



Addressing Water Inequality in Rural Indonesia: A Community-Based Approach with Clean Water Intervention Mechanism

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Abstract. Water is the lifeblood of planetary health and human civilization [1]. However, in Indonesia, access to water remains a challenge, particularly in rural areas. While 95% of households in urban areas have access to basic water services, this figure drops to 82% in rural areas [2]. Establishing water access for rural communities is a sustainable way to address global resilience challenges and improve quality of life. It addresses essential needs such as health, agriculture, and economic opportunities, thereby enhancing overall community well-being and resilience. This study examines community-based rural water supply programs and local water community ownership with clean water intervention mechanisms by Habitat for Humanity Indonesia. This study uses a qualitative method based on case study observations. Kampung Wangun Cileungsi, Bogor Regency and Tirta Wangun Water Committee are used as case studies. The authors argue that community-based rural water supply and sanitation programs, accompanied by the formation of the Tirta Wangun Water Committee, play a significant role in ensuring the sustainability of water sources and equity within the community. This study shows that by involving the community in conservation practices and water quality monitoring, pollution can be reduced, and aquatic ecosystems can be protected. This leads to improved water quality consumption, reduced carbon footprints through the use of more efficient local technologies, and the protection of natural habitats supporting biodiversity. Consequently, overall environmental health improves, supporting ecosystem balance and climate change mitigation.

Keywords: Water Access, Rural Communities, Global Resilience, Community-Based Approach

1 Introduction

In the midst of increasingly complex global challenges, water remains one of the central issues in efforts to build community and environmental resilience. Water is essential for human health and plays a critical role in agriculture, industry, and ecosystems. However, access to clean water continues to be a significant problem in many countries, including Indonesia. According to UNICEF and WHO, approximately 95% of households in urban areas have access to basic water services, while only 82% of households in rural areas have similar access [2]. These disparities affect the quality of

life and well-being of individuals and have the potential to undermine social and economic resilience.

The inequality in access to water is not just a local issue, but part of a larger global challenge. In Indonesia, despite progress in providing clean water, there are still significant regional variations in access between provinces and districts. A study found that access to clean water varies widely across provinces, with some areas such as DKI Jakarta achieving 93.4% coverage, while other areas like Bengkulu report only 41.1% [3]. These findings highlight the need for greater attention to underserved regions.

In this context, building sustainable water infrastructure is crucial to addressing this increasingly urgent challenge. Kampung Wangun Cileungsi in Karang Tengah Village, Babakan Madang District, Bogor Regency, is one of the locations where Habitat for Humanity Indonesia has implemented a project to improve access to clean water. In collaboration with a donor, Habitat for Humanity Indonesia has successfully provided access to clean water for 152 families and seven public facilities (school, mosque, prayer room) in the village. Additionally, the Habitat team conducted training on clean and healthy living practices for the beneficiaries, distributed shelter kits, and planted trees. This initiative not only improves access to clean water but also empowers the community to maintain the sustainability of water resources, fostering a healthier and more sustainable environment for all.

With this community-based approach, Habitat for Humanity Indonesia aims to address the challenges of unequal water access and strengthen community resilience to climate change. Resilience to climate change is a key aspect of sustainable development strategies. According to the Global Water Partnership, climate change is exacerbating the global water cycle and increasing the risk of water-related disasters, such as floods and droughts [4]. Therefore, it is essential for countries to integrate water security and climate resilience into their development plans.

Community-based approaches to water resource management can help create more resilient systems. Collaboration between governments, non-governmental organizations, and local communities can lead to innovative solutions to environmental challenges [5]. By sharing knowledge and best practices, communities can strengthen their adaptive capacity and reduce vulnerability to environmental risks.

This article aims to explore how the collaboration between Habitat for Humanity Indonesia, local government and local communities in Kampung Wangun Cileungsi can generate sustainable solutions to complex social and environmental issues. Through a community-based approach, we can create a wide-ranging positive impact, improving the quality of life and supporting global resilience in the face of planetary challenges.

2 Methodology

This research adopts a qualitative approach with a case study methodology. The case studies examined are the program providing access to clean water in Kampung Wangun Cileungsi and the Tirta Wangun Water Committee. The authors analyze the clean water supply program using a community-based approach in Kampung Wangun Cileungsi, Karang Tengah Village, Babakan Madang District, Bogor Regency. The analysis follows the seven stages of the clean water supply project guidelines developed by Habitat for Humanity Indonesia:

1. Water quality testing
2. Establishment of a local water committee
3. Issuance of a decree by the village government
4. Memorandum of Understanding (MoU) with the local government
5. Provision of water meters
6. App-based water usage monitoring
7. Reverse osmosis (RO) implementation

The data obtained were further analyzed using Wirutomo conceptual framework [6]. Wirutomo explains that the basic elements of socio-cultural life consist of structural, cultural, and processual elements [7]. These concepts can be used as analytical models in both macro and micro societal contexts.

Structural elements are typically seen as external forces acting upon individuals, and may be legally and officially institutionalized by the government or remain informal. Social structures are shaped by power relations that influence human behavior by regulating, constraining, or enabling actions, while also providing means for individuals to act.

Cultural elements refer to systems of values, norms, belief systems, customs, and traditions that exist within individuals or communities. These elements have the power to shape beliefs, thinking patterns, attitudes, and behavior. Cultural change, when it occurs, is often gradual and resistant to alteration due to its deeply embedded nature.

Processual elements pertain to the dynamic interactions within a community, which result from human reflective and interpretative abilities. These are manifested in aspirations, negotiations, and social movements, which serve as drivers of both structural and cultural change. The processual aspect flows freely from symbolic interactions—interpersonal negotiations that create social order and are relatively independent of structural or cultural constraints [7].

Maynard, as cited in Wirutomo, emphasizes that in reality, structure, culture, and processes do not exist in isolation but rather intersect, support, influence, and diffuse into one another, forming a complex system [7]. These three foundational components—structural, cultural, and processual—must be understood holistically and systemically. They should not be viewed as separate entities but as interconnected and overlapping dimensions that work in tandem (cross-cutting) to shape societal dynamics.

3 Results and Discussion

3.1 Clean Water Supply Program in Kampung Wangun, Babakan Madang District, Bogor Regency

Habitat for Humanity Indonesia is a non-governmental organization focused on providing decent housing and access to basic services, including clean water and sanitation. In an effort to achieve this vision, Habitat for Humanity Indonesia has implemented various programs aimed at improving the quality of life of communities, particularly in underserved areas. One of the primary programs is the WASH (Water, Sanitation, and Hygiene) program, which aims to enhance access to clean water, proper sanitation, and good hygiene practices.

The WASH program by Habitat for Humanity Indonesia encompasses several initiatives designed to improve community health through enhanced access to clean water and sanitation. Through this program, Habitat aims to reduce the risk of waterborne diseases and raise community awareness regarding the importance of hygiene. Previous projects under this program have included the construction of clean water infrastructure in remote villages and training for communities on proper sanitation practices.

One of the significant WASH projects is the provision of access to clean water in Kampung Wangun Cileungsi. Located in Karang Tengah Village, Babakan Madang District, Bogor Regency, Kampung Wangun Cileungsi faces serious challenges in accessing clean water. With a population of 17,129 people, approximately 910 families, or 3,640 individuals, in this village lack access to proper clean water sources. This is a critical issue, considering that clean water is a basic necessity for the health and well-being of the community.

Several factors contribute to the community's lack of access to clean water in Karang Tengah Village, including inadequate infrastructure, economic difficulties, and complex policies and regulations. Research by Triono highlights that many rural areas in Indonesia face significant barriers to accessing clean water due to these challenges [8]. Additionally, Sukaritni and Saleh along with Febriawati et al. noted that climate change has exacerbated the situation, resulting in fluctuations in water source availability [9][10].

Due to these constraints, the residents of Kampung Wangun Cileungsi have been forced to rely on alternative water sources such as rivers and rainwater, or purchase water from individuals with private pipelines. These practices are not only costly but also pose health risks due to the unreliable quality of the water. As a result, the clean water access program initiated by Habitat for Humanity Indonesia, in collaboration with local donors, is of critical importance.

The clean water supply program in Kampung Wangun Cileungsi spanned seven months, beginning in October 2023 and concluding in May 2024. The program successfully provided clean water to 152 families, benefiting approximately 760 people, and supplying seven public facilities frequently used by the community. The entire program, from planning to implementation, was completed in this seven-month period.

The water source for this project originates from Leuwi Cepet, located at an elevation of 86 meters above sea level. Utilizing this natural water source, the distribution system was designed to deliver water to residents' homes through a 2.5-kilometer-long main pipeline using a gravity-fed system. This infrastructure provides a more stable and reliable supply of clean water, a stark contrast to the alternative sources previously used by the community.

Water from the main pipeline is then distributed through a network of pipes to individual house connections. Each household is equipped with a water meter, enabling families to monitor their water usage more efficiently. This system not only aids in the sustainable management of water resources but also promotes awareness of the importance of responsible water consumption.

The active involvement of the community is one of the key criteria that makes this program particularly noteworthy. The community of Kampung Wangun Cileungsi was involved in every stage of the program, from planning to maintaining the facilities after

its completion. Previous research has demonstrated that community participation in water supply projects can enhance their sustainability and effectiveness [11][12]. Involvement at every stage fosters a strong sense of ownership and responsibility toward the resource.

Research by Dushkova and Ivlieva indicates that community empowerment can increase resilience in the face of environmental challenges [13]. By actively involving the community, the program to provide access to clean water in Kampung Wangun Cileungsi not only addresses the community's basic need for clean water, but also empowers them to protect and maintain the infrastructure that has been established. This approach aligns with the goals of sustainable development and contributes to long-lasting, positive changes.

3.2 Implementation of the Clean Water Supply Program

Water Quality Test. The clean water supply program in Kampung Wangun Cileungsi was implemented by Habitat for Humanity Indonesia through systematic steps that were oriented to the community's needs. Before initiating the program, the Habitat team coordinated with village authorities to identify areas where clean water access was inadequate. The results of this assessment indicated that Kampung Wangun Cileungsi was a priority area, with more than 70% of residents lacking access to clean water.

After identifying the priority areas, the team proceeded with observations, assessments, and surveys of the situation in Kampung Wangun Cileungsi. The results confirmed that the village qualified for assistance, in line with guidelines set by WHO/UNICEF Joint Monitoring Programme (JMP) [2]. Following this, the team conducted socialization and discussions with local officials, including those from the neighborhood unit and community unit, to ensure active community participation in the development process. Community involvement in decision-making is essential to foster a sense of ownership and collective responsibility for the project [14].

To identify the optimal water source, the team conducted surveys and discussions with village officials, the neighborhood unit and community unit leaders, and other stakeholders. The chosen water source was located in the Leuwi Cepet area, which is owned by PT Perhutani. PT Perhutani representatives verbally granted permission to use part of their land for the construction of a clean water reservoir.

The next step was to conduct laboratory tests to evaluate the quality of the water source and determine the appropriate filtration method, ensuring that the water produced would meet community needs. The water quality tests were conducted in a government-authorized laboratory, following the standards outlined in Ministry of Health Regulation No. 32 of 2017 concerning environmental health standards and water quality requirements for hygiene and sanitation purposes [15]. This systematic and community-oriented approach ensured that the clean water provided was safe and suitable for consumption by local residents.

Local Water Committee Establishment. The establishment of a local committee is one of the critical initial steps in this program. The local committee was formalized through the Articles of Association by the Village Head, under the name Tirta Wangun Water Committee. The primary objective of this committee is to involve the community at every stage of the program, from planning to maintenance. The active participation of the community in the formation and functioning of the committee is essential for ensuring the long-term sustainability and success of the project [16].

The process of selecting committee members was conducted through discussions and deliberations involving various stakeholders, including village representatives, neighborhood unit officials, community unit officials, residents, and vulnerable groups. This inclusive and representative committee structure aims to enhance the sense of ownership and responsibility toward the project. A total of 20 committee members were selected, each of whom will play an active role in ensuring the sustainability of the program. The formation of the committee is not merely a technical aspect of the program but also a form of social intervention that empowers the community.

Decree by Village Government. After the selection of the 20 committee members, the Tirta Wangun Water Committee was formally established through a decree issued by the Village Head. This authorization process serves several strategic and multifaceted purposes. The decree provides legal legitimacy to the committee, making it an official entity recognized by the village government. This recognition is essential to ensure that the committee operates with the support of local authorities, facilitating access to resources and backing necessary to fulfill its responsibilities.

Moreover, the decree serves as a structural framework outlining the duties, authorities, and responsibilities of committee members. With this official document, each member has clear guidelines regarding their role in managing water resources in the village. This structure promotes accountability and transparency in the committee's operations, enhancing community trust in the committee [17]. Additionally, the decree facilitates broader community participation in decision-making processes related to water management, thereby fostering a sense of ownership and collective responsibility for the project's success [14]. Hence, the decree not only strengthens the legal standing of the committee but also reinforces community engagement in the sustainable development process.

Following the issuance of the decree, the Habitat team conducted training sessions aimed at enhancing the committee's understanding of water resource management techniques, facility maintenance, and the use of efficient technology to ensure the distribution of clean water.

MoU with the local government. In this step, Habitat for Humanity Indonesia should collaborate with the village government and Community Health Center (Puskesmas) to draft an MoU that includes water quality control through laboratory tests every six months. According to the MoU, Habitat for Humanity Indonesia's team will continue monitoring for two years after the project is completed. This two-year period is considered to ensure the transition to community independence, especially the Tirta Wangun Water Committee, in managing the water provision program, allowing Habitat for Humanity Indonesia to move on to other areas in need of assistance.

The MoU between the community, represented by the Village Government, and the Community Health Center is expected to ensure proper water management and quality control in Kampung Wangun Cileungsi. However, as of the time this article was written, the MoU has not been realized due to overlapping policies. According to Community Health Center Babakan Madang, water source quality control is the responsibility of the village government as the territorial authority. On the other hand, the village government believes that water quality control falls under the authority of Community Health Center Babakan Madang as the provider of public health services.

This issue arises because there is no health facility at the sub-district or village level. Ideally, each village should have its own Community Health Center serving the area. However, since Karang Tengah Village does not have a Community Health Center, it must coordinate with the district-level Community Health Center, which serves a broader region. On the other hand, Community Health Center Babakan Madang feels that water quality control in Karang Tengah Village is not their responsibility, considering the already significant workload and functions of the district Community Health Center. This situation has hindered the realization of an MoU at the local government level regarding water source quality control and monitoring. In fact, cross-sector and cross-regional collaboration should be fostered for the benefit of the wider community, and the government, as the policy authority, should facilitate this effectively.

Water Meter Provision. *Community Socialization and Beneficiary Verification.* Before initiating the implementation, the Habitat team ensures that all land use permits are properly secured. Subsequently, the Habitat team engaged in consultations with the Water Committee, as well as local neighborhood and community associations, to identify the beneficiaries of the clean water program. This initial assessment identified 152 households and 7 public facilities in need of clean water access. A subsequent verification process was conducted over a seven-day period to validate the data collected. The results confirmed the necessity of assistance for 152 households and 7 public facilities, solidifying the target population for the program.

Following the verification, the Habitat team facilitated a comprehensive socialization session to communicate the objectives and technical details of the clean water development initiative [17]. During this session, the team introduced the gravity-fed water supply system, outlining its key components: the catch basin at the water source, the inlet basin for preliminary filtration, and the reservoir for storing filtered water. A gate valve was also incorporated into the design to regulate water distribution to household connections. Moreover, Habitat for Humanity Indonesia extended its support beyond household water connections by implementing bathroom drainage

systems and providing tubs as secondary water storage solutions for the beneficiaries, ensuring a more comprehensive approach to water access and management.

Construction of Clean Water Facilities. The construction of a 36.75 m³ reservoir exceeded the required capacity for 152 household connections and 7 public facilities. This work was executed by builders under the supervision of a trained head builder and a construction supervisor from Habitat for Humanity Indonesia. The local community was actively involved through a system of mutual cooperation, despite initial challenges in mobilizing participation. Continuous education efforts by the Habitat team and the Water Committee eventually succeeded in organizing the community to participate daily. As a result, the reservoir construction was completed in 3 months.

Simultaneously, the Water Committee, guided by the head builder and construction supervisor, constructed the catch and intake basins at the water source in Leuwi Cepet, owned by PT Perhutani, at an altitude of 86 meters above sea level. This elevation allows for gravity-assisted water distribution, with a source discharge of approximately 8.2 liters per second. The intake basin, with a volume of 2.25 m³, was equipped with a silica sand quick filter for water filtration.

After the completion of the reservoir, catch, and intake basins, the main and distribution pipes were installed using HDPE pipes. The head builder led the technical pipe connections, while the community assisted by burying the pipes according to The National Standardization Agency of Indonesia guideline [18]. Once the piping system was complete, household connections, including water meters and faucets, were installed, allowing for accurate water usage measurement. Additionally, connections to beneficiaries' bathrooms and public facilities were completed, with tubs provided as secondary storage units in bathrooms.

The entire construction process, lasting approximately 5 months, faced challenges in raising community awareness and participation in mutual cooperation. However, through continuous outreach and education by the Habitat team, supported by the Water Committee, head of neighborhood unit and head of the community unit, these challenges were successfully addressed.

Pipe Cleaning, Water Flow, and Hydraulic Tests. Pipe cleaning and sanitation of the clean water facilities were conducted by chlorinating the system with 5 mg/L of chlorine, in accordance with Ministry of Health Republic Indonesia Regulation Number 02 Year 2023 [19]. This process ensured the removal of dirt and sediment, making the facilities safe for use. Subsequently, water flow and hydraulic tests were carried out over a one-week period to confirm the water supply reached 152 households and 7 public facilities. Once these tests were successful, a water quality test was conducted by taking two random samples from household faucets. The lab test, performed at TUV Nord using Ministry of Health Republic Indonesia Regulation Number 02 Year 2023 as a reference, confirmed that all water quality parameters were met [19].

However, given the water source is located in an open area, the Habitat team informed residents that the water should only be used directly for bathing, washing, and toilet needs. If the water is to be consumed, it must first be boiled to 100°C to eliminate any harmful viruses, bacteria, and parasites. Boiling the water ensures it is safe for drinking, as recommended by WHO and UNICEF JMP [2].

Upon completion of the infrastructure, the Habitat team conducted training sessions to strengthen the Water Committee's capacity. Topics included budget management, financial record-keeping, and fundraising strategies for the maintenance and repair of the clean water infrastructure. These sessions aimed to equip the committee with the skills necessary to ensure the long-term sustainability of the program.

Clean and Healthy Living Behavior Training. To ensure the sustainability of the clean water supply program, the Habitat team partnered with the Babakan Madang Community Health Center to provide Clean and Healthy Living Behavior training to beneficiaries, the Water Committee, neighborhood unit officials and community unit officials. A total of 159 participants, representing beneficiary families and public facilities, attended the training. The training covered three key topics: the 10 Steps of Clean and Healthy Living Behavior training in households, handwashing with soap, and maternal and child health.

Participants also received hygiene kits to support Clean and Healthy Living Behavior practices at home. The training achieved an 87.4% success rate in improving participants' knowledge, as 139 participants showed a significant increase in their post-test scores compared to their pre-test results. Beyond imparting new knowledge, the Clean and Healthy Living Behaviors training fostered sustainable hygiene and sanitation practices in the community. Strengthening awareness of hygiene and health practices enables the community to better utilize and maintain the clean water infrastructure effectively.

Providing Shelter Kits and Cleaning Kits. The provision of shelter and cleaning kits was conducted to address the disaster vulnerability of Kampung Wangun Cileungsi. As part of disaster mitigation and preparedness efforts, Habitat for Humanity Indonesia distributed shelter kits to 152 beneficiary families. Each shelter kit contained 12 essential items, including hoes, hammers, crowbars, spades, measuring tapes, saws, 3-inch and 4-inch nails, cloth gloves, sharpening stones, flashlights with batteries, and sack bags.

In addition to the shelter kits, each family received a cleaning kit to support Clean and Healthy Living Behavior practices at home. The cleaning kit included a broom, bucket, mop, fiber cloth, rubber gloves, toilet brush, and sack bags. These tools were provided to help families maintain hygiene and cleanliness in their living environments.

Water Source Conservation through Tree Planting. The high-protection tree planting activity, which lasted for two days, was conducted in collaboration with the local community to strengthen partnerships for environmental and water resource conservation in Kampung Wangun Cileungsi. The selection of tree species aimed not only to protect water sources but also to contribute to overall water and soil conservation. According to research by Bogidarmanti et al., the selected trees help control erosion, reduce landslide risks, reinforce riverbanks, and act as barriers against soil movement, contributing to environmental stability [20].

The species planted include Clove (*Syzygium aromaticum*), Cashew (*Anacardium occidentale*), Guava (*Psidium guajava*), Rambutan (*Nephelium lappaceum*), Soursop (*Annona muricata*), Avocado (*Persea americana* Mill), Jackfruit (*Artocarpus heterophyllus* Lam.), and Aren Palm (*Arenga pinnata*). This tree planting initiative is

expected to positively impact the environment by promoting carbon sequestration. To evaluate the trees' contribution to reducing atmospheric carbon, the Indonesian National Standard (SNI) 7724:2011 on Carbon Stock Measurement and Calculation can be used [21]. The following table outlines the first-year carbon stock calculations for these species.

Table 1. Calculation of first year carbon stocks

Tree Species	Specific Gravity of Wood (gr/cm3)	Diameter (cm)	Biomass	Carbon Stocks each species (kg)	Number of trees planted	Total of Carbon Stocks each species (kg)
<i>Syzygium aromaticum</i>	0,79	9	27,49	12,92	10	129,2
<i>Anacardium occidentale</i>	1,21	10	55,49	26,08	10	260,8
<i>Psidium guajava</i>	0,75	9	26,1	12,26	10	122,6
<i>Nephelium lappaceum</i>	0,91	10	41,73	19,61	10	196,1
<i>Annona muricata</i>	0,36	12	26,62	12,51	10	125,1
<i>Persea Americana</i> Mill	0,5	0,5	22,93	10,78	15	161,7
<i>Artocarpus heterophyllus</i> Lam.	0,61	0,61	27,97	13,15	10	131,5
<i>Arenga pinnata</i> (Wurmb.) Merr.	0,85	0,85	889,85	418,23	11	4600,53
Total of trees planted					86	
Total carbon reserves of 86 trees in the first year						5727,53

Based on the table, the projected carbon stock absorbed by the 86 trees planted around the water source in Kampung Wangun Cileungsi is estimated at 5.727,5 kg in the first year. This tree planting initiative not only aims to protect water resources but also enhances the system's resilience to environmental challenges. By stabilizing the climate, providing food and shelter for wildlife, and improving air quality through photosynthesis, tree planting contributes to broader environmental sustainability efforts [22].

Apps-based water usage monitoring. An app-based system would ideally monitor water usage in each household served by this project, allowing real-time tracking of water availability, accessibility, and consumption. The app would also generate periodic utilization reports, aiding in effective water management. However, in Wangun Village, this technology was not implemented, as most water committee members lacked the necessary skills to use the app.

Instead, the Habitat team provided training on budget management, financial recording, and fundraising strategies to support the maintenance and repair of the clean water infrastructure. After the program's completion, the Habitat team has continued to offer monitoring and assistance when needed, ensuring the program's ongoing success and sustainability.

Reverse osmosis (RO). In the Wangun Village clean water supply program, the Water Committee has not yet implemented a Reverse Osmosis (RO) system. To generate income and fund infrastructure maintenance, the committee has adopted a strategy of selling water to vendors in the nearby tourist area at a higher rate than that charged to the local community. This approach not only boosts revenue but also helps cover the operational and maintenance costs of the infrastructure, ensuring the continued provision of high-quality clean water services.

3.3 Impact of the Clean Water Access Project on SDG Targets

SDG 3 – Good Health and Well-Being: The provision of clean water in Kampung Wangun Cileungsi has had a significant positive impact on community health. Access to clean and safe water drastically reduces the risk of waterborne diseases such as diarrhea, cholera, and skin infections. Additionally, improved public health positively influences work productivity, which in turn enhances the economic welfare of the residents in Kampung Wangun Cileungsi.

SDG 6 – Clean Water and Sanitation: The clean water infrastructure project in Kampung Wangun Cileungsi directly supports the achievement of Sustainable Development Goal 6. By providing effective water supply infrastructure, the project has facilitated better hygiene practices within the community. This reduces the risk of water contamination and significantly improves the overall quality of life for the residents.

SDG 1 – No Poverty: Access to clean water offers considerable benefits to low-income communities in Kampung Wangun Cileungsi. The project eliminates the need for families to purchase expensive commercial water, allowing them to allocate their financial resources towards other essential needs, such as education, nutritious food, and healthcare. In this way, the clean water project contributes to reducing the financial burden on low-income households and supports poverty alleviation efforts.

SDG 5 – Gender Equality: The clean water infrastructure in Kampung Wangun Cileungsi also contributes to gender equality by reducing the time and physical burden typically borne by women and girls who often travel long distances to fetch water. With closer access to water, women and girls can devote more time to educational pursuits, income-generating activities, and other productive efforts. This shift not only enhances

their well-being but also promotes their empowerment and greater participation in socio-economic activities.

SDG 11 – Sustainable Cities and Communities: The clean water project enhances the quality and sustainability of basic infrastructure in Kampung Wangun Cileungsi, contributing to the development of sustainable communities. Access to clean water supports healthier living conditions, reduces the risk of health-related crises, and strengthens community resilience in the face of environmental challenges. Furthermore, the improvement of infrastructure may attract additional investment, thus fostering local economic growth.

SDG 13 – Climate Action: The implementation of efficient water supply systems can contribute to reducing greenhouse gas emissions by minimizing the energy required for water pumping, treatment, and distribution. Additionally, the use of environmentally friendly technologies in water management supports local efforts to mitigate the impacts of climate change and enhances community resilience to environmental fluctuations.

SDG 15 – Life on Land: Planting trees around water sources and catchment areas plays a crucial role in improving soil structure and increasing water retention capacity. Vegetation helps to filter pollutants and prevent soil erosion, which in turn safeguards the quality of water sources. This approach not only sustains local ecosystems but also contributes to biodiversity conservation efforts.

3.4 Structure, Culture, Process Analysis

Structure. Structure is an element that exerts a coercive force and is institutionalized, either legally or officially, by the government or other formal entities. According to Kasri and Wirutomo, the structure of water and sanitation access in rural areas is shaped by the natural environment (topography), governance of programs, budget allocations, and social stratification [23].

In the context of the clean water access project implemented by Habitat for Humanity Indonesia, the social structure includes the relationships between the government, non-governmental organizations (NGOs), local communities, and the physical infrastructure for water provision. Access to clean water in Indonesia is regulated by the Presidential Regulation of the Republic of Indonesia No. 37 of 2023, while environmental health quality standards related to water are further stipulated in Ministry of Health Republic Indonesia Regulation No. 2 of 2023. According to this regulation, water quality monitoring is conducted through surveillance, laboratory tests, risk analysis, and follow-up recommendations [19][24]. The monitoring process involves both internal and external assessments. The regulation also promotes intersectoral collaboration through the integration of health and water resources policies. Moreover, the Government of Indonesia has outlined a plan to secure climate-resilient water resources.

However, these regulations are challenging to implement at the community level. Furthermore, the regulations are absolute, without provisions for particular local circumstances. Currently, there are no established standards in Indonesia for managing clean water at the household level. Therefore, in the clean water supply program in Wangun Village, the Habitat team followed standards and guidelines set by the World Health Organization (WHO). According to the WHO guidelines for drinking water

quality, responses to microbial contamination—such as chlorination, boiling, or other methods—depend on local practices, with boiling being the most common method in the community [25]. Given that the WHO guidelines highlight boiling as an effective household-level measure to eliminate microbial contamination, the project incorporates hygiene education that recommends boiling water before drinking to remove pathogens or fecal indicator organisms. Additionally, the Habitat team trained water committees to clean water reservoirs and pipes with chlorine at least once a month.

Culture. Culture encompasses any system of values, norms, beliefs, and customs that have been internalized by individuals or communities, and that exert a “power” to shape the behavior and attitudes of community members from within [7]. The culture of the local community plays a crucial role in the success of the clean water access program in Kampung Wangun Cileungsi, particularly in relation to perceptions, respect for community leaders, and social behaviors.

As stated by Wirutomo, changes in cultural elements take a relatively long time to internalize [7]. Before the implementation of the clean water access program in Kampung Wangun Cileungsi, the local community did not treat water before consumption. Water from rivers and other natural sources was directly utilized for daily needs, including cooking and drinking. This practice was based on the belief that their water sources were well-maintained and free from contamination. However, laboratory tests conducted by the Habitat for Humanity Indonesia team indicated that the water being used by the community was not classified as drinking water and required further treatment to be safe for consumption. This long-standing belief could have serious implications for public health if left unaddressed. Previous studies have highlighted that trust in the safety of natural resources can hinder the adoption of healthier practices [26].

Following the Clean and Healthy Lifestyle training conducted by Habitat for Humanity Indonesia in collaboration with the Babakan Madang Community Health Center, the residents of Kampung Wangun Cileungsi gradually began to adopt new practices aligned with clean and healthy living. This demonstrates that educational interventions can accelerate the internalization of new values within a community.

Process. Wirutomo explains in his book that processual elements are dynamic, emerging from interactions between individuals, and serve as a means for negotiating interpersonal or group order that is relatively free from structural and cultural constraints [7]. In the project to provide access to clean water in Kampung Wangun Cileungsi, the social process is evident in the interactions and dynamics between the community and stakeholders involved in the project. Through dialogue and negotiation with relevant parties, the community was able to express their needs and actively contribute to finding solutions [27].

The social process in this project also reflects community empowerment efforts. The community was not only involved in the planning phase but also took an active role in maintaining the clean water infrastructure after the project was completed. Research by Rouse et al. demonstrates that when communities are actively involved, the sustainability of projects improves, as they are motivated to care for and maintain the resources that have been developed [11].

The dynamic social process can lead to long-lasting positive change within the context of sustainable development. By involving the community in decision-making and maintenance, this project not only addresses the basic need for clean water but also raises awareness about the importance of sanitation and health. Studies by O'Reilly et al. indicate that programs incorporating education on sanitation can result in significant long-term behavioral changes [12]. Furthermore, the empowerment of communities to maintain the clean water infrastructure illustrates how social processes can foster positive change within the framework of sustainable development.

Structure-Culture-Process Intersection. Cultured Structure (CS) refers to a structure in which certain components are successfully internalized by the community and become an integral part of its culture. In the project to provide access to clean water in Kampung Wangun Cileungsi, one manifestation of this cultured structure is the implementation of regulations regarding water usage tariffs for each household connection. Previously, the community accessed water without any associated costs; however, with the new system, residents are required to pay tariffs based on their water consumption. This new regulation has been accepted by the community, and the rules are followed without resistance, demonstrating how the structural component has been internalized and has become part of the community's way of life.

Structured Culture (SC) refers to a culture that has been formalized and organized within a community. In the context of Kampung Wangun Cileungsi, the local residents have long practiced the tradition of helping others through shared contributions, where the amount given is voluntary and based on the individual's ability and willingness to assist neighbors in need. This cultural practice was adapted into the water supply project and institutionalized through a formal customer code of conduct agreement. In this agreement, users are required to pay a monthly abodement fee, which serves as both a form of collective responsibility and a cross-subsidy within the water usage tariff system. This fee is mandatory, regardless of the customer's water consumption, reflecting the structured nature of this cultural adaptation.

Cultured Process (CP) refers to a social process that has been internalized within the community, leading to the development of new cultural practices. In the water supply project in Kampung Wangun Cileungsi, the residents, who were actively involved in every stage of the project, created spaces for dialogue and negotiation. This ongoing interaction fostered the development of a new culture that is more responsive to health and sanitation issues. This shift is evident in how the residents of Kampung Wangun Cileungsi began to adopt clean and healthy living practices in their daily routines after participating in the Clean and Healthy Living Behavior training. The integration of these practices illustrates how the social process has evolved into a new cultural norm within the community.

Processed Structure (PS) refers to a condition in which structural elements are reconsidered and adapted through community dialogue and negotiation. In the case of the clean water program in Kampung Wangun Cileungsi, the community initially protested against the ratification of customer discipline rules and the proposed water usage fees. The residents provided feedback to the Tirta Wangun Water Committee, requesting an adjustment to the water tariff rates. This process illustrates how the community engaged in dialogue to renegotiate and revise the existing structural elements (rules) governing the water supply system. Such interactions demonstrate the

community's active role in reprocessing and shaping the structure to better fit their needs and preferences.

The residents of Kampung Wangun Cileungsi are accustomed to using water sources without prior treatment, making it necessary to educate them about the importance of water treatment for consumption. Ideally, water treatment policies should be regulated by government laws. However, in practice, these policies and regulations—being structural elements—face challenges in their implementation within the community. The water treatment standards set by the government include various parameters that cannot be met with simple treatment methods. Therefore, policy adaptation is needed to ensure the sustainability of the clean water provision program for the residents of Kampung Wangun Cileungsi.

Habitat for Humanity Indonesia has adopted a water treatment approach for consumption based on WHO standards. Referring to the Guidelines for Drinking Water Quality, these WHO guidelines provide detailed solutions for household-scale clean water and drinking water treatment. The establishment of a water committee to manage the sustainability of the program after handover demonstrates the role of the process element. This process involves adapting government policies to the realities on the ground and implementing WHO standards that are more practical at the community level. The management process also involves the community through the water committee, ensuring that after the program is completed, the community can independently maintain the provision of clean water.

The intersection of these three elements creates a complex dynamic. When policies (structure) do not align with local culture and resources, innovative adaptation processes are required to achieve sustainability. The formation of the water committee by Habitat for Humanity Indonesia serves as a concrete example of how the process element can bridge the gap between structure and culture, enabling the clean water provision program to function and be sustainable in Kampung Wangun Cileungsi.

4 Conclusion

This study shows that the clean water access provision project in Kampung Wangun Cileungsi has a significant impact on public health and quality of life through community involvement in the planning, implementation and maintenance of water infrastructure. This participation not only creates a sense of collective ownership and responsibility, but also contributes to the protection of aquatic ecosystems and the reduction of carbon footprint through more efficient local technologies. Nonetheless, the challenges faced in implementing the program point to the need for a more integrated strategy that is sensitive to the local context. The project not only meets the basic need for clean water, but also strengthens environmental health and supports ecosystem balance, marking an important step towards a more sustainable and resilient future.

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