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RELATIONAL WATER PLANNING: SPATIAL LEGITIMACY AND THE POLITICS OF LAKE WATER LEVELS IN LAKE TEMPE, INDONESIA

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ABSTRACT

People often view the management of lake water levels as a technical hydrology issue governed by scientific models, regulations, and water management infrastructures. Nevertheless, such a perspective tends to neglect the socio-ecological characteristics of lake water-level management by the local community. This paper aims to describe the decision-making process related to the water level of Lake Tempe by integrating the interactions between government policies, socio-ecological characteristics of the community, and cultural elements of lake-based communities. In this paper, a qualitative approach was employed by applying Lefebvre's theory of the production of space to illustrate the relationships between the conceived space, the perceived space, and the lived space of water management practices. The findings suggest that the management of lake water-level policy is largely governed by the technocratic rationality of hydrology, while the fishing community perceives the fluctuation of the lake water level through the perspective of ecological cycles of sustainability. The tension between two rationalities reveals that the management of lake water levels serves as a platform for negotiating spatial legitimacy, where technical knowledge rooted in state concepts interacts with ecological knowledge grounded in community perspectives. This article will introduce the concept of relational water planning, where water management will be understood as the production of space shaped by the interaction of hydrological systems, socio-ecological practices, and the legitimacy of knowledge in the course of the planning process.

KEYWORDS: Relational Water Planning, Spatial Legitimacy, Hydrosocial Governance, Lake Governance, Spatial Production, Safe, Water Acces.

1. INTRODUCTION

The hydrological processes affecting lake water levels include not only natural factors but also human activities and land use dynamics within the catchment area. Various studies have confirmed the impact of fluctuations in lake water levels, implying that climate change, evaporation, and anthropogenic factors such as land conversion and infrastructure development in the catchment area play essential roles [1], [2].

The relationship between the dynamics of the physical world and human intervention reveals the fact that changes in the water levels of the lake cannot be understood as a hydrological phenomenon, but as a social, institutional, and policy process in water resource management. "Contemporary water governance research increasingly recognizes that interactions among infrastructures, institutions, ecological processes, and competing knowledge systems produce water systems" [3]. This is an important shift from the technocratic hydrology paradigm to the social-ecological view of water as a relational entity produced through social practices, power relations, and institutional representations of water governance and utilization [3]. In such a context, the decision-making process in the management of water levels, the construction of water control infrastructure, or the delineation of water bodies is not completely neutral, as it is always the reflection of epistemic and political decisions on the production and organization of water space [4], [5]. However, most of the practices in the management of lakes in various regions of the world have been focusing on the water levels as a hydrological parameter to be maintained through the regulation of water levels for the sake of flood control, stability of water systems, and the efficiency of water management [2], [6].

The tension between the technocratic approach and social-ecological dynamics is visible in the management of floodplain lakes in tropical regions. In the Indonesian case, tropical lake systems reflect local economic activities and social practices in the community. Research on lake systems in Indonesia has indicated that changes in water elevation not only affect the conditions of lake ecosystems but also affect the livelihood activities of people who depend on fish resources, agriculture, and settlement activities in lake waters [7], [8]. Thus, lake management has come to be understood as a socio-hydrological problem in which social-ecological dynamics play a crucial role in the dynamics of water management. This research has also indicated that fishing communities in Lake Tempe have implemented strategies to adapt to the changing dynamics of the lake. These include developing seasonal fishing activities, adjusting to spatial movement within the lake, and creating floating settlements that respond to the lake's conditions [9], [10], [11]. One of the lake systems in Indonesia is Lake Tempe in South Sulawesi. Its area spans approximately 350 to 400 km² during the rainy season, but it shrinks to about 100 km² in the dry season. The lake has a catchment area exceeding 4,500 km², including the Walanae River and Bila River systems [8], [12]. Fluctuations in water levels have traditionally been one of the significant ecological processes affecting fisheries productivity and shallow wetland areas used as spawning grounds for fish populations. Thousands of local fishermen rely on the seasonal dynamics of this lake for their fishing activities and spatial movements within water areas [8]. However, following the construction of the Tempe Movable Weir, the lake management has shifted towards hydrological stabilization, maintaining a standard water level of +5 meters above sea level. This approach is deemed essential for flood control and the overall stability of the regional water system [12]. Consequently, this has led to differing viewpoints between state technical institutions and the fishermen who rely on the lake's natural fluctuation.

Most of the current research on the management of lakes continues to focus on the biophysical aspects, such as water quality, eutrophication, sedimentation, and the regulation of hydrological processes through technological interventions [2], [6]. At the same time, the current literature on water governance emphasizes the necessity to consider water bodies as social-ecological systems, influenced by the interplay between social and environmental factors [13], [14]. The concept of hydrosocial territories suggests that water is shaped by the interplay of hydrological materiality, power relations, and social practices that define the scope of authority vested in the determination of water reality [3], [15]. While this approach has evolved rapidly in the context of river basins and irrigation systems, the literature that focusing specifically on the analysis of the determination of water levels in lakes as a form of socio-spatial production remains scarce. In other words, the water levels in lakes are viewed as hydrological variables or management instruments, rather than spatial products of the interplay between different forms of knowledge, interests, and environmental experiences.

The study breaks away from this void by exploring the determination of water levels in Lake

Tempe as a spatial production involving the interaction of state policy representations, community practices, and the lived experiences of lake communities. Specifically, it seeks to answer the question: How are decisions regarding lake water levels shaped by interactions among policy representations, community socio-ecological practices, and the experiences of aquatic communities? To achieve this, the study employed a qualitative method with a case study design, involving semi-structured interviews with relevant institutions and fishing communities, two focus group discussions, 30 days of field observations, and an analysis of policy documents related to lake management. The data were analyzed using thematic analysis, guided by Lefebvre's perspective of spatial production, which refers to conceived, perceived, and lived spaces.

Through analysis, this article presents the concept of relational water planning, a water planning approach that views water bodies not merely as hydrological entities but as social-ecological spaces shaped by the interaction of policies, social practices, and community experiences. In theory, the article contributes to the body of knowledge about water planning and management in three ways. First, it expands the application of Lefebvre's theory of space production in understanding water resource management and lake management. Second, it integrates the hydrosocial territories approach with an analysis of ecological temporality and epistemic legitimacy in water management conflicts. Finally, it develops a conceptual framework for relational water planning, which emphasizes that water level determination is a process of spatial negotiation between the state, the community, and ecological processes. Thus, this article illustrates that lake management involves not only technical aspects but also the creation of spaces that determine the sustainability of water systems and the lives of those who rely on them.

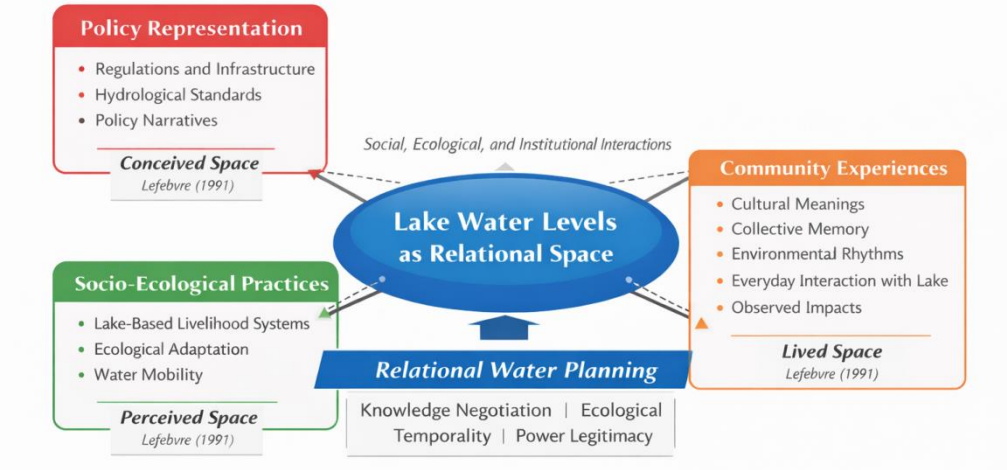

Figure 1: Conceptual Framework of Relational Water Planning in Lake Water Level Management

2. RESEARCH METHODOLOGY

2.1. Research Approach and Design

This study employs an interpretive qualitative approach and a case study design focusing on Lake Tempe in South Sulawesi. The methodology is ideal for understanding the dynamics in determining the lake's water levels, which involves not only technical hydrological aspects but also a socio-spatial process. It is because the water levels are influenced by the interaction between institutional policies, the socio-ecological practices of local communities, and the lived experiences of those living near the lake. The case study approach is particularly effective for exploring complex water management issues and their contexts, as it allows for comprehensive analysis of how institutional frameworks and the socio-ecological practices intertwine within the spatial setting of water management [16], [17].

2.2. Analytical Framework

This study adopts Henri Lefebvre's production of space framework to examine how lake water levels are shaped by the interplay of policy, socio-ecological practices, and the lived experiences of local communities [18].

Lefebvre's framework identifies three key dimensions of space production:

1. Conceived Space—the space created through technical representations and policy interventions, including regulations and hydrological modeling.
2. Perceived space—the space created by socio-ecological practices and community activities.

3. Lived space—the space experienced through individual realities, identities, and the cultural significance that the community attaches to it.

2.3. This Framework Analyses

The interplay between water level governance policies, socio-ecological practices, and the lived experiences of residents in the lake area.Study Area

The study area is the Lake Tempe region in Wajo Regency, South Sulawesi. This floodplain lake has a water surface area of approximately 350 to 400 km² during the rainy season and around 100 km² in the dry season, with a catchment area that exceeds 4,500 km². The fluctuation in water levels creates a vital socio-ecological system that supports fishing and the livelihoods of local communities [8], [12]. Additionally, the presence of the Tempe movable weir for water level management puts the area at the intersection of technical water management and the practices of residents.

2.4. Selection of Informants

The research informants were chosen through a purposive sampling method, selecting participants based on the significance of the information they held and their engagement with the research topic [19]. This method is frequently utilized in qualitative research related to natural resources management and governance, as it allows for profound insights from those actively involved in these activities [20], [21], [22]. The research included 18 informants, who comprised the following:

1. 4 officials from the River Basin Authority (BBWS) Pompengan Jeneberang.
2. 5 officials from the Wajo Regency local government.
3. 7 fishers and floating house residents of Lake Tempe.
4. 2 local academics.

The research aimed to gather different perspectives on lake governance, incorporating insights from experts in lake hydrology, regional policymakers, and the socio-ecological viewpoints of local residents. Data collection continued until the study reached data saturation, meaning no new substantive themes emerged from the research participants [23]. An overview of the characteristics of the research respondents is presented in the table below.

Table 1: An Overview of the Characteristics of the Research Respondents.

Respondent Category	Number of Respondents	Estimated Age Range	Main Interview Topics
State Actors (BBWS)	2 persons	40–55	Hydrological modeling, determination of lake water level standards, infrastructure management, and technical approaches to water governance.
Local Government Officials	2 persons	35–50	Policy implementation, coordination between national and regional governance, and spatial planning related to lake management.
Fisher Communities	4 persons	30–60	Daily adaptation to water level fluctuations, fishing practices, mobility patterns, and ecological knowledge of the lake.
Customary/Local Leaders	3 persons	50–75	Cultural values, local norms, historical narratives, and community-based interpretations of lake space.
Community Elders	2 persons	65–85	Collective memory, intergenerational knowledge, and traditional perspectives on environmental changes.
Other Local Actors	3 persons	30–55	Community participation, responses to water governance policies, and social dynamics in lake management.

Source: Processed Data

2.5. Data Collection Techniques

Data collection for the research utilized four techniques: semi-structured interviews, focus group discussions, observations, and policy analysis. These methods were implemented to gain an extensive

understanding of lake governance dynamics and the relationships among stakeholders involved in lake governance activities.

2.5.1. Semi-Structured Interviews

As stated by Junnier, "Semi-structured interviews are commonly used in qualitative research to study informants' understanding, perceptions, experiences, and meanings" [24]. In this research, the interviews were designed to explore the perceptions of the ideal lake water level, the impact of fluctuations in the lake water levels on economic and ecological activities, and the decision-making processes involved in lake management through dialogues. Such interviews enabled the research to maintain its focus on key themes while providing the informants the opportunity to share their experiences in depth [25], [26]. The interviews, which lasted between 45 and 90 minutes, involved 18 participants who were engaged in the management and utilization of Lake Tempe. Key themes in the interviews included informants' views on the lake's water level, economic activities such as fishing, and the connection between lake management policies and local livelihoods. The informants represented several main actor groups, including:

- River Basin Organization (BBWS): 4 participants.
- Wajo Regency Government: 5 participants.
- Fishers and communities: 7 participants.
- Other actors, such as academics and researchers: 2 participants.

The composition of the informants was crafted to reflect the three regimes of legitimacy examined in this research: techno-hydrological legitimacy, local political-economic legitimacy, and ecological-cultural legitimacy.

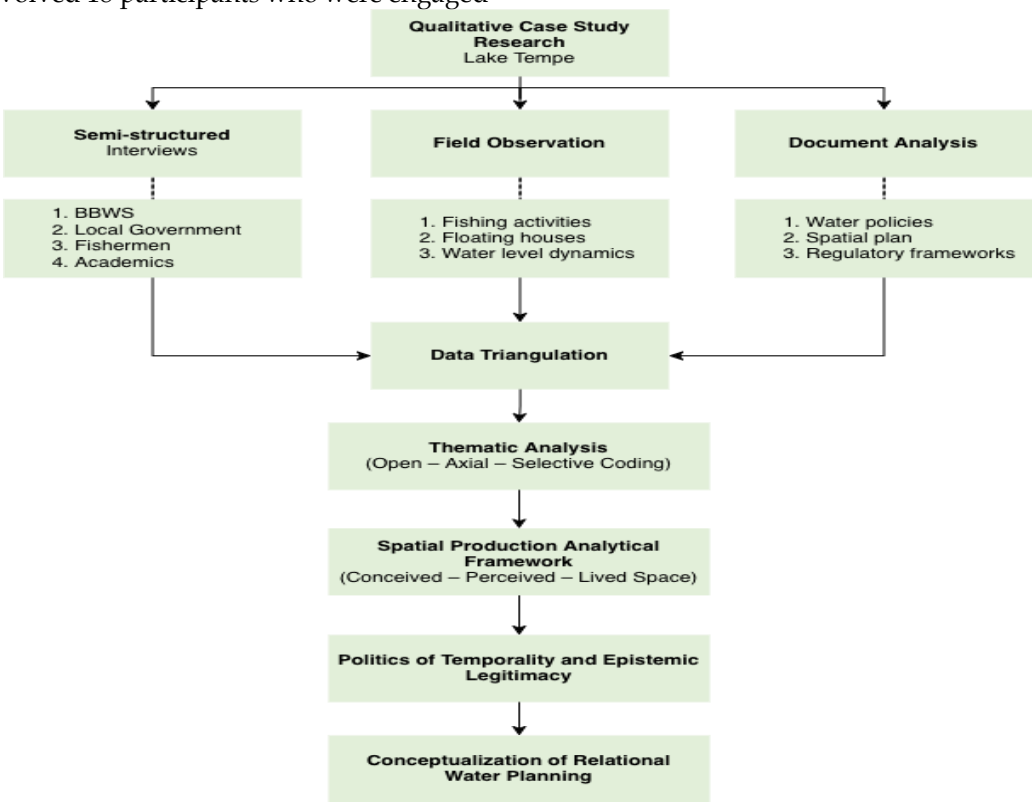

Figure 2. Research Methodological Framework.

2.5.2. Focus Group Discussion (FGD)

This research also utilized two focus group discussions (FGDs) with fishermen, the community, and the local government. The FGD was used to explore the nature of interactions among the actors, including the differing views on the ideal lake water level [27].

2.5.3. Field Observation

Field observations were carried out over approximately 30 days at key locations around Lake Tempe, including floating settlement areas and fishing sites. The purpose of these observations was to assess how fishing communities are responding to changes in lake water levels, specifically regarding their mobility on the lake and shifts in the location of their economic activity.

2.5.4. Document Analysis

To identify the dimension of conceived space, this study analyzed several policy and technical documents related to the management of Lake Tempe. The documents reviewed include:

1. Minister of Public Works Regulation No. 28/PRT/M/2015 on lake buffer zones.
2. The Regional Spatial Plan (RTRW) of Wajo Regency.
3. Technical documents and water level management reports from the River Basin Organization (BBWS).
4. Technical reports on the operation of the Tempe movable weir.

This analysis aimed to understand how lake water levels are represented within the regional management policy framework. Document analysis serves as a data collection method that allows researchers to interpret the significance of data and the context of policies and regulations governing water resource management [28].

2.6. Data Analysis

Data were analyzed using thematic analysis to identify meaningful patterns (Braun & Clarke, 2019). This approach allows the researcher to interpret the experiences, perceptions, and practices of individuals based on data collected from the interviews and document analysis related to the management of Lake Tempe. The analysis involved a three-stage coding process.

1. Open coding is the process of discovering initial themes from the data collected through interviews, observations, and policy documents. In this stage, the researcher pinpointed key concepts and themes related to the management of lake water levels.
2. Axial coding involves linking themes and analytical categories through codes. In this stage, the conceptual themes include conceived space, perceived space, and lived space, as outlined in Henri Lefebvre's spatial production theory. Furthermore, the coding process addresses the political dimension of temporality and the legitimacy of knowledge and power in the lake water management process.
3. Selective coding involves integrating analytical themes to clarify the connections between water management policies and practices and the lived experiences of the lake water community. This process aims to illustrate how lake water levels are socially produced through the interaction of conceived space, everyday spatial practices, and the lived experiences of the community.

During the coding and analysis process, the researchers utilize NVivo software to facilitate coding and organizing themes, as outlined by Dalkin et al. (2021) and Silver and Woolf (2017). This approach follows the six steps of thematic analysis described by Braun and Clarke:

- Data familiarization,
- Initial codes,
- Theme searching,
- Theme review,
- Defining and naming themes,
- Report production.

NVivo software also plays a significant role in managing, coding, developing themes, and exploring relationships within the data. It contributed to enhancing the rigor, transparency, and overall validity and reliability of our qualitative research [29], [30].

2.7. Data Validity and Research Ethics

The researchers employed several approaches in this study to ensure the validity of the research findings. First, it applied the technique of triangulation by comparing the results from in-depth interviews, field observations, focus group discussions (FGDs), and policy documents to verify consistency [31], [32]. Second, it utilized a member checking technique, where the initial interpretations of the findings were revisited and discussed with selected key informants to ensure that their interpretations aligned with their experiences in the field.

The study adhered to the principles of research ethics. All participants were interviewed after being informed about the research objectives and the intended use of the findings. To protect their confidentiality, the identities of the participants were not disclosed in the article [33]. Additionally, the researchers acknowledge the potential influence of their positionalities as academics in the field of planning on the analysis process. Consequently, the findings were analyzed reflexively, taking into account the diverse interpretations of the participants involved in the research [34].

3. RESULT

3.1. Conceived Space: Policy Representation in Determining Lake Water Levels

The analysis of documents and interviews with institutional actors suggests that the management of Lake Tempe is perceived by technical agencies primarily as hydrological stability and regional flood

management. The lake's water level is viewed as a technical parameter that can be managed through control infrastructure and the establishment of specific thresholds. This approach represents a technocratic perspective on water management that focuses on stabilization through regulation, management of systems via regulation and modeling, and regulation through infrastructure [3], [35], [36].

In the technical management documents, the water level elevation of +5 meters above mean sea level is advanced as the optimal condition, which balances the storage capacity while reducing flood risk. The aforementioned approach is reinforced by the interview results of officials from water management institutions, as shown below:

"If the water level is too low, the storage capacity of the lake is not optimal. However, if the water level is too high, it increases the risk of flooding. Therefore, an elevation of around five meters is considered the safest from a hydrological point of view."

(Official from BBWS Pompengan Jeneberang, interview, July 2023)

The aforementioned results indicate that the water level of the lake is constructed as a hydrological space, which can be modeled, measured, and technically managed. Such an approach is consistent with the global trends in the management of the lake, which highlights the importance of water level regulation as a primary instrument for maintaining hydrological stability [1], [2], [37]. In the case of Lake Tempe, the aforementioned approach is closely related to the overall interest in flood control, irrigation, and water utilization [38], [39].

In the context of Henri Lefebvre's theory of the representation of space (H. Lefebvre, 1991), this representation can be understood as conceived space, developed through technical abstractions. In the course of conceived space, the state portrays Lake Tempe as a measurable and standardized area. In this framework, the +5 m elevation not only indicates hydrological features but also reflects the spatial organization of water boundaries, zoning regulations, and the legitimacy of state intervention. This representation of space aligns with other research indicating that lake boundaries and aquatic spaces are shaped through regulation and spatial analysis to address anthropogenic impacts and support ecosystem health [40], [41], [42].

The representation of space through technical parameters reflects a technocratic approach to managing hydrological systems. In this framework, the lake serves as strategic hydrological infrastructure, using water level regulation to address hydrological uncertainty through standardization and control [4], [43]. However, this management approach is also intertwined with political and institutional power dynamics in the organization of water space [5], [44]. In the case of Lake Tempe, the +5 m elevation policy exemplifies a form of territorialization, showcasing the assertion of state power through territorial boundaries and spatial control. The +5 m elevation serves a spatial ordering function, shaping socio-ecological relations. Additionally, this representation of space also reflects normative visions of order, efficiency, and control within water management systems [3], [45].

Nevertheless, the success of water management policies is also dependent on the ability to integrate social aspects and actor perceptions in a manner that accommodates ecological dynamics within adaptive governance structures [6], [46], [47]. The dominance of technical knowledge ignores socio-ecological practices despite their critical role in the sustainability of aquatic ecosystems [13], [14]. This is also reflected in the case of Lake Tempe, where policies on the elevation of lake water levels are not necessarily consistent with the perceptions of local communities who have adopted adaptive strategies for survival based on lake water level dynamics in fishing activities and floating settlements [9], [10]. Thus, the question of lake water level determination is more than a simple policy decision; it is a question of space production that defines the possibilities of socio-ecological practices and thus conceives of space as an arena of power articulation and negotiation of diverse interests in lake management.

3.2. Perceived Space: Socio-Ecological Practices in Lake Utilization

Contrary to policy descriptions of lake water level dynamics as standardized parameters of lake hydrology, the socio-ecological practices of fishing communities in Lake Tempe demonstrate that the aquatic environmentis shaped by the interactions between human activities and lake ecology. For example fishers do not rely on on standardized lake water level elevation; instead, they are influenced by ecological factors such as water depth, the presence of swamp vegetation, and fish movement dynamics.

The fisher explained:

"If the water level is too high, fish struggle to access shallow swamps, which are typically their spawning grounds. However, when the water level is around three to four meters, there are more fish."

(Lake Tempe fisher, interview, August 2023).

The fisher's statement regarding the Lake Tempe

fishery demonstrates the crucial role of water levels in fish reproduction. This aligns with global research emphasizing the significance of water levels in managing lake ecosystems and sustaining fish resources [2], [6]. Additionally, the practices of local fishers reflect their experiential knowledge in managing the lake and its resources [11], [48].

Further observations in the field also demonstrate the importance of the mobility of the aquatic space in the fishers' practices in the management of the lake. The fishers have floating houses and boats. These are regularly moved in response to the changes in the water levels and the fishers' fishing practices.

"A floating house has to follow the water. When the water rises, we move a little; when it recedes, we move again."

(Lake Tempe fisher, interview, August 2023).

The mobility of fishers in Lake Tempe demonstrates that aquatic space is created by direct adaptation to changing water levels. The design of floating houses and boats allows them to adjust to variations in depth and fish location, effectively integrating living and production spaces within daily life. Research reveals that the configuration of these floating houses is intentionally adaptable to fluctuations in water levels [10], and the livelihood systems are closely tied to the ability to understand the hydrological changes [9]. Fishers have identified an optimal water level of 3 to 4 meters, ecological conditions that support fish reproduction, vegetation management, and boat mobility. This suggests that perceptions of aquatic space are formed through consistent ecological experiences rather than solely subjective views of the fishers [49], [50].

In this context, these practices represent perceived space, which refers to space created by human activities and their interaction with the environment. The lake should not be viewed merely as a technical object defined by its height; instead, it is a relational landscape that is continually 'worked' through adaptive practices [51], [52]. The knowledge gained from this experience becomes a foundation for spatial rationality and is essential for effective sustainable fisheries management [13]. When this knowledge is overlooked, policy may create discrepancies between planned space and practiced space [44], [47]. Thus, perceived space emphasizes that variations in water levels are not anomalies but integral parts of natural cycles, while also exposing the inconsistencies between technocratic approaches and adaptive practices in shaping lake space.

3.3. Lived Space: The Meaning of Space and Community Identity of the Lake

In addition to being an economic space and a location for ecological practices, Lake Tempe is also a space with significant social and cultural meanings for the communities living within its vicinity. For the fishing communities, the lake is not only an economic space but rather a lived space, influencing their community identity. It was said by a community leader during a focus group discussion:

"We were born on the lake, grew up on the lake, and live by the lake. So, when water conditions change due to policy, it is not only about fish but also about our way of life." (Fisher community FGD, September 2023)

This discovery is consistent with the increasingly large number of studies that show community perceptions of water management are affected by experiences, values, and community preferences in addressing environmental risks and changes [49], [50]. In the case of Lake Tempe, community perceptions are closely related to community adaptive responses to flooding patterns and seasonal changes, including risk-sharing strategies and forms of social-ecological resilience that are developed over time [9]. The presence of floating houses and mobility patterns that are associated with changes in water levels and unique spatial patterns of settlement point to the adaptive and culturally embedded relationship of the community with the lake [10], [53].

From Henri Lefebvre's perspective, this aspect of space can be viewed as a "lived space," shaped by everyday practices, collective memory, and the symbolic meanings attached to it. In this view, the lake is not merely a physical entity or a hydrological system but a "lifeworld," tied to identity formation, emotions, and community understanding [51], [54]. Here, the community perceives water level regulation not as a technical measure but as a disruption of the relational balance established over the years. Furthermore, this perception points out the tension between administratively represented space and culturally represented space. Policies aimed at maintaining specific water levels are often viewed through a technocratic lens, overlooking the ecological experiences that inform the community's relationship with water. This understanding leads to the concept of hydrosocial territories, where water is considered a relational space shaped by the interaction of various components of space [43], [55], resulting in both a redistribution of water resources and a redefinition of spatial meaning and community subjectivities.

The mismatch between policy frameworks and

experiences is, therefore, directly related to participation and legitimacy concerns within water governance. Several studies have pointed out that policy success is heavily dependent on how far local knowledge and perceptions are incorporated into policy processes [13], [44], [46]. In the context of Lake Tempe, when lived space is not considered an important component of policy space, tensions are created, not only between institutions but also between cultures. These tensions, ultimately, have implications for perceptions and compliance with water resource management policy by local communities [11], [48]. The concept of lived space emphasizes that aquatic spaces are not merely spaces for existence; they are filled with meaning beyond just economic activities or technical management. Conflicts regarding water levels extend beyond economic or technical interests and are fundamentally tied to the perceptions and meanings associated with how the lake should be experienced. Thus, a comprehensive understanding of lake governance must incorporate lived experiences, identities, and memory as essential elements in policy processes.

3.4. Relational Production of Space in Lake Water Level Governance

The analysis of these three spatial dimensions shows that the water level in Lake Tempe results from a complex interaction among policy representations of institutions (conceived space), socio-ecological practices of local communities (perceived space), and lived experiences of those in the lake communities (lived space). Thus, following Henri Lefebvre's theory on the production of space, Lake Tempe is not an objective reality; it is a relational space shaped by ongoing dialectical interaction among policy representations, socio-ecological practices, and meanings [51], [56].

The interplay between these dimensions creates a relational space where the lake's water level serves as a point of negotiation between the state's technical rationality and local knowledge. The concept of hydrosocial governance illustrates that the conflict surrounding the governance of Lake Tempe's water level highlights the constructed nature of water, which is a socio-political entity shaped by power dynamics, knowledge, and social practices [3], [15], [57]. In this context, the water level functions as a socio-spatial artifact, influenced by processes of territorialization, access, and the competing interests of various stakeholders involved [44], [58].

The study indicates that conflict regarding the governance of Lake Tempe's water level arises not only from differing interests between the state and the local community but also from varying interpretations of the water level's significance, which is seen as both an ecological and a social space. Technical institutions view the water level as a result of hydrological models and administrative regulations. In contrast, the fishing community sees it as influenced by ecological, economic, and seasonal factors. These differing perspectives often intersect due to the power dynamics present in the decision-making processes [12], [59].

Thus, lake governance needs a strategy that transcends the level of technical control and has the potential to integrate different forms of knowledge and interests. Adaptive and participatory governance strategies are critical for integrating socio-ecological dynamics, community perceptions, and temporal complexities of water level management [14], [60], [61]. This synthesis has shown that the dynamics of water level management in Lake Tempe require a relational spatial approach that connects conceived space, perceived space, and lived space for developing more inclusive policies for lake governance.

4. DISCUSSION: RELATIONAL WATER PLANNING AND SPATIAL LEGITIMACY

4.1. Limitations of the Techno-Hydrological Paradigm in Water Planning

The research findings have shown that the management of water levels in Lake Tempe has largely been influenced by a technocratic approach that conceives water as a hydrological system that could be controlled by using technical variables such as water level elevation, storage volume, and flood regulation. This approach reflects a managerial paradigm of modern water governance in which hydrology and infrastructures are considered the main tools for decision-making in water resources management [3], [35], [62]. According to this approach, water is considered a biophysical object that could be optimized by using different technologies and administrative strategies to reduce uncertainty in the natural environment [4], [35].

However, the present study reveals that such an approach is not sufficient to comprehend the complex socio-ecological processes involved in the fishing communities' utilization of the lake. In fact, in the day-to-day lives of the local communities, the water levels of the lake cannot be understood as hydrological elevation levels; rather, the water levels of the lake form part of the local communities' perception of the ecosystemic cycle, which influences

the fish productivity of the lake. Research on socio-ecological systems reveals the hydrological changes of the lake play an essential role in the maintenance of the local communities' aquatic ecosystem and their economic well-being [2], [6], [63]. This contrast between technocratic rationality and socio-ecological practices is also well established in the literature on water governance in various regions of the world, which reveals the failure of water management approaches to account for the local communities' knowledge and practices [3], [15], [64].

These results thus reinforce the idea that water level management in a lake is not only a technical task but also a political activity involving power relations, knowledge distribution, and the legitimacy of decision-making. The literature on water politics highlights the idea that water resource management is, by its very nature, a site of contestation among water management actors with divergent interests, knowledge bases, and power positions [3], [15], [65].

4.2. The Production of Water Space and Dialogue with Planning Theory

Lefebvre's theory of the production of space offers a useful framework for analysis. According to this theory, space is not neutral but is produced through the interaction of the conceptual representation of space, social practice, and the experience of space. In the context of water management, this theory offers us the opportunity to see that water levels in a lake are not just a simple water management fact but the product of social relations involving different forms of knowledge and interest.

The results indicate that water management policy in Lake Tempe is shaped by the interaction of technical models and administrative regulations, representing conceived space. Conversely, the fishers' interpretations of water levels represent perceived space, arising from social practice and economic activities. Additionally, the lake's significance as a living space for the community represents lived space, formed through the interaction of the experience and identity.

These results contribute to the planning literature, which highlights the role of dialogue among the actors involved in the spatial planning process. The communicative planning approach considers the deliberative nature of the planning process, which involves several actors in the production of shared knowledge of the space [66], [67], [68]. Nevertheless, this study demonstrates that the dialogue among the actors in the socio-ecological system, such as the lake, is not only based on the divergent interests of the actors but also on the epistemological divergences in the perception of environmental reality.

The conflict over lake water level management reflects not only the differing interests of the state and the fishing communities but also a clash of two spatial perspectives: the technocratic approach, which focuses on water level management, and the ecological perspective, which refers to the environmental dynamics. This aligns with the hydrosocial governance framework, which views water as shaped by the interaction between ecological factors and social relationships [3], [15], [64].

4.3. Water Politics and Spatial Legitimacy in Planning

The results of this study suggest that decisions regarding the lake's water level involve negotiation of knowledge legitimacy. In the context of state policy, the legitimacy of water management relies on technical expertise and administrative regulations. For fishing communities, however, the legitimacy is grounded in ecological knowledge and social practices developed through long-term interaction with the environmental reality.

This phenomenon reveals that water management is also a process of spatial legitimacy—i.e., a process in which various actors seek to assert their authority in defining what is considered to be the ideal spatial conditions. Legitimacy is a key concept in planning theory, as it is related to the extent to which society accepts a certain policy in the context of spatial decision-making processes [66], [67]. Moreover, the water management literature also reveals that legitimacy conflicts in water resource management are related to the legitimacy conflicts between scientific knowledge and local knowledge [3], [15].

Thus, the decision-making process on lake water levels cannot be understood as a strictly technical decision but as a political process in which the legitimacy of various forms of knowledge and spatial interests is negotiated.

4.4. Theoretical Contribution: Relational Water Planning

Based on empirical findings and the discussion of the theoretical concepts, the article aims to contribute to the development of planning theory by introducing the concept of Relational Water Planning. It posits the idea that water is not just a physical resource that can be managed through hydrological models; rather, it embodies a network of relationships shaped by policy approaches, social practices, and individual experiences.

Relational water planning encompasses three key

dimensions in the water management process:

- Technical–Hydrological Dimension

This dimension refers to water infrastructure, hydrological models, and regulations for water levels. This dimension can be understood as the conceived space in the framework of Henri Lefebvre, in which water is reduced to an administrative parameter for control and stability [2], [6].

- Socio-Ecological Dimension

This dimension refers to community practices of adapting to the dynamics of nature, such as fishing and the movement of floating houses, and can be understood as the perceived space in the framework of Henri Lefebvre [9], [10].

- Cultural-Spatial Dimension

This dimension focuses on the meaning, identity, and experiences of water space and is related to lived space [49], [69].

This concept transcends the dominant water resource planning paradigm, which is dominated by technocratic and managerial logics. While the dominant paradigm focuses on the regulation of hydrological variability, the concept of relational water planning highlights the need to understand the interrelations between ecological variability and social practices. In this regard, the concept is similar to the paradigm of adaptive planning and social-ecological governance, which highlights the need for flexibility in managing ecological variability and uncertainty [35], [63] but advances these concepts further by incorporating the dimensions of spatial production and legitimacy in water resource planning and management.

The contribution of this article is to develop a conceptual framework of water resource planning and management by bridging theories of the production of space, water resource management and planning, and planning theory. This article highlights that water resource management, from the perspective of relational water planning, is not merely a technical issue. It involves a process of spatial production and complex interrelations between ecological systems and social practice, as well as the legitimacy of knowledge in water resource planning and management.

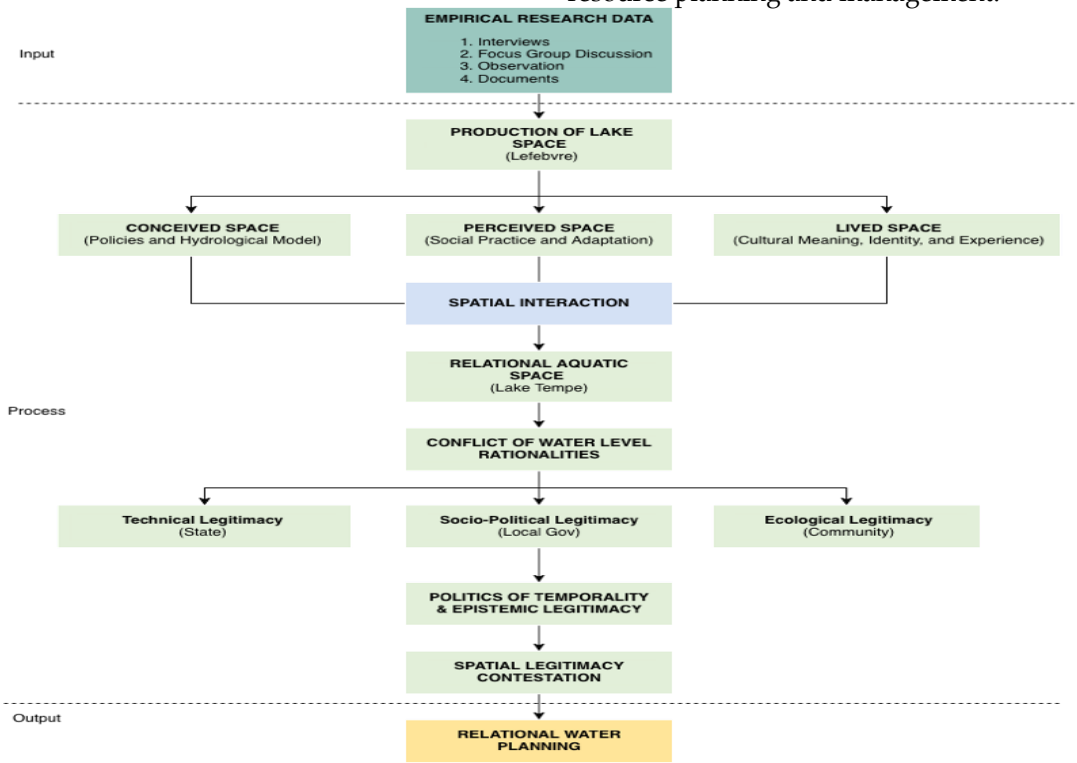

Figure 3. Conceptual Diagram

The following conceptual diagram illustrates how Lake Tempe's water levels are produced as a relational space through the interaction of conceived, perceived, and lived spaces. State policy representations create conceived space through regulations and standardized water levels, while fishing communities shape perceived space through their practices and ecological adaptations. Lived space embodies the social and cultural significance of lakeside communities. The interaction of these dimensions produces a contested relational aquatic space, where technical experts, local governments, and fishing communities negotiate legitimacy through temporal and epistemic politics, ultimately

leading to the conceptualization of relational water planning.

The concept of spatial legitimacy in this research is understood as a process in which various actors—state, local government, and community—negotiate and claim authority in determining spatial conditions that are considered legitimate in managing lake water levels. As shown in Figure 3, spatial legitimacy arises from the interaction of Lefebvre's three dimensions of space production, namely conceived space, perceived space, and lived space. In the conceived space, legitimacy is formed through technical and institutional rationality (technical legitimacy), which is manifested in hydrological policies and models; in the perceived space, legitimacy develops from community social-ecological practices (socio-ecological legitimacy) in adapting to lake dynamics; and in the lived space, legitimacy is rooted in cultural meaning, life experience, and community identity (cultural/ecological legitimacy). The interaction of these three dimensions produces a contestative relational space, where various knowledge systems and interests negotiate in what is called spatial legitimacy contestation. In the context of water planning, this emphasizes that determining water level is not merely a technical decision but rather the result of negotiations between various forms of legitimacy so that relational water planning positions spatial legitimacy as a normative and political dimension that connects hydrological systems, social-ecological practices, and cultural meanings in more inclusive and contextual water management planning.

4.5. Relational Water Planning in Dialogue with Planning Theory

The relational water planning approach discussed in this article is not isolated; it engages in a meaningful dialogue with established school traditions of planning theory. In this article, the relational process of space production of the water level of Lake Tempe has been conceptualized from a relational perspective. In this regard, this article not only extends but also critically questions the core principles of existing dominant school traditions of planning theory. In the case of Lake Tempe, the water level process not only reflects biophysical processes but also closely relates to community adaptation strategies and the overall socio-ecological configuration of the lake system [9], [10]. The following is a detailed explanation.

Firstly, this article offers an ontological and epistemological critique of the comprehensive-rational school of thought. Comprehensive-rational planning theory has long conceptualized space as a stable entity where decisions are made on the basis of objective technical analysis and conflicts are considered problems of optimization [70]. In this regard, the water level of a lake is considered a neutral parameter that can be technically calculated by hydrological models. However, the case of Lake Tempe has revealed that space is inherently dynamic and relational, technical data are not objective but embedded with institutional interests, and conflict is inherently related to the politics of space and time. Recent literature has shown that technical models are not objective but are embedded with certain normative values [36], [71], while global studies have revealed the complex interactions of natural and human factors influencing lake water level changes [1], [2]. Thus, decisions related to water level are inherently related to politics rather than technical considerations.

Secondly, relational water planning is also positioned in dialogue with communicative planning. There is a convergence and extension of the two concepts. Communicative planning focuses on deliberation, knowledge pluralism, and legitimacy through dialogue. It is also supported by water governance literature that emphasizes the integration of local and scientific knowledge [13], [14], including the case of Lake Tempe [11], [48]. However, this perspective has been limited to the social arena without considering how space is actually produced. Through the integration of the production of space perspective and relational planning [15], [51], this study has demonstrated how deliberation not only facilitates the process of conflict resolution but also actually produces space through decisions on water elevation that impact the settlement of people living around the lake.

Thirdly, relational water planning is positioned in dialogue with agonistic planning. In this case, there is a convergence and extension of the two concepts. Agonistic planning focuses on conflict as an essential dimension of the planning process. Water governance literature has demonstrated that it is an arena of conflict [43], [57]. However, this perspective has been limited to the discursive arena of conflict. This study of Lake Tempe illustrates that conflict is not only discursively embedded but also rooted in the numerical values of water elevation and shifts in the lake's boundaries. Therefore, this perspective has extended agonistic planning by incorporating the material dimension of the production of aquatic space.

Fourthly, with reference to ecological and

adaptive planning, this research contributes by developing the spatial and temporal analysis. The existing literature highlights the importance of institutional adaptation and social learning in dealing with ecological changes [14], [60]. The global lake restoration literature also highlights the importance of long-term adaptive planning approaches [6], especially in the context of climate change and environmental degradation [40], [72]. However, such approaches tend to ignore the ways policy helps produce space and temporalities. Relational water planning fills this research gap by showing that water planning decisions on elevation produce access, mobility, and identity at the same time as they reflect political choices around temporality [61], [73].

In this way, relational water planning draws upon the traditions of comprehensive-rational planning, communicative planning, agonistic planning, and adaptive planning. Relational water planning challenges the neutrality of comprehensive-rational planning approaches, develops communicative planning through the analysis of spatial and temporal dimensions, develops agonistic planning through the inclusion of materiality, and develops adaptive planning through the analysis of temporality and spatiality. The contribution of relational water planning lies in its ability to rethink water as a relational space created through the interaction of power, knowledge, and nature [55].

Engaging in such a discourse, the research contributes to planning theory both conceptually and as a case study. It underscores the need for an ontological shift in water planning: from stabilization to relationality; from optimization to plural legitimacy; and from control to the acknowledgment of lived socio-ecological dynamics. And it is within such a discourse that relational water planning is proposed as a methodology that more integratively connects biophysical analysis and the politics of space.

5. CONCLUSION

The research indicates that the issue of Lake Tempe's water levels extends beyond a simple hydrological question; it is a socio-spatial process constructed by the mutual interaction of state policies, socio-ecological practices of the lake communities, and the lived experiences of the lake inhabitants. Through the lens of Lefebvre's theory of the production of space, the research has shown that the management of the lake waters' level is a product of the mutual interaction of conceived space—the space produced by the state's technocratic representations; perceived space—the space produced by the socio-ecological practices of the lake's fishing communities; and lived space—the space that reflects the lived experiences of the lake's inhabitants and their identities. Such a discourse underscores that water management policies are not merely representations of a set of decisions; they are also arenas of spatial politics within which different forms of knowledge are negotiated [3], [15].

Based on the explanation above, this article contributes to the development of planning theory by introducing the concept of relational water planning. The concept views the management of water resources as a relational practice that integrates technical-hydrological, socio-ecological, and cultural dimensions of water in an interconnected spatial system. By incorporating the dimension of spatial legitimacy, researchers highlight the importance of understanding water management decisions not only from a technocratic perspective but also through the negotiations on legitimacy among various forms of knowledge and power in the planning processes. Consequently, this article broadens the discourse on water resources planning, traditionally dominated by technocratic approaches, to emphasize the significance of the socio-ecological space of water produced by relationships of power, knowledge, and practices [15], [64], [65].

The implications of the concept of relational water planning are also of great value for the practice of regional planning and the management of water resources. The management of lake water levels is not possible merely by applying technical approaches based on hydrological modeling; rather, it is a planning process that needs to be able to bridge different spatial rationalities, such as local knowledge and the cultural meanings of aquatic environments. Thus, the concept of water planning needs to be understood as a spatial negotiation that includes different aspects, such as ecology, society, and politics of decision-making processes. This approach is in line with the scientific literature on social-ecological systems governance, which highlights the need for integrating scientific and local knowledge in natural resource management [35], [63].

However, it is important to note that there are limitations of the current research that open avenues for future research. First of all, the research was based on a single case of a tropical lake; therefore, the generalization of the findings to different types of aquatic environments needs to be supported by comparative research in different geographical locations. Secondly, the research has focused more on

the socio-spatial aspects of lake water level management; therefore, it is recommended that future research include social aspects along with more hydrological and ecological information to understand the relationships of people with their natural environments. Finally, it is recommended that future research could include models that could link the concept of relational water planning with other concepts, such as social-ecological systems governance and adaptive water management; thus, it could have a wider scope of application for research in the field of water resource planning.

In summary, the article emphasizes that managing lake water levels is a complex process of spatial production that demands an understanding of the intricate relationships between ecology, society, and the legitimacy of knowledge in planning. The introduction and development of the concept of relational water planning aims to enhance planning theory by underscoring the need to view water as a relational space shaped by the negotiation of various spatial rationalities in environmental governance.

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