help shift societal values toward greater equity and sustainability. Similarly, *systemic* transformations may face contestation during the implementation phase of transformation policies, where policy analysis can contribute to more effective execution. Finally, in the *enabling* approach, contestation arises from individuals and the community. Here, integrated policy analysis can empower the establishment of fairer and more equitable policies.

Policy analysis activities are often conducted in a fragmented manner to support specific (water) transformation goals. Our framework further aims to serve as a meta-level tool that hopefully can be used for evaluating or planning collective policy analysis efforts, enhancing their effectiveness in achieving a certain water transformation goal or set of goals.

5. ILLUSTRATIVE USE OF ANALYTICAL FRAMEWORK: SUPPORTING TRANSFORMATION OF INDONESIA'S WATER ALLOCATION AND RIGHTS SYSTEM

5.1. Case introduction

Over the last two centuries, Indonesia's water governance and management regimes have undergone multiple changes. These changes were profoundly shaped by the nation's political, economic, and cultural choices. From colonial influences to post-independence reforms, each phase in Indonesia's history exerted influence

Table 1 | Analytical framework of policy analysis support for navigating contested transformations.

	Structural transformation	Systemic transformation	Enabling transformation
Contestations and relation to the policy process	Sustainability ideologies are contested through different values and narratives which can shape policy directions.	The policy is used as a strategic means. Contestations may happen during implementation.	Contestation may upscale into social movement demand for fairer and more equitable policy.
Policy analysis activities			
Research and analyze …	The structural foundation, including its historical processes	The problem in policy design and implementation	Community's problem, actor networks, and the political window
Design and recommend …	The structural shift needed	Policy improvement	Sustainable and equitable solutions
Advise strategically …	On how to establish a structural shift	The policy implementation	On social innovation and movement
Clarify values and arguments …	Around sustainability, equitability, and similar societal values	Around policy priorities, solutions, and acceptance	Of the community and other groups
Democratize …	Participation of different groups in society	Access to policy arenas and policy-making for different actors	People in the community's transformative spaces
Mediate …	Discourses among different groups in society	Policy debate and incoherency among policy actors and policy sectors	Community with other actor groups or within communities
Expected outcomes from supportive policy analysis for contested situations	A shift in ideologies that recognizes the value of equitability and sustainability next to dominant economic development values	Effective transformative (water) policy reforms	Empowered individuals and communities for sustainability initiatives

on water policies (Ruritan 2014; Pasandaran 2015). Today, sustainability transformations are still needed to address the persistent water challenges (Wijanto & Prathiwi Widyatmi 2020).

For example, water scarcity exists due to the uneven distribution of availability and demand, even though Indonesia has ample or even abundant fresh water in general (see Figure 1). The rainfall is concentrated during the wet season, leading to widespread flooding. Meanwhile, some regions suffer from drought during the dry season (Portal Informasi Indonesia 2024). Moreover, Java, which hosts almost 60% of the national population (or 150 million people), the economy, and the rice production, only has 6% of the water availability (Republic of Indonesia's Law Number 59, 2025). Half the national households also resort to groundwater abstraction, with 20% connected to water supply systems, 4% relying on bottled water, and the remaining using alternative sources (Presidential Regulation No. 18, 2020).

Additionally, excessive groundwater abstractions have caused land subsidence in several Indonesian urban agglomerations, with Jakarta as the most well-known example (Republic of Indonesia's Law Number 59, 2025). Indonesia also has the largest tropical peatland in the world, covering 21 million hectares or 11% of the land area. Sadly, the loss of water due to drainage development has increasingly led to forest fires (Ramdani & Mustalahti 2023). The ongoing socio-economic development and climate change will place higher pressure on

Fig. 1 | Water use index across Indonesian river basins.

water resources, and it is projected that the current situation will not be sustainable in the long run (Hatmoko *et al.* 2019).

5.2. Contested transformations of water allocation and rights system

Water allocation refers to the combination of policies, mechanisms, and instruments that regulate who can abstract water from a shared resource, how much and when it may be used, and how it is returned (OECD 2015). A water right is a formal or informal entitlement to withdraw water under specified terms and conditions (Bird *et al.* 2009). The regime of water allocation and rights is strongly related to how water is valued in society (OECD 2015). Ideally, it should be adaptive when pressure on the resource intensifies, new scientific understanding emerges, or societal preferences shift. However, it often remains highly path-dependent, making transformations challenging (OECD 2015; Grafton *et al.* 2017).

The three approaches to transformations can also be used to identify some of the typical contestations that exist in relation to water allocation reforms. From a *structural* transformation lens, water allocation and rights scholars have emphasized three complementary societal values: water as a public good and a human right (Gleick 1998), water as an economic good (Rogers *et al.* 1998), and water as part of nature (Falkenmark & Rockström 2004). Although these values are not necessarily conflicting in theory, practice, and policy dialogues, they are often at the root of contestations within *structural* transformations. From a *systemic* transformation lens, similar contestations can be identified in relation to water allocation management and delivery systems. Some groups emphasize the role of government regulations and permits in water allocation systems (Bosch *et al.* 2021), others focus on market mechanisms and economic incentives (Rodgers & Hellegers 2005), and a third group stresses the importance of informal platforms and negotiated approaches for water allocation (Vos *et al.* 2020). The appropriate form of decentralization is also often contested, even if the principle is widely acknowledged (Dinar *et al.* 2007). Finally, from an *enabling* transformations lens, contestations arise among groups in society over the roles and positions of vested interests and historic water users vis-à-vis historically marginalized groups and new emerging water users (Tatar *et al.* 2022).

5.3. Results of applying the analytical framework

5.3.1. Structural transformations

5.3.1.1. The observed contestations. Our observations indicate that Indonesian water allocation arrangements exhibit a strong preference toward valuing water from a social perspective, especially by considering water as a public good that should be managed fully by the government. It is argued that water is essential for daily life and is considered a fundamental human right (Meeting 5,14). Water is seen as given by God and holds deep religious significance (Meeting 2). Additionally, water plays a crucial role in food security, particularly in irrigating rice paddies, the country's staple crop. Water should be freely accessible to the public and subsistence farmers (Meeting 5,8,9). As mandated by the constitution, the government should bear full responsibility for managing water and ensuring it is never commercialized (Meeting 5).

This strong social value is reflected in Indonesia's current water law. The Republic of Indonesia's Law Number 17 (2019) stipulates that water is allocated based on a fixed priority order. The highest priority is given to environmental flow and domestic consumption, followed by irrigation for smallholder farmers, and then the public water supply system. Only after these needs are met, can water be allocated to commercial users following a permit and licensing mechanism (Meeting 4). Additionally, the government may impose a water management service fee, from which domestic users and smallholder farmers are exempted. Currently, 80% of water use in Indonesia is for irrigation purposes (Indonesian Ministry of Public Works 2024). The government also allocates water based on their cropping calendar, which typically guides farmers to plant rice paddy and alternative grains to ensure food security (Meeting 9,12).

Today, some actors in Indonesia continue to urge for a shift in the value assigned to water by society. These actors argue that many Indonesians still view water as abundant, and this mindset needs to change (Meeting 14). They point out that low tariffs for clean water result in wasteful consumption. It is also difficult to recover the investment cost. Furthermore, participatory management, including private sector involvement, may help accelerate water sector development (Meeting 6,8). Another major concern is groundwater, which remains largely unregulated in Indonesia. Its use is rarely monitored, and few or no tariffs are imposed, leading to the depletion of reserves (Meeting 6,13). However, limiting access to groundwater in the absence of a reliable alternative water service may jeopardize economic activities and water security for urban users.

Several policy actors also suggested that sustainability is a crucial aspect of water allocation. For example, they recognize that political ambitions for economic growth are rarely linked to water availability (Meeting 1). Excessive groundwater abstraction has significantly impacted sustainable development, particularly in urban areas, and contributed to land subsidence (Meeting 2,14). Additionally, the widespread consumption of bottled water has led to environmental problems, such as plastic pollution (Meeting 2). However, we note that the role of water in maintaining ecosystem services and biodiversity is rarely discussed. The only relevant statement is that the government keeps the maintenance flow of the rivers before allocating water (Meeting 4).

5.3.1.2. Policy analysis activities. Policy analysis *research and analyze* activities have likely contributed to a better understanding of why the current political preference exists in Indonesia. Ruritan (2014) and Pasandaran (2015) analyzed the water values well into the colonial government era. To reduce widespread famine and casualties due to enforced plantation policy, the colonial government's *Ethische Politiek* introduced government-led and large-scale irrigation infrastructure. When Indonesia gained independence in 1945, the founding leaders further embraced this ideology, as written in the constitution, that 'the land, the waters, and the natural resources within shall be under the powers of the state and shall be used to the greatest benefit of the people'.

Internationally, the 1992 Dublin statement helped shape the understanding that water is a scarce resource with economic value for its competing users and initiated the shift from government-led toward more participatory or egalitarian governance (Ruritan 2014). A reform effort was established to align with an improved understanding. Policy analysis activities may have contributed by assessing the possible benefit of recognizing water's economic value. For example, Rodgers & Hellegers' (2005) *design and recommend* activities collected various research data to come to a recommendation that combining water rights and trading mechanisms in the irrigation system can enhance water efficiency, allowing reallocation to other sectors, without significantly compromising farm incomes.

Policy analysis has also provided deeper insight into the present water values in Indonesian society. C*larify value and arguments* activities, such as those by Valette (2024) and Wijanto & Prathiwi Widyatmi (2020), highlight the coexistence of different water values and the contestations involved. Contestations have occurred between the civic group advocating water as a public good and the proponents of the economic good paradigm. The contestations mainly revolve around private sector involvement, in which the civic groups argue that commercialization of water poses significant risks to human rights. Interestingly, both studies noted that the value of water for environmental sustainability is absent in the contestations.

Finally, based on our analytical framework and not on the collected data, we expect that policy analysis activities could lead to enhanced consideration of sustainability and equitability aspects by society, that is, a transformation of the societal values around water, in Indonesia. For example, policy analysis through *research and analyze* or *mediate* activities can help in formulating economic development models that are integrated with water sustainability. Policy analysis can also *mediate* the dialogue between the social and economic perspectives. Lastly, policy analysis activities can help ensure a more balanced perspective in water discussions, or *democratizing*, by including the value of water for the ecosystem and biodiversity, which is currently overlooked in the discourse.

5.3.2. Systemic transformations

5.3.2.1. The observed contestations. Indonesia's political preference has placed primary responsibility for water system management in the hands of the government, which serves as both the main developer and regulator. The government constructs reservoirs and irrigation infrastructures to ensure water access for the people (Meeting 5,8). They also manage 229 dams and oversee 9.1 million hectares of irrigation systems (Indonesian Ministry of Public Works 2024). Additionally, the government manages water allocation across the country through the river basin organizations that oversee 131 river basin zones (Presidential Decree 12, 2012). In some river basins, state-owned enterprises, namely PJT, assist in water allocation operations and infrastructure maintenance. In return, they received water management service fees from hydropower generation and commercial users (PJT1, accessed 2025).

The water allocation operations start with river basin organizations formulating allocation plans annually. Water users are invited to the multi-stakeholders' 'TKPSDA' meeting to submit their projected demand. Allocation plans are made by considering the projected water availability and the users' priority ranking (Meeting 8,11). However, we observed that significant challenges persist, particularly with the capacity to implement this allocation policy effectively. For example, the government fiscal constraints for the operation and maintenance of infrastructure have led to suboptimal water delivery performance (Meeting 5,12). Resources for monitoring compliance and measuring water usage are also very limited (Meetings 1,5,6,10,11,15). On the ground, issues such as illegal water use, over-abstraction beyond permitted limits, and difficulties in enforcing the law further complicate the implementation effort (Meeting 6,9,10,14). Moreover, the water users' platform

is not yet fully effective and operational (Meeting 4,14). Currently, only 14% of the national-level river basin organizations are considered to have the capacity to oversee allocation plans effectively (Meeting 4).

Water allocation management also often overlaps with other sectors (5,11,14,15). For example, groundwater management falls under the jurisdiction of the Ministry of Energy and Mineral Resources, while surface water is managed by the Ministry of Public Works. Currently, there is no joint use and integrated allocation plan between these two organizations (Meeting 5). In another example, the agriculture sector remains focused on productivity and rural livelihoods, and sometimes takes conflicting actions. Pumps were distributed to farmers during the dry season to allow water extraction from the groundwater, irrigation channels, or nearby rivers (Meeting 10,12). These and other challenges suggest that perhaps the current policies are not in the most appropriate form to be able to implement them effectively.

5.3.2.2. Policy analysis activities. Improving Indonesia's water allocation governance has been a key focus of various policy analysis activities. For example, a *research and analyze* study conducted by FAO has improved the understanding of water allocation and rights policy practice in the local context. The study found that water allocation was practiced differently across two research locations in Java and Kalimantan. They suggest that the national framework neither adequately accommodated these geographical differences nor was fully implemented accordingly (AlAfghani *et al*. 2024). FAO also supports the Indonesian government with a multidisciplinary task team, *advising* them *strategically* by developing a water accounting roadmap and helping *mediate* between government sectors to improve policy coherence (GWP SEA 2023; WSI 2024).

In another example, *research and analyze* activities have helped identify the possible cause of the lack of government capacity in operating water systems. ADB (2016) suggests this includes the absence of independent and direct funding for the operation of the government's river basin organizations. The study also suggests that state-owned water service enterprises (PJT) demonstrate superior performance, partly due to their ability to collect revenue from commercial users, and their correspondingly lower dependence on fluctuating government budgets and shifting political priorities.

Policy analysis has also played an essential role in the process of irrigation management reform or management transfer (Alaerts 2020). This reform aimed to transfer and share some of the responsibilities from the government to the farmers. Policy analysis activities played an essential role, especially in the design phase between 1999 and 2004, where *mediate* activities structured the dialogue and knowledge exchange between multi-sectoral task forces and experts (Nugroho 2001; Alaerts 2020) and *design and recommend* activities helped the drafting of national-level regulations and operational instructions (Nugroho 2001; Alaerts 2020).

In addition to observed policy analysis activities, we also indicate that policy analysis can potentially support systemic transformations further by *clarifying the value and arguments* of the policy actors, particularly in identifying opportunities for negotiation and policy improvement. Additionally, policy analysis activities can continue to play the role of *designing and recommending* or *advising strategically* on issues such as joint groundwater and surface water allocation or strengthening institutional capacity. Furthermore, policy analysis can contribute to democratizing policy improvement, ensuring that it accommodates a diverse geographical landscape, given the country's vast size.

5.3.3. Enabling transformations

5.3.3.1. The observed contestations. The Indonesian government invests through various policies to empower water users, most notably the farmers, in the water allocation and rights system. For example, water user associations are established to enhance farmers' agency and participation in irrigation management. This considers that most farmers operate on a small scale, with 60% owning land of less than 0.5 hectares in size

(Indonesian Ministry of Agriculture 2022). The government also provides a cropping calendar to guide farmers on which crops to plant and then allocates water accordingly. Typically, they guide farmers to plant rice paddy and water-efficient grains like maize or mung beans during the dry season (Meeting 7,8). Additionally, the government is investing in *climate-smart agriculture*, which includes hydro-meteorological information systems development and farmers' training programs (Meeting 8).

However, our discussions revealed that during the dry season, farmers often deviate from the cropping calendar. They prefer to plant rice paddy during the dry season, which offers higher market prices but is also more water extensive. Farmers will negotiate the water use and apply rotating irrigation schedules among themselves. Sometimes, this also leads to water conflicts between farmers (Meeting 8,10,12). However, there is no clear formal institutional mechanism when there is a conflict involving water users at the same hierarchical level. This is also the case when disputes arise between commercial water users (AlAfghani 2023). Moreover, farmers tend to resist adopting water-efficient technologies. Innovations such as information systems for water and crop management, as well as water-efficient rice farming, have been developed but are perceived as difficult (Meeting 9,15).

Contestations in Indonesia not only involve farmers or the agricultural sector but also include broader sectors. Literature suggests that Indonesia demonstrated a strong grassroots movement, which was driven mainly by the issue of domestic water supply, and in which civil coalitions successfully annulled the 2004 water law (Wijanto & Prathiwi Widyatmi 2020; Koeswahyono *et al.* 2022). They complained that the law accommodated private sector involvement and did not align with the values of the constitution. Furthermore, they contended that such 'privatization' led to the commercialization of water, posing the risks of abusing human rights access to water, development discrimination, and enhancing various conflicts between corporations and local communities (Testing of Law Number 7 Year 2004 2013).

5.3.3.2. Policy analysis activities. Policy analysis activities have provided valuable support in *enabling* transformations that comprised contestation. For example, Suhardiman & Giordano (2014) conducted *research and analyze* activities and suggested that irrigation field staff are crucial actors in the irrigation system. These street-level bureaucrats serve as the frontline in water distribution and often navigate complexities between policy directives and local realities. They urged the involvement of this actor in the policy-making arena. Policy analysis also clarified that water conflicts arise not only from competing uses for economic purposes but also from efforts to prevent fires in peatland regions. Ramdani & Purnomo (2022) *clarified values and arguments* among actors in a peatland region, and they highlighted ambiguity in the allocation mechanism. The communities believed the timber companies withheld water during the dry season, while the company argued that they had followed the regulation that instructs them to keep the peatland water table high.

Policy analysis may also have enabled a contestation-based social movement. Wijanto & Prathiwi Widyatmi (2020) *advised* a civil coalition *strategically* that opposing private involvement in piped water infrastructure was not fully aligned with the real challenges. Instead, they suggested that movements should prioritize more pressing concerns, such as pro-poor development and ecosystem sustainability. This argument is further supported by Bakker *et al.* (2008), who suggest that the failure to provide a clean water supply to low-income areas is not only the impact of private sector involvement but also a more complex issue. Additionally, GGGI (2019) contributed to addressing this issue by *mediating* dialogue between affected communities and policymakers, aiming not only to have their voices heard but also to ensure that decision-makers understand their struggle first-hand.

Going forward, other policy analysis activities could also support enabling transformations, for instance, by *clarifying values and arguments* of communities regarding their understanding of sustainable water allocation and the rights system. Policy analysis can also conduct collaborative *research and analyze* or *design and recommend* activities with community and civil coalitions. These efforts can focus on pressing and strategic issues, such as sustainable farming, ecosystem protection, or pro-poor development. Moreover, policy analysis can also *advise strategically* to help bring the perspectives of the communities or coalitions into the policy arena.

5.3.4. Summary

Indonesia's water allocation and rights system's transformation to sustainability is likely to encounter various forms of contestation. However, policy analysis activities have played a role in addressing these challenges and can continue to facilitate further progress. Table 2 summarizes our case study results on observed key contestations, and indicates both the observed and unobserved (potential) role of policy analysis in supporting the different transformations.

6. DISCUSSION

This article has addressed the question: How can policy analysis facilitate contested transformations in water governance? Our literature review suggests that transformations can be approached in different ways, with the three lenses by Scoones *et al.* (2020) offering a useful distinction, namely: *structural transformation*, which aims to reshape the political, economic, and cultural foundation of society; *systemic transformation*, which deliberately steers change through strategic interventions; and *enabling transformation*, which emphasizes grassroots initiatives and community actions. However, all these approaches can face contestations, whether in the form of debates over sustainability narratives, challenges in transformation policy implementations, or grassroots conflicts that may escalate into resistance or social movements.

These contestations often culminate in the policy arena, where resolutions are sought. As Patterson & Paterson (2026) suggest, transformations can be seen as a series of policy battles and settlements. The discipline of policy analysis has recognized that the policy arena is typically contested, and in the past decades, it has developed methods to support complex public policy processes. Building on this knowledge and the hexagon model for policy analysis (Mayer *et al.* 2004, 2013), we propose a framework suggesting that policy analysis activities can help navigate contestations across different transformation approaches. This framework can also serve as a meta-level evaluation or planning tool for collective policy analysis efforts, to help achieve more effective transformation outputs.

We applied the framework to the case of Indonesia's water allocation and rights system, allowing us to assess its use in practice. It supported integrated analysis of the contestations involved – an approach that is rarely found in other literature related to this case study. The transformation of the water allocation and rights system in Indonesia is likely to be contested across multiple dimensions, including conflicting views of water's value, the use and suitability of diverse institutional mechanisms, and via community actions on the ground. Through this analysis, we also identified policy analysis activities that have contributed and can contribute to facilitating further sustainability transformations.

The use of the proposed framework also revealed that the observed policy analysis activities are mostly located in the top half of the hexagon (Mayer *et al.* 2004, 2013), where the more traditional (and less interactive and participatory) policy analysis activities are located. Fewer activities related to *democratize* policy analysis activities and *enabling* transformation approaches were observed. In the future, this type of policy analysis activity could be employed to complement existing activities and draw in new participants, supporting them in making their voices heard in discussions on transformations of water allocations.

Table 2 | Policy analysis support to Indonesia's water allocation and right system transformation.

	Structural transformation	Systemic transformation	Enabling transformation
Contestations: for water allocation policy (in general) and *manifestations in the case of Indonesia*	How to combine desires for water as a human right, an economic good, or as belonging to nature? *Water is primarily perceived as a public good for social purposes. Efforts to incorporate neo-liberal economic principles have been thwarted but remain to exist. Discussions on environmental sustainability are only limited.*	What is the best way to manage sustainable water allocations? For instance, which mix of government regulation, economic mechanisms, and user platforms, or which level of decentralization? *The government holds significant responsibility for the water allocation system. Yet, challenges arise in implementation capacity and coordination with other sectors.*	How can marginalized groups and emerging water use(r)s become agents for improved water allocation? *Farmers may not comply with the policy and resist adopting technology. Conflicts among water users exist and there is no formal resolution mechanism. Civil activism against water privatization has led to the annulment of previous water law.*
Policy analysis activities (observed and unobserved potential)			
Research and analyze …	Helped to understand the historical trajectory of the current dominant value.	Have informed the challenges in implementation, including the institutional problems.	Informed the importance of irrigation field staff.
Design and recommend …	Informed the potential benefit of using economic instruments in water allocation.	Have supported the early phase of irrigation management transfer.	Has potential if undertaken with communities or grassroots coalitions at center.
Advise strategically …	Has potential if undertaken for coalition with specific stance in mind.	Was given through water accounting roadmap development.	Was given to civil coalitions, to address more strategic issues.
Clarify values and arguments …	Highlighted the coexistence of different water values and the lack of environmental sustainability perspectives.	Has potential to find room for policy negotiation and include perspectives on implementation realities.	Potentially bring perspectives of unheard and marginalized groups about sustainable water allocation and rights systems to the fore.
Democratize …	Has potential to add the recognition of water for ecosystem sustainability and biodiversity and achieve a more balanced perspective.	Is a potential policy improvement in accommodating diverse geographical landscapes.	Has potential to inform marginalized groups about water allocation practices and connect them with (local) policy-makers.
Mediate …	Has potential to highlight dependencies and find common ground between civic, economist, and environmentalists.	Activities assisted in multi-sectoral coordination.	Has potential to mediate within communities/local user groups or between emergent and vested interests.

This finding may reflect that current water allocation policy debates are mostly held with experts, bureaucrats, and policy-makers in national and regional government and semi-public agencies. This does not seem to be unique for Indonesia. In many countries, water allocation issues, and possibly water management issues more broadly, are discussed by water experts, often located in government organizations and water research institutes. At the same time, there may be valid reasons why such activities are less visible in transformation processes of water allocation policies, perhaps because they are not easy to implement, do not receive recognition in comparison to the dominant sources feeding and capturing the debates on these issues.

Our single case analysis is also based on a limited set of interviews and documents. Indeed, our understanding of contestation across transformation approaches is based on interviews with actors mainly from water management authorities. Ideally, the perspectives of all involved actors should be included, such as those from civil society organizations and at the field level. Nevertheless, the pattern observed in our case does seem to hold face validity, particularly in highlighting contestations across transformation approaches, and the role and underused potential of policy analysis.

Although our analytical framework for policy analysis of contested transformations may seem to label everything as policy analysis and as (potentially) transformative, this terminology may not be used in practice for the activities that we cover in our framework. The point of this research is not to 'capture' everything as policy analysis or as transformative, nor to identify all other related terms, but rather to enable experts who recognize themselves as working as policy analysts or in transformations to use their experience and expertise to engage with new types of activities, and for transformation scholars to be able to access the expertise available within the policy analysis domain, and closely related domains such as planning, evaluation, strategic impact assessment, and decision-making under uncertainty.

Looking ahead, we invite fellow scholars to critically assess and refine our thinking. For example, the analytical framework could benefit from application to another case of sustainability transformations and from a research approach that investigates whether policy analysis activities genuinely contribute to transformational changes. Moreover, further real-world testing of this framework – by actively conducting policy analysis in contested transformation scenarios – can also help to further refine and strengthen its practical relevance and robustness.

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DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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