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Rationality, Adaptation and Social Capital in Household Livelihood Shifts Following the Construction of the Bili-Bili Reservoir, Indonesia

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Abstract

Large-scale infrastructure development disrupts not only the material foundations of agrarian livelihoods but also the social and ecological systems through which households manage uncertainty. This study argues that the livelihood shifts observed among households affected by the construction of the Bili-Bili Reservoir in Lanna Sub-district, Gowa Regency, Indonesia, are best understood as products of contextual rationality operating at the individual level and enacted through household-level strategies. Using a qualitative phenomenological approach with 15 purposively selected informants, each representing a distinct household directly affected by the reservoir's construction functioned as a structural shock that exceeded the adaptive capacity of the existing agrarian system, triggering differentiated household responses—including reservoir fisheries, small-scale trade, home-based enterprise, and labor migration—whose variation reflects systematic differences in individual skills, asset endowments, and social capital access rather than arbitrary or purely compelled choice. Theoretically, this study advances the sustainable livelihoods framework by specifying the mechanism linking individual rationality to household adaptive outcomes, and by showing how social capital—in its bonding, bridging, and linking dimensions—shapes the option set within which rational calculations are made. These findings suggest that post-displacement livelihood recovery is more effectively supported by policies that strengthen social network structures alongside physical and financial provision.

Keywords: rationality; livelihood system shift; social capital; adaptation; diversification

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1. Introduction

Large-scale infrastructure development, such as reservoirs, is often viewed as a technical solution for water supply, energy, and flood control. However, behind these benefits lie complex socio-economic consequences, particularly for communities whose livelihoods depend on land resources [1–3]. The loss of agricultural land due to water inundation forces communities to change the ways they earn their livelihoods [4].

Previous studies addressing the impacts of reservoir construction have focused particularly on shifts in community livelihoods [3,5–7] and changes in geographical landscapes [8,9], while research on livelihood strategies has examined how communities integrate innovation in response to resource loss [2,4,7,10,11]. Studies such as Ninan [5] on

the Kedung Ombo Reservoir and Sitorus et al. [12] have identified economic rationality and social solidarity as factors in post-displacement adaptation. However, these studies share two important limitations. First, they tend to analyze adaptation at the level of the community as a whole, leaving the household—the actual unit within which livelihood decisions are negotiated and enacted—underexplored as an analytical focus. Second, while rationality is frequently invoked as an explanatory concept, it is rarely specified as a process: existing accounts describe that affected populations made adaptive choices, but do not adequately explain how individual rational calculations translated into particular household strategies, or why different households facing the same structural shock arrived at different livelihood outcomes. This gap is consequential because it limits the ability of both theory and policy to account for the variation in adaptive capacity that is consistently observed in post-displacement contexts. The present study addresses these gaps by treating rationality as an attribute of individual actors whose decisions are structured by household-level assets and embedded in community social networks, thereby linking the micro-level process of decision-making to the macro-level pattern of livelihood diversification.

Following Chambers dan Conway [13], a livelihood system encompasses the capabilities, assets, and activities through which individuals and households generate and sustain their means of living. A livelihood system is considered sustainable when it can maintain adequate outcomes across the five capital dimensions—natural, physical, human, financial, and social—while retaining sufficient adaptive capacity to withstand shocks, stresses, and structural changes [11].

This study employs the concept of contextual rationality—distinct from classical instrumental rationality, which assumes actors possess complete information and pursue utility maximization under unconstrained conditions. In reality, households displaced by reservoir construction face incomplete information, limited options, and urgent time pressures that make optimization in the classical sense impossible. Drawing instead on the concept of bounded rationality [14,15], this study understands individual decision-making as a process of satisficing—selecting the most viable available option given the specific constraints, skills, and social resources each actor possesses at the moment of choice. What distinguishes this study's use of rationality from purely economic accounts is its insistence that the calculus is not only material: individuals weigh economic opportunity alongside social obligations, risk tolerance, household role distribution, and cultural familiarity with particular livelihoods. Rationality here is thus contextual in the sense that what constitutes a reasonable choice is always relative to the structural conditions and relational resources specific to each household—not a universal standard of optimality.

This research aims to identify the livelihood system shifts of households around the Bili-Bili Reservoir following the loss of agricultural land, with specific attention to the rational reasoning that individual household members employed in selecting and pursuing new livelihood strategies. It also examines the variation in those strategies across households—including diversification into fisheries, trade, home-based enterprises, and migration—and analyzes the role of social values, trust, and community solidarity as contextual resources that shaped household decision-making. The contribution of this study lies in its application of the livelihood framework to trace how the Bili-Bili Reservoir's construction functioned as a structural shock, and how individual rationality, operating within household units and embedded in community social networks, produced a diverse and differentiated set of adaptive responses—a dynamic that is frequently underexplored in infrastructure development research.

2. Materials and Methods

This research employs a qualitative approach with a phenomenological method to understand the experience of rationality in community livelihood system shifts following reservoir construction. The research location is focused on Lanna Sub-district, Parangloe District, Gowa Regency, South Sulawesi Province, Indonesia (Figure 1). The selection of this location is based on the fact that the area is one of the regions directly affected by the construction of the Bili-Bili Reservoir. The impact of this construction has not only altered the ecological and spatial structure of the area but has also significantly influenced community livelihood patterns. The Lanna Sub-district serves as an important representation because this area has experienced fairly complex livelihood diversification, ranging from agriculture, inland fisheries, and trade, to other informal employment, which emerged as a form of adaptation to environmental and resource changes resulting from reservoir construction. Therefore, this area is considered strategic for exploring the dynamics of community rationality in responding to the socio-economic transformation that has occurred.

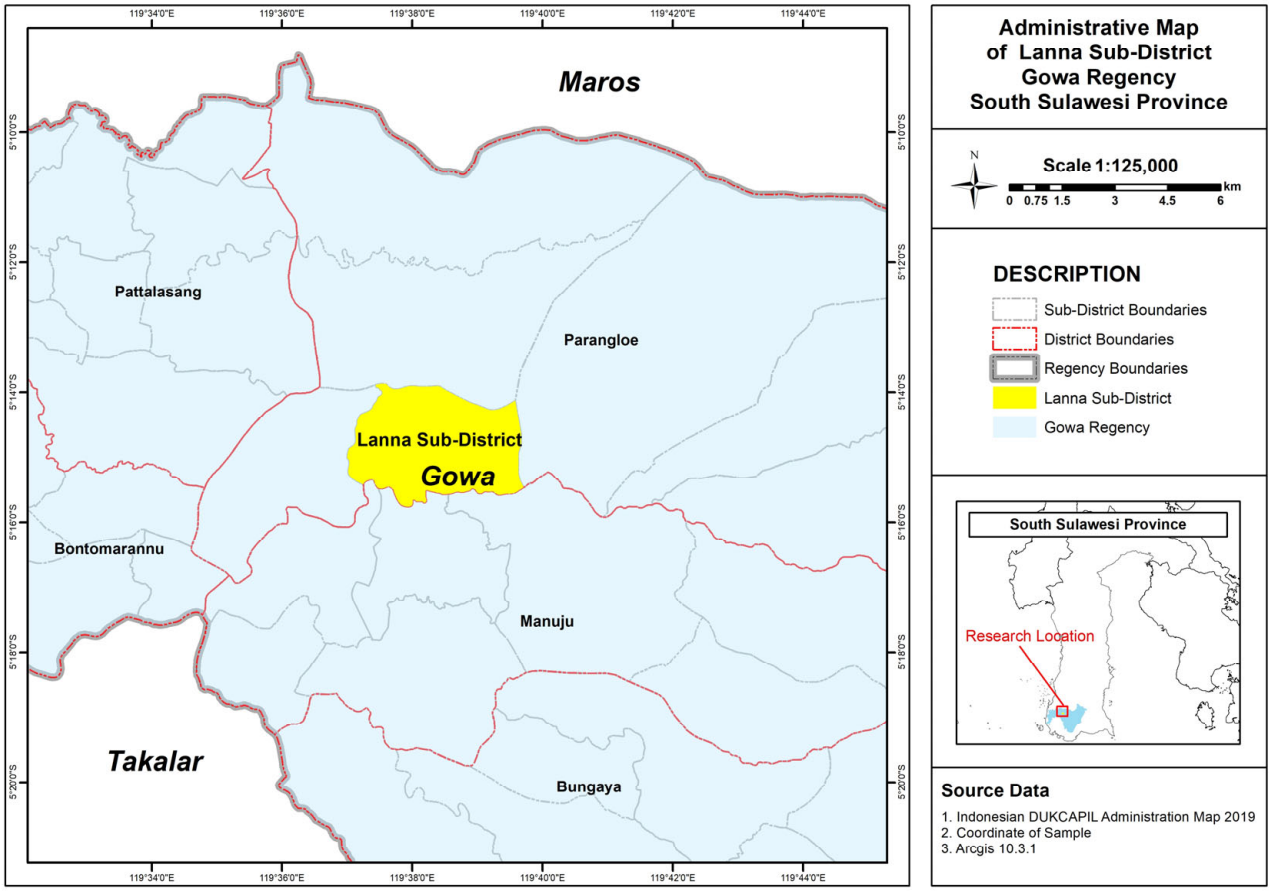


Figure 1. Research Location Map, Lanna Sub-District, Gow Regency, South Sulawesi Province, Indonesia.

A phenomenological approach was adopted because the central analytical question—how individuals experienced, interpreted, and responded to the loss of their agricultural livelihoods—cannot be adequately answered through aggregate measures or externally observed behavior alone. Understanding why a particular household chose fisheries over trade, or migration over home-based enterprise, requires access to the meaning-making processes through which individuals assessed their circumstances and arrived at their decisions. Phenomenology is well suited to this purpose precisely because it prioritizes the lived experience of participants as the primary source of analytical insight [16–18], allowing

the study to trace the reasoning behind livelihood choices rather than merely documenting their outcomes.

The selection of informants employed a purposive sampling method that enables researchers to select samples according to research objectives [19,20]. This technique was chosen due to its capability in identifying and selecting individuals or groups who possess in-depth knowledge or experience with the phenomenon under study [21]. A total of 15 informants were selected, each representing a distinct household that had been directly affected by the construction of the Bili-Bili Reservoir (Table 1). Informants were selected based on three criteria: (1) they had directly experienced the loss of or significant change in access to agricultural land due to reservoir construction; (2) they were actively involved in household economic decision-making; and (3) they had pursued different livelihood strategies following relocation, such as shifting to reservoir fisheries, trade, services, migration, or home-based enterprises. By applying these criteria, the sample was designed to capture not a single type of experience, but rather the range of adaptive responses present within the community. The determination of this sample size follows the principles of adequacy and appropriateness in qualitative research, and also considers data saturation, where the addition of new informants no longer yields significant new information or themes [22].

Table 1. List of Informants.

Informant Code	Age	Current Occupation
IM 01	58	Lemang seller (culinary)
IM 02	55	Tailor
IM 03	59	Reservoir fisherman
IM 04	55	Restaurant owner
IM 05	57	Truck driver
IM 06	58	Fish collector and trader
IM 07	66	Fruit vendor
IM 08	57	Agricultural laborer
IM 09	55	Rice farmer
IM 10	57	Agricultural laborer
IM 11	54	Rice farmer
IM 12	63	Sand laborer
IM 13	60	Restaurant owner
IM 14	55	Reservoir officer
IM 15	54	Village official

Data collection was conducted through a combination of several techniques to obtain comprehensive and in-depth data [23]. The first technique was in-depth interviews, utilizing a semi-structured interview guide that allowed flexibility in exploring information [24]. The first was in-depth interviewing using a semi-structured guide that maintained thematic direction while allowing informants the freedom to narrate their experiences in their own terms [25]. All interviews were conducted face-to-face at the research location—either at the informant's home or place of business—a deliberate choice consistent with the phenomenological orientation of the study, which requires an emotionally close and naturally occurring conversational space. This approach allowed the researcher to attend not only to the content of responses but also to expression, pause, tone, and the social context

surrounding each informant. With the consent of each participant, interviews were audio-recorded to ensure accuracy and prevent loss of information. Alongside recording, the researcher maintained field notes during and immediately after each session, documenting key points, non-verbal responses, the atmosphere of the conversation, and preliminary analytical reflections. Following fieldwork, all audio recordings were transcribed verbatim in their entirety to preserve the original meaning of each statement. Transcripts were then read repeatedly to develop a holistic understanding of each informant's experiential context before the coding process began. Interviews were conducted until data saturation was reached, where no significant new information or themes emerged from additional informants [26]. The second technique was direct observation of economic activities in the field, conducted repeatedly across multiple sessions throughout the research period. Observations covered reservoir fisheries operations, small-scale trading, home-based enterprises, and patterns of social interaction among community members, and were documented through standardized field protocols [26].

Data analysis employed an interactive model consisting of three iterative stages [27]. In the first stage, data condensation, interview transcripts, observation notes, and documentation were coded independently by both the first author and the supervising researcher, each of whom had been directly involved in fieldwork. Coding followed a descriptive approach [28], to identify key themes related to livelihood assets, strategies, and outcomes (Figure 2). Where interpretive disagreements arose between coders, these were resolved through analytical dialogue—returning to the original transcript, the interview context, and the theoretical framework to ensure that each theme was grounded in the data rather than in prior assumptions. Analysis was conducted manually without the use of qualitative software, a deliberate choice consistent with the phenomenological orientation of the study: direct engagement with the text allowed the researchers to remain attentive to nuance, emotional register, and implicit meaning in each participant's narrative. In the second stage, data display, coded themes were organized into thematic matrices mapping relationships among livelihood asset changes, adaptive strategies, and household outcomes. The third stage, conclusion drawing and verification, involved identifying patterns across cases and validating interpretations through triangulation of interview, observation, and documentary data.

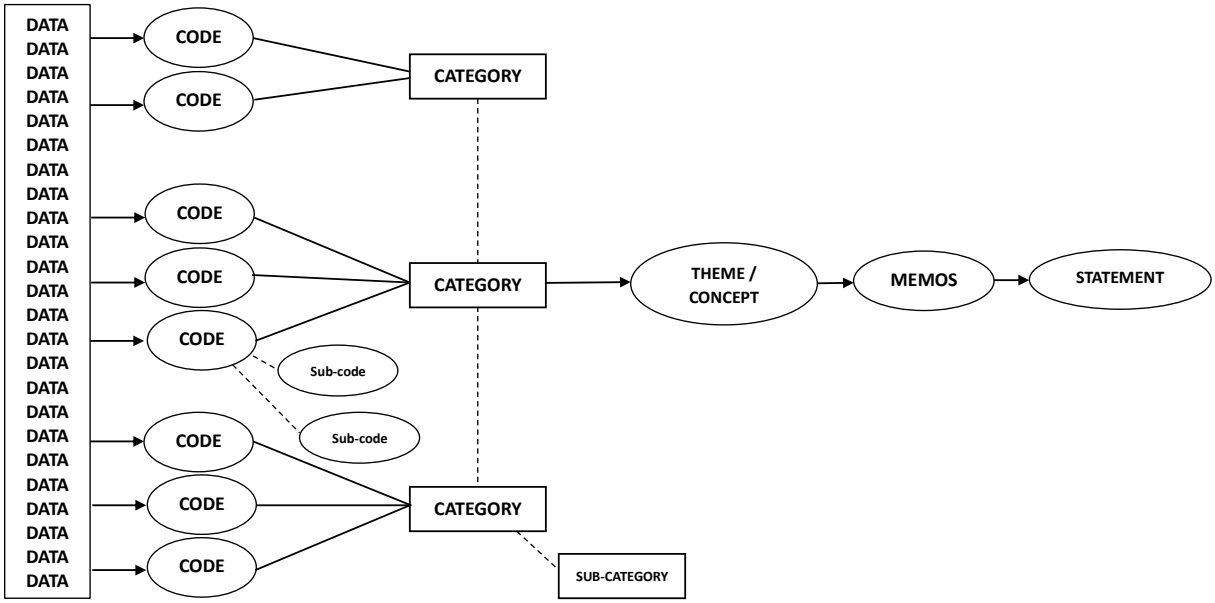


Figure 2. Structure of coding categories and sub-categories derived from qualitative data analysis.

To assess the relative significance of different capital types in household adaptation, the thematic coding process explicitly tracked which forms of capital—natural, physical, human, financial, or social—were referenced by informants as enabling or constraining specific livelihood decisions. The frequency, consistency across informants, and functional role attributed to each capital type in the narratives informed the analytical judgment that social capital served as the primary enabling resource during the post-displacement transition, a judgment further supported by the comparative observation that households with stronger social networks demonstrated more successful adaptive outcomes across the four indicators used in this study.

All informants in this study provided verbal consent for the inclusion of their interview data in this article. We anonymized all sources to ensure their privacy. The research received ethical clearance from the Faculty of Social and Political Sciences, Hasanuddin University under Approval Number 038339/UN4.8/PT.01.04/2024, as well as research permission from the Gowa Regency Government under Approval Number 31413/S.01/PTSP/2024.

3. Results

3.1. Livelihood System Before Reservoir Construction

Before the construction of the Bili-Bili Reservoir, the lives of local communities were highly dependent on the abundance of natural assets that were naturally available and plentiful in the surrounding environment. Fertile agricultural land, clear river flows, and forest products served as the primary foundation in supporting daily livelihood needs. These community activities were carried out sustainably with primary yields including rice, corn, and vegetables, while forest products were utilized for household purposes as well as complementary additional economic support.

In the context of agricultural practices, communities implemented traditional techniques that were highly adaptive to local ecological conditions. Rainfed systems, manual irrigation, and the use of simple tools became part of an agricultural strategy that had been tested through generations. Although not market-oriented, this system proved sufficiently stable in meeting family food needs. Harvest yields were not sold in formal markets, but rather used for social purposes, customary ceremonies, or exchanged in informal networks based on local trust.

Meanwhile, the physical assets utilized by communities at that time also reflected independent economic capacity. Work equipment such as hoes, wooden plows, and buffaloes was used as primary aid in production activities. These tools functioned not only technically but also held symbolic value as productive heritage passed down between generations. Their maintenance was conducted collectively, without dependence on external technology, reflecting a high degree of technological sovereignty at the local level.

This interdependence was reinforced by solid social bonds in daily life. Values such as mutual cooperation, village deliberation (musyawarah kampung), and collective work became fundamental principles in the management of shared resources, particularly in irrigation systems and planting season rotation. Social capital in the form of trust and solidarity not only strengthened social cohesion but also functioned as a safety net in facing natural risks and production uncertainties.

On the other hand, the family unit played an important role as the center of production and consumption in the community livelihood structure. Each family member had specific and complementary roles in economic activities: men focused on primary production, women processed harvest yields, and children were involved in supporting activities. This division of labor created efficiency within the household sphere while simultaneously transmitting values of productivity and responsibility across generations.

The local livelihood system at that time operated with minimal dependence on the state or formal markets. Most living needs were met through local mechanisms including non-monetary exchange, barter, and product exchange systems grounded in trust relations. This self-sufficiency provided a degree of insulation from external economic shocks, though it also reflected the absence of formal safety nets and the limited reach of state services into the area—conditions that constrained household options as much as they fostered local solidarity.

Economic and social practices were guided by local knowledge of seasons, land conditions, and ecological rhythms rather than by market logic, reflecting a form of rationality that was deeply embedded in experience and cultural practice. This system had proven sufficiently stable to sustain basic household needs across generations. However, stability should not be read as absence of hardship: subsistence agriculture offered limited surplus, restricted access to education and healthcare, and left households vulnerable to droughts, crop failures, and other ecological shocks for which no formal insurance existed. Pre-existing inequalities in land ownership and household composition also meant that not all families shared equally in the security this system provided. The agrarian livelihood system before reservoir construction was thus neither uniformly resilient nor uniformly fragile—it was a locally adapted arrangement that met basic needs within significant structural constraints.

The Bili-Bili Reservoir, located in Gowa Regency, South Sulawesi, dams the Jeneberang River, which has a length of approximately 90 km and a catchment area of approximately 600 square kilometers. Physical construction of the reservoir commenced in 1992 and was completed in 1997, after which the inundation process began progressively between 1997 and 1999, submerging approximately 13 villages scattered across Parangloe District. This project has multiple functions, serving as flood control, raw water supply, agricultural irrigation, hydroelectric power generation, and tourism. However, behind this success, it has also transformed the landscape and livelihood systems of the surrounding agrarian communities. Many community members lost their agricultural land and ultimately adapted by becoming fishermen, sand laborers, tailors, fish traders, and entrepreneurs, demonstrating how large-scale infrastructure development has brought profound socio-economic changes to their lives.

Over time, as the socio-economic impacts of the reservoir's presence became increasingly apparent, communities in the affected areas began to independently adjust to the new conditions. They undertook various forms of adjustment, including changing professions to become fish collectors, opening food businesses, working as sand mining laborers, or conducting small-scale trading activities. In this transition process, various forms of rational considerations became evident as the basis for their economic choices and adaptation strategies. These changes also created new social configurations in post-reservoir communities, characterized by distinctive livelihood systems, asset ownership, and varying degrees of dependence on social networks.

3.2. Livelihood System After Reservoir Construction

The construction of the Bili-Bili Reservoir fundamentally restructured the conditions under which households in Lanna Sub-district organized their livelihoods. The inundation of agricultural land severed access to the primary productive resource upon which households had depended, while the conversion of surrounding forests into restricted zones disrupted ecological relationships that had sustained supplementary household needs across generations. Compensation land was provided in some cases, but was frequently incompatible with the agricultural knowledge and practices of affected households, limiting its value as a substitute productive asset.

The immediate consequence at the household level was the collapse of a stable, if constrained, agrarian income base and its replacement with a more precarious set of livelihood options—informal labor, small-scale trade, and fisheries—each characterized by greater exposure to market fluctuations and seasonal variability than the subsistence system they replaced. Access to new livelihood assets was uneven: not all households possessed the capital, skills, or social connections to make the transition equally well, producing a widening of socio-economic inequality within the community that had not been as visible under the more homogeneous agrarian system.

While these adaptive responses reflect community agency in the face of displacement, the new livelihood arrangements remained highly vulnerable due to their dependence on market dynamics, seasonal fluctuations, and external interventions. Consequently, livelihood security became more uncertain than under the previous agrarian system.

The social fabric that had previously supported collective livelihood management also came under pressure through two interconnected mechanisms. First, spatial displacement disrupted the shared routines—communal irrigation work, coordinated planting cycles, collective harvest labor—through which trust and reciprocity had been continuously reproduced. When households no longer worked the same land in the same seasons, the practical basis for gotong royong eroded. Second, the shift toward individually oriented market livelihoods introduced competitive dynamics that had been largely absent from the subsistence system: households now competed for customers, fishing grounds, and trading locations rather than cooperating around shared agricultural resources. These pressures did not eliminate social capital, but they changed its character—from a community-wide collective resource to a more selective asset mobilized through specific kinship and network ties. The detailed dynamics of this transformation across the five capital dimensions are examined in Section 3.3.

At the household level, economic decisions that had previously been guided by ecological knowledge and collective norms were now shaped by immediate market opportunities and crisis management imperatives. Women took on expanded income-generating roles while continuing to manage domestic responsibilities, working-age members migrated to urban labor markets, and households increasingly relied on government assistance programs that were largely short-term and structurally misaligned with post-relocation needs. Together, these shifts produced a new form of household rationality—one oriented not toward ecological continuity but toward adaptive flexibility within conditions that remained largely unfavorable.

3.3. Changes in Livelihood Assets

3.3.1. Natural Capital

The construction of the Bili-Bili Reservoir has resulted in major changes to the form and function of natural capital that had been the primary foundation of the livelihood system for communities in Lanna Sub-district and its surroundings. Natural capital such as agricultural land, small forests, rivers, and grazing fields that were previously used for subsistence agriculture and local livestock farming have now largely changed in function to become inundation areas. This change not only eliminated the main economic resources but also disrupted the ecological relations that had been deeply rooted in community life.

The construction of the Bili-Bili Reservoir has caused the loss of agricultural land and grazing fields that had been the main source of community livelihoods. Lands that were previously managed through generations are now inundated with water, forcing many families to lose their professions as farmers and livestock breeders. Beyond the material losses, the construction of the reservoir also disrupted the agrarian identity that had been embedded in daily life, as the following account illustrates:

> *"Before the Bili-Bili Reservoir was built, I worked as a farmer. That was my main occupation for a long time, and the agricultural land I managed was the main source of my family's livelihood. We planted rice, corn, and occasionally vegetables, enough to meet our daily needs. However, since the reservoir construction began, everything changed drastically. Water from the reservoir inundated all of my agricultural land, and from that moment, I completely lost the land where I used to work. As a result, I also lost the main source of livelihood that had supported our family's life all this time." (IM 05)*

Several residents shifted to completely new and unfamiliar occupations, such as becoming fishermen or truck drivers, without prior experience. This adaptation pattern reflects a form of contextual rationality, where economic decisions are made under structural pressure and resource constraints. Amid this situation, responses also emerged that demonstrated local initiative; some women, for instance, chose to run small businesses from home to maintain family economic independence. This was expressed by a resident as follows:

> *"Rather than just staying at home without income, I thought it would be better to try doing whatever I could do. I didn't want to keep hoping for assistance. If I kept waiting, I wouldn't know when it would come. It's better to start with what I have, even if it's small. The important thing is to have my own effort…" (IM 02)*

The loss of daily interaction with land left not only material impacts but also emotional ones. For some families, life before the reservoir may have been simple, but it was able to meet basic needs without having to depend on external parties. Now, this change has shifted the household economic structure while simultaneously creating longing for a more stable and independent past. This was expressed by a resident as follows:

> *"……Our life was indeed simple at that time, but honestly, I can say that all daily needs were met. Not excessive indeed, but enough to eat, send children to school, and live peacefully without depending much on others" (IM 06)*

These findings demonstrate that natural capital, which was previously local, sustainable, and integrated with community life, has been replaced by a new economic system that is more dependent on markets and technology. This transformation has not only triggered economic uncertainty but also ecological trauma and social dislocation. Consequently, development policies in post-reservoir areas need to consider natural capital restoration strategies as well as efforts to reconstruct the community's ecological relations. This is important to ensure that large-scale infrastructure development does not leave prolonged structural vulnerability for affected communities.

3.3.2. Physical Capital

Following the construction of the Bili-Bili Reservoir, affected communities experienced changes in the form and function of physical capital, namely tangible assets such as dwellings, production facilities, work tools, business buildings, and public infrastructure. The loss of land as the main source of livelihood forced communities to adapt by building or modifying physical capital to support new economic activities. Physical capital became an important arena for the livelihood transition process, where homes no longer functioned solely as domestic spaces but also as units of economic production and distribution.

The transformation of physical capital following reservoir construction is clearly visible in the adaptive efforts of communities to maintain their livelihoods. Several residents replaced their agricultural production tools by building new business spaces based on daily economic needs. In some cases, multifunctional stalls were built independently, serving dual functions as dwellings and business spaces, complete with charcoal stoves, traditional cooking equipment, and simple gazebos for customers. This initiative reflects creativity

in creating new forms of household physical assets. This was expressed by a resident as follows:

> *"In the past, I only had a hoe and farming tools, but now I built this stall myself. I built it from bamboo, gradually, then bought tables, bought a charcoal stove. This is also a dwelling, but I can sell here. I also made a seating area so people can relax and eat lemang." (IM 01)*

Similar strategies were found among women who converted the function of living rooms into production spaces, such as sewing areas. With capital from cooperative assistance and family loans, they obtained production equipment such as sewing machines and other supporting equipment. This process demonstrates how women play a central role in the restructuring of household physical capital through independent initiative and social networks. This was expressed by a resident as follows:

> *"I used to work in the rice fields, but after they were inundated, I learned to sew. Starting from borrowing a machine, then receiving cooperative assistance, I was finally able to buy my own machine. Now I work at home; I transformed this living room into a sewing area. There's a table, thread rack, everything arranged so I'm comfortable working." (IM 02)*

Similar adaptation was also undertaken by some men who chose to build new businesses in strategic locations, such as tourism areas. Semi-permanent food stalls began to be built from simple structures and were continuously improved gradually, for instance, by adding kitchens, cooling equipment, and dining utensils to enhance customer comfort. This was expressed by a resident as follows:

> *"...Initially, I only used a tent and wooden table, now I've added a kitchen, bought a refrigerator too. Little by little I make improvements so people are comfortable eating here." (IM 04)*

Beyond individual assets, the existence of public infrastructure such as main roads, small docks, and local markets also supports new economic productivity. Improved road access not only facilitates the distribution of raw materials for household business operators but also opens the community to trade goods and inputs from outside the immediate region—including sewing materials, cooking equipment, and fishing gear—that were previously inaccessible. Docks serve as important points for fishery activities now pursued by some residents. Nevertheless, most physical assets were obtained through cooperatives, personal savings, or family networks rather than through direct state provision. The minimal institutional support in this regard underscores how much of the physical capital reconstruction was driven by community initiative rather than formal assistance.

Overall, the interviews reveal that the success of household economic adaptation heavily depends on the community's ability to access and reconstruct physical capital relevant to the new conditions. This process requires creativity, gradual investment, and adequate social support. Therefore, in the context of post-relocation due to large-scale development projects, the role of physical capital is not only as a means of production but also as a space for articulating survival strategies that are dynamic and contextual in nature.

3.3.3. Human Capital

In facing relocation and economic structural changes due to the construction of the Bili-Bili Reservoir, human capital emerged as a key element in supporting the sustainability of community livelihoods. This capital encompasses practical skills, adaptive knowledge, work ethic values, and self-learning capacity, which enable individuals to respond to structural pressures creatively and purposefully. The transition from agriculture to the

informal sector did not occur passively but rather through the mobilization of both existing skills and those developed autodidactically.

Some residents re-utilized old skills relevant to the new life context. For instance, sewing skills learned in their youth were revived and made into the main source of income, while others chose to learn new skills, such as truck driving, to adapt to local labor market dynamics. This pattern demonstrates that previous work experience functions as a strategic reserve for dealing with the loss of physical assets, while simultaneously strengthening household adaptive capacity in the medium term.

The choice of new professions was not merely reactive but was grounded in rational and contextual considerations. In many cases, individuals utilized social networks, assessed market opportunities, and considered personal capabilities before making decisions. This was expressed by a resident as follows:

> *"...I saw that many people needed fresh fish, so I started collecting fish from neighbors too, then selling them to the market. I thought, rather than waiting for fate, it's better to organize myself so there's daily income." (IM 06)*

This rationality is reinforced by a strong work ethic and high discipline, reflected in the consistency of opening businesses every day without holidays. This serves as an indicator of commitment to micro-enterprises as economic support for families in situations full of uncertainty. This was expressed by a resident as follows:

> *"...when selling like this, I have to open every day. There are no holidays. If I close, there's no income..." (IM 01)*

Most skills learning processes occur through informal channels. Residents learn through direct practice, observation of their surroundings, and social interaction. This learning strategy demonstrates that human capital in the local context cannot be reduced to formal education alone but rather develops through social intelligence, daily experiences, and individual flexibility in facing change.

Post-relocation economic transformation has also altered gender roles at the household and community levels. In many cases, women emerged as primary actors in rebuilding the family economic foundation. They not only assumed the role of breadwinners but also became driving forces in community-based small business innovation. This role demonstrates that the distribution of human capital is equitable across genders, while simultaneously affirming the importance of economic recovery approaches that are responsive to gender dynamics.

The mobilization of human capital is also reflected in the emergence of various forms of micro-enterprises, such as food stalls, vegetable kiosks, sewing businesses, and fish collection. These enterprises demonstrate how courage, creativity, and risk management become part of daily economic practices. In the post-relocation context, human capital becomes the primary foundation of household resilience, as it is able to replace the limitations of natural and physical capital lost due to infrastructure development.

Thus, it can be concluded that human capital plays a central role in the adaptation process of affected communities. The ability to learn independently, identify opportunities, and rebuild livelihood systems demonstrates the high level of social resilience possessed by local communities. More than merely surviving, human capital enables them to reformulate life strategies rooted in local knowledge, community solidarity, and empowered internal capacity.

3.3.4. Social Capital

Social capital becomes key for communities affected by reservoir construction to survive and adapt. This social capital, in the form of kinship networks and inter-resident

solidarity, functions as the main source of information, emergency assistance, and economic support. It is this social capital that enables affected residents to recover and find new ways to continue their lives. This was expressed by a resident as follows:

> *"Community interaction relationships here are quite good. We are still within the family sphere; no outsiders have interfered yet. This kinship relationship is very helpful, especially in providing information about opportunities or new businesses, and in helping each other with daily needs." (IM 01)*

Amid major changes due to reservoir construction, residents continue to maintain mutual cooperation as their main strength. They help each other build houses, assist one another when neighbors hold events, and work together in cleaning the environment. They believe that gotong royong is not only a cultural heritage but also their way of lightening life's burdens and strengthening solidarity amid limitations. This was expressed by a resident as follows:

> *"Alhamdulillah, mutual cooperation here is still very well maintained. It is usually done when building houses, cleaning the environment, or if there are wedding events. We all unite to help neighbors, without expecting compensation. This tradition increasingly strengthens community relationships." (IM 07)*

Another form of social relations, namely trust, becomes an important basis in the sustainability of the informal economy. For instance, those who work as fish collectors establish mutually trusting relationships with fishermen. They often receive fish first and pay for it after it is sold. This relational pattern occurs due to high trust formed from long-standing interactions. This was expressed by a resident as follows:

> *"Fishermen here have known me for a long time. They give me fish first, then I pay after it's sold. That cannot be obtained just like that; I have to maintain their trust." (IM 06)*

Thus, it can be concluded that social capital plays an important role in enabling communities to create opportunities and build new support structures. Trust-based relationships and strong solidarity serve as primary support for their livelihood sustainability and socio-economic stability. In this context, social capital is not merely a means of survival but also a source of strength to rebuild a more independent, adaptive, and empowered life amid structural changes due to state development.

3.3.5. Financial Capital

Reservoir construction has also transformed community assets from agrarian to non-agrarian. Their land has turned into cash or simple trading assets, forcing residents to seek new livelihoods that are more informal and uncertain. Under these conditions, family and community support becomes the primary support in helping the community economy.

Another challenge faced by affected residents is dependence on markets and raw material price fluctuations, which directly affect the production capacity of small businesses. Rising prices of main commodities, such as glutinous rice, force some business operators to reduce production volumes or switch to using alternative fuels. This strategy often creates a dilemma between maintaining product quality and reducing production costs. This was expressed by a resident as follows:

> *"When glutinous rice prices rise, I sometimes reduce the amount of lemang I make. Gas is also expensive; sometimes I switch back to using firewood. But if I reduce too much, the taste of lemang also changes. We're in a difficult position either way." (IM 01)*

Amid various limitations, many residents voice hopes that the state will be more actively present in strengthening their economic foundation. Capital assistance, skills

training, raw material subsidies, and access to production tools are the forms of support most needed.

3.4. Changes in Livelihood Strategies and Outcomes

The livelihood strategies that emerged following reservoir construction were not uniform—they varied systematically across households depending on the combination of assets, skills, social networks, and individual circumstances each possessed at the moment of displacement. Four broad patterns of household strategy are evident from the fieldwork. The first is internal household diversification, in which different members of the same household pursued different income sources simultaneously—one member fishing while another operated a small food stall, for example—in order to spread risk and stabilize total household income. The second is specialization in reservoir-based resources, pursued by households with relevant prior experience or proximity to the water, who identified fishing or fish collection as the most accessible new livelihood given the assets they already held. The third is partial migration, in which one or more working-age household members relocated to urban areas to generate remittance income while remaining members sustained local livelihoods. The fourth is home-based enterprise development, most commonly pursued by women, who converted domestic spaces into production and trade units—sewing, food preparation, and small retail—drawing on cooperative credit and kinship networks to acquire the necessary equipment.

Assessing the relative success of these strategies requires moving beyond income levels alone. This study employs four qualitative indicators: income stability over time, capacity to meet basic household needs (food, education, healthcare), ability to develop or expand the livelihood activity, and resilience to economic shocks without falling back into extreme vulnerability. Applying these indicators, two broad household trajectories emerge from the data.

Households that combined multiple income sources—particularly those pairing local enterprise with remittance flows, cooperative support, or access to government training programs—demonstrated stronger performance across all four indicators. Their income, while not always high, was more consistent; their ability to absorb shocks such as seasonal fishery declines or raw material price increases was greater; and several reported gradual capacity to reinvest in their enterprises, such as upgrading stall equipment or expanding product ranges. These were predominantly households whose members possessed transferable skills, maintained active social networks across bonding, bridging, and linking dimensions, and were able to access at least one form of external capital—cooperative credit, family loans, or government assistance—during the transition period.

By contrast, households dependent on a single informal income source without adequate asset or network support showed greater vulnerability across all four indicators. Daily income from informal labor fluctuated considerably, leaving little capacity for savings or investment. These households were most susceptible to minor economic shocks—a rise in glutinous rice prices, an off-season in reservoir fisheries, a family health emergency—that pushed consumption below basic needs thresholds. Their inability to diversify was not a matter of preference but of constraint: without transferable skills, initial capital, or social connections to new economic opportunities, the range of viable options available to them was substantially narrower than for better-positioned households.

This comparative assessment reveals that the structural outcome of the Bili-Bili Reservoir's construction was not a uniform livelihood shift but a differentiated one—in which pre-existing differences in human capital, social capital, and asset access were amplified by displacement, producing households on a spectrum from relative adaptive stability to

prolonged vulnerability. The strategies pursued were rational responses to real constraints, but the conditions enabling those strategies were unequally distributed from the outset.

4. Discussion

The findings from Lanna Sub-district demonstrate that household adaptation following the construction of the Bili-Bili Reservoir cannot be understood as a spontaneous response to crisis or as mere compulsion in the face of displacement. Rather, it constitutes a rational process—contextual in nature, differentiated across households, and shaped simultaneously by economic calculation, social relations, and cultural attachment. Individual household members assessed the options available to them given their specific skills, assets, and networks, and arrived at livelihood strategies that reflected the balance of opportunity and constraint particular to their circumstances. This analytical framing—contextual rationality operating at the individual level and enacted through household strategy—anchors the discussion that follows and connects the empirical findings of Section 3 to two broader theoretical contributions: the role of social capital in structuring household option sets, and the mechanisms through which individual rational decisions translate into differentiated livelihood outcomes.

This framing situates the Bili-Bili case within a wider literature on post-displacement adaptation, which has consistently found that affected populations do not remain passive in the face of land loss [2,11,29]. Studies such as Ninan [5] and Sitorus et al. [12] have identified rationality and social solidarity as factors in adaptation, while broader livelihood research has documented diversification into fisheries, trade, and service sectors as common responses to agricultural land loss [7,10,30]. What the present study adds is a specification of the process through which these outcomes are produced: the variation across households is not incidental but reflects structured differences in individual human capital, household asset endowments, and social network access that shaped the range of rational choices available to each household [31,32]. The loss of land was thus not only an economic loss but a disruption to the social identity and collective decision-making structures through which livelihoods had previously been organized [33], making the reconstruction of livelihood systems simultaneously a material and a social project.

4.1. The Roles of Social Capital

The construction of the Bili-Bili Reservoir forced individual households in Lanna Sub-district to confront the loss of agricultural land and the disruption of livelihood systems they had depended upon for generations. Under these conditions, social capital emerged as a critical resource precisely because it extended the reach of household decision-making beyond the assets each family directly possessed. As Putnam [34] affirms, social capital constitutes networks of trust and reciprocal norms that strengthen social coordination—and for affected households, access to these networks became as strategically important as access to physical or financial capital.

At the household level, bonding social capital—ties rooted in kinship and close neighborly relations—provided the first layer of support. Families drew on these relationships to share food, exchange labor, and circulate livelihood information in the immediate aftermath of displacement. This form of capital lightened economic burdens for individual households and provided psychological security during a period of acute uncertainty. As Szreter and Woolcock [35] describe, bonding capital functions as social protection that prevents destitution, a dynamic clearly evident in how Lanna households navigated the early stages of relocation.

Beyond these immediate bonds, households also mobilized bridging social capital by cultivating cross-group networks that opened access to non-agrarian economic op-

portunities. Individual households that engaged with inter-village traders, for instance, were able to find wider markets for locally produced goods such as processed foods and garden produce. These horizontal connections enriched the information available to individual decision-makers and expanded the range of livelihood options households could realistically pursue [35].

Linking social capital—vertical connections between households and formal institutions—further shaped household adaptive strategies. Households that established relationships with local government offices and non-governmental organizations gained access to assistance programs, skills training, and business capital. These connections were particularly consequential for households that had lost the bulk of their productive assets through inundation. As Woolcock [36] notes, linking social capital enables communities to access greater resources and authority, and in the Lanna context this translated directly into expanded household livelihood options.

The most resilient households in this study were those that successfully combined all three forms of social capital. By drawing simultaneously on bonding ties for immediate support, bridging networks for economic opportunity, and linking connections for external resources, these households were able to construct more stable and diversified livelihood systems than those relying on any single form alone. This finding aligns with Akintimehin et al. [37], who emphasize that the strategic combination of social capital networks produces more sustainable adaptive outcomes.

This does not mean social capital functioned without tension at the household level. Strong bonding ties occasionally generated obligations that constrained individual household decision-making, while over-reliance on linking connections risked creating new dependencies on external actors. As Rockenbauch & Sakdapolrak [38] caution, social capital carries both integrative and exclusionary potential, and households navigated these trade-offs differently depending on their circumstances.

The claim that social capital played the most significant role in post-reservoir adaptation requires analytical justification rather than mere assertion. Across the five capital dimensions (Section 3.3), all experienced disruption following reservoir construction—natural capital was inundated, physical capital required wholesale replacement, human capital needed reorientation toward unfamiliar livelihoods, and financial capital was largely absent or inadequate during the transition. What distinguished social capital was not simply its presence but its functional primacy during the period when all other capital forms were simultaneously depleted or inaccessible. Natural and physical capital could not be recovered quickly; financial capital was beyond most households' immediate reach; human capital required time and opportunity to develop. Social capital, by contrast, was available immediately and at low transaction cost—it required no startup investment, no formal qualification, and no external approval. It was precisely because bonding, bridging, and linking networks were already embedded in household relationships that they could be activated in the immediate aftermath of displacement, while other capital forms were still being reconstructed. Furthermore, the data reveal that access to social capital was the primary differentiator between households that successfully diversified their livelihoods and those that remained trapped in precarious informal labor: households with stronger social networks were more able to access training programs, cooperative credit, and market information that enabled the reconstruction of other capital forms. Social capital thus functioned not merely as one adaptive resource among several, but as the enabling condition through which other capital forms could be rebuilt.

Ultimately, the Lanna case illustrates that household adaptation following reservoir construction cannot be understood through material assets alone. Social capital—sustained through practices of mutual cooperation, village deliberation, and informal problem-

solving—functioned as a dynamic resource that households actively drew upon and cultivated in pursuit of livelihood stability. This finding reinforces the argument of Narayan and Cassidy [39] that social capital is a determining factor in the adaptive capacity of vulnerable households, and suggests that development responses to large-scale infrastructure displacement should attend as carefully to social network structures as to physical and financial provision.

4.2. Rationality Behind Livelihood System Shifts

The construction of the Bili-Bili Reservoir did not produce a uniform household response. Instead, it generated a structured set of differentiated strategies—reservoir fisheries, small-scale trade, home-based food enterprises, sewing, sand labor, and migration—whose variation reflects not randomness but the operation of contextual rationality at the individual and household levels. Understanding why different households chose different pathways is precisely where the concept of rationality becomes analytically productive rather than merely descriptive.

Rationality in this context is not a universal calculus but a process of weighing available options against specific constraints. The options available to most affected households were in practice limited: continue farming on shrinking or compensated land, shift to reservoir fisheries, enter small-scale trade or the informal service sector, or migrate. Within these constrained options, individuals assessed which path best matched their skills, their household's existing assets, and the social resources they could draw upon. As Elster [40,41] argues, individuals make decisions through rational calculations shaped by the specific conditions they face—and in Lanna, those conditions differed considerably across households.

Households in which members had prior experience with water-based work, or who already owned basic fishing equipment, found the transition to reservoir fisheries the most accessible rational step—a match between existing human and physical capital and the new resource the reservoir itself had created. By contrast, households located near newly developed roads and tourism infrastructure, or whose members possessed cooking or retail skills, were better positioned to pursue food vending or small trade. The reservoir simultaneously eliminated livelihoods and created new markets; rational households assessed which of those markets they were best equipped to enter [42]. The variation in outcomes documented (Section 3.4) is thus not incidental—it is evidence of rationality at work across households with different asset profiles.

Human capital was equally decisive. Women who had acquired sewing skills through cooperative training—or who revived skills from earlier in their lives—drew on that capital to convert domestic spaces into production units. Their choice was rational not because it was the most lucrative option available, but because it was the most viable given their skills, domestic responsibilities, and access to cooperative credit. Migration, meanwhile, was predominantly pursued by working-age household members whose individual rational assessment was that local opportunities were insufficient relative to the costs of remaining—a calculation made possible by strong enough kinship networks to sustain the household during the transition [42].

This framework also clarifies the role of social capital in rational decision-making. Social networks did not determine household strategies, but they shaped the option set from which individual household members chose. A household member who trusted a fisherman enough to receive fish on credit before payment (as described by IM 06 in Section 3.3.4) was able to enter fish collection—a livelihood requiring minimal startup capital—precisely because that trust relationship effectively substituted for financial capital. This is rationality operating within a social context: the individual calculates based not

only on material assets but on the relational resources their position in the community makes available [34,35].

Government programs and policies also shaped the decision environment within which households reasoned. Access to skills training, microcredit, and cooperative assistance did not determine outcomes uniformly, but they did expand the option set available to certain households, particularly those with sufficient social and linking capital to access these programs. As Chambers and Conway [13] emphasize, sustainable livelihood adaptation requires policy environments that actively strengthen household adaptive capacity rather than merely providing temporary relief. In Lanna, households that successfully connected with such programs—through community networks or direct engagement with local government—were able to leverage external resources into more durable livelihood strategies.

Assessing whether these rational adaptations were successful requires moving beyond income levels alone. Households that successfully combined multiple income sources demonstrated greater capacity to meet basic needs consistently—food security, access to education, and resilience to health shocks—even when individual income streams remained volatile. Fisheries income fluctuated seasonally; food stall revenue depended on daily foot traffic; remittances were irregular. Yet households that sustained two or more income channels were markedly more stable than those dependent on a single source. In this sense, the rationality of diversification is confirmed by its outcomes: not the elimination of vulnerability, but the construction of a livelihood system flexible enough to absorb shocks that the previous agrarian system, once dismantled, could no longer withstand. The theoretical contribution of the livelihood framework here is precisely its capacity to link the process of individual rational decision-making to the structure of household outcomes—showing not just what changed, but why specific households changed in specific directions, and with what degree of success.

5. Conclusions

The construction of the Bili-Bili Reservoir in Lanna Sub-district, Gowa Regency, Indonesia, produced a structural shock that dismantled the agrarian livelihood system upon which households had depended for generations, forcing a differentiated set of adaptive responses whose variation reflects the unequal distribution of skills, assets, and social networks across affected households. This study has examined that process through the analytical lens of contextual rationality operating at the individual level and enacted through household-level strategies, with the community understood as the social context that shapes—but does not determine—the options available to each household.

This study advances the literature in three ways. First, it specifies the mechanism linking individual rationality to household livelihood outcomes in post-displacement contexts: rather than treating rationality as a general characteristic of community adaptation, this study demonstrates that rational decision-making is an individual-level process structured by household asset profiles, operating within social networks that expand or constrain the options available to each actor. This specification moves beyond descriptive accounts of adaptive behavior toward an explanatory framework capable of accounting for variation across households facing the same structural shock. Second, it demonstrates that social capital functions as the enabling condition for the reconstruction of other capital forms—not merely one adaptive resource among several, but the resource through which access to physical, financial, and human capital is made possible during the period when all capital forms are simultaneously depleted. This insight refines the sustainable livelihoods framework by establishing a functional hierarchy among capital types in post-displacement contexts rather than treating them as equivalent inputs. Third, it contributes an empirical case from

Eastern Indonesia that illustrates how community-level livelihood integration—previously organized around collective agricultural rhythms—fragments into household-level strategies following large-scale displacement, producing new forms of social differentiation and inequality that are not captured by community-level analyses alone.

These findings carry two direct implications for development policy. First, interventions following large-scale infrastructure displacement should prioritize the early activation and strengthening of social capital networks—cooperative structures, community deliberation mechanisms, and peer information systems—before and during the transition period, rather than focusing exclusively on physical and financial compensation. Households that navigated the transition most successfully did so by mobilizing social resources that no policy program provided; policy that actively supports these networks would reduce the dependence on household-level variation in social capital endowment that currently produces unequal adaptive outcomes. Second, skills training and microcredit programs should be designed with an understanding of the household strategies they are meant to support—delivered in ways that are accessible to households pursuing internal diversification strategies, responsive to the specific livelihood options created by the new infrastructure, and sustained over a timeframe commensurate with the length of the transition period rather than delivered as short-term interventions.

This study's qualitative phenomenological design enables depth of interpretation but limits generalizability. Future research should test the analytical framework developed here—contextual rationality, household as a unit of strategy, and social capital as an enabling condition—using quantitative or mixed-methods approaches across multiple reservoir-affected communities in Indonesia and comparable contexts elsewhere. Particular attention should be given to measuring the long-term stability of the adaptive strategies documented here, and to whether the social capital networks that enabled initial adaptation have proven durable under the competitive pressures of market-oriented livelihoods over time.

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