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Empowering Local Institutions for Clean Water Management and Fire Risk Reduction in Kampung Adat Kuta, Ciamis

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Abstract

This study aims to strengthen clean water governance and fire risk reduction in Kampung Adat Kuta, Ciamis Regency, West Java, through a community-based empowerment approach. Using a participatory Community Partnership Program (PKM), the methods included community socialization and problem mapping, technical training for 20 residents, installation of a simple hydrant and clean water distribution network using HDPE pipes, and institutional strengthening through the establishment of a Community Water Management Group (KPA) and Standard Operating Procedures (SOPs). The results show increased technical capacity and awareness among residents, the formation of a functional local water management institution, and the availability of infrastructure supporting both daily water needs and fire emergency response. The program demonstrates that integrating local wisdom with appropriate technology effectively enhances community resilience. In conclusion, the Kampung Adat Kuta experience offers a replicable model of community-based water governance that supports heritage preservation, disaster risk reduction, and sustainable tourism development.

Keywords: community empowerment, clean water management, fire mitigation, tourism village, Kampung Adat Kuta.

INTRODUCTION

Kampung Adat Kuta is a traditional Sundanese community located in Ciamis Regency, West Java, Indonesia. The village is well-known for preserving its cultural and ecological values, particularly through customary laws (pikukuh adat) that prohibit modern construction materials and deforestation in the surrounding protected forest area (Pemerintah Kabupaten Ciamis, 2023). Despite the abundance of natural clean water sources originating from nearby springs, the community faces challenges in developing a structured water distribution system and lacks adequate fire protection facilities.

The settlement is dominated by traditional wooden houses (rumah panggung), which are highly susceptible to fire hazards especially during the dry season when water accessibility is limited (Badan Penanggulangan Bencana Daerah Ciamis, 2022). The absence of an organized water management system also hinders disaster preparedness and compromises environmental sustainability. These conditions threaten not only the residents' safety but also the preservation of local heritage and the sustainability of cultural tourism activities that have been gradually developing in the area (Putra et al., 2021).

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As Kampung Adat Kuta continues to gain recognition as a potential cultural tourism destination, integrating environmental resilience with community-based water management becomes essential. Sustainable tourism in traditional villages depends on the synergy between resource governance, disaster risk reduction, and local participation (UNWTO, 2020). Therefore, the Community Partnership Program (PKM) was designed to empower local communities to manage clean water resources effectively and to establish a simple, community-based fire protection infrastructure that aligns with local traditions and capacities.

The objectives of this study: (1) To establish a community-based clean water management institution that ensures equitable distribution and sustainability. (2) To develop a simple fire protection system utilizing local water sources and appropriate technology and (3) To strengthen the technical capacity and disaster preparedness of the community through participatory training and institutional empowerment.

This study contributes to the theoretical development of community-based natural resource management (CBNRM) and community-based disaster risk reduction (CBDRR) by offering an integrated and operational model that combines local institutional empowerment, participatory governance, and appropriate technology in a traditional village context. Prior studies have extensively discussed community participation in water management (Harvey & Reed, 2021) and local-level disaster resilience (Paton & Johnston, 2017; Shaw et al., 2020), yet empirical evidence that systematically links clean water governance with fire risk reduction in culturally regulated settlements remains limited. This research extends the CBNRM framework (Meinzen-Dick et al., 2022) by demonstrating how customary norms and local wisdom can be institutionalized through formal mechanisms such as community management groups and Standard Operating Procedures (SOPs). Furthermore, the study advances the CBDRR discourse by showing how everyday infrastructure, clean water systems can be strategically repurposed as disaster mitigation assets, aligning with the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015). In doing so, this research enriches sustainability theory by positioning local institutions as adaptive governance mechanisms that bridge environmental management, disaster resilience, and cultural preservation.

From a practical perspective, this study provides a replicable and low-cost implementation model for enhancing clean water access and fire preparedness in traditional and rural communities. The use of appropriate technology such as HDPE-based water distribution networks and simple community hydrant systems reflects principles of sustainable rural infrastructure development (Schumacher, 2021; Ministry of Public Works and Housing, 2022). The participatory training of local residents and the establishment of a Community Water Management Group (KPA) offer practical guidance for ensuring long-term system functionality and community ownership, which are widely recognized as critical success factors in rural water supply programs (Harvey & Reed, 2021; UNDP, 2021). Additionally, by strengthening environmental safety and disaster readiness, the program supports the sustainability of cultural tourism destinations, consistent with UNWTO's framework on sustainable rural tourism development (UNWTO, 2020). Therefore, this study serves as a practical reference for policymakers, local governments, and development practitioners seeking to integrate heritage conservation, environmental sustainability, and disaster risk reduction within community-driven development initiatives.

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METHOD

The implementation of the Community Partnership Program (PKM) in Kampung Adat Kuta was designed using a participatory and community-based empowerment approach, emphasizing inclusiveness and sustainability. According to Chambers (2017), community empowerment must begin with participatory problem identification and local capacity development to ensure long-term behavioral change. The PKM followed five key stages, as outlined below:

1. Socialization and Problem Mapping

This initial stage aimed to engage community members and traditional leaders in identifying key issues related to clean water availability, access, and fire vulnerability. Participatory rural appraisal (PRA) techniques were used to map local water sources, distribution points, and risk-prone areas (Sulaiman et al., 2021). The approach ensured that interventions were contextually relevant and aligned with community needs.

2. Technical Training and Capacity Building

Twenty selected residents received training on clean water distribution management, maintenance of hydrant systems, and basic fire response procedures. The training emphasized practical skills and the application of appropriate technology, such as high-density polyethylene (HDPE) pipes for low-cost and sustainable infrastructure (Ministry of Public Works and Housing, 2022).

3. Installation of Clean Water Infrastructure

The project installed one hydrant fire box unit, one 2-inch galvanic pole, and HDPE pipes with diameters ranging from 1 to 2 inches across approximately 300 meters of distribution network. This infrastructure aimed to ensure adequate water access for daily needs and emergency use during fire incidents.

4. Institutional Development and SOP Formulation

To maintain sustainability, a Community Water Management Group (KPA) was formally established through participatory meetings. The KPA, guided by local adat norms, developed Standard Operating Procedures (SOPs) for water distribution, usage priorities, and maintenance schedules (Nurjanah & Setyowati, 2020).

5. Evaluation and Reporting

The evaluation phase assessed the functionality of the infrastructure, the effectiveness of community training, and the level of participation. The team used qualitative feedback and observation methods to identify lessons learned and strategies for replication in other traditional villages (Sugiyono, 2023).

This five-step implementation framework aligns with sustainable rural infrastructure development principles, combining technical, social, and institutional strengthening (UNDP, 2021).

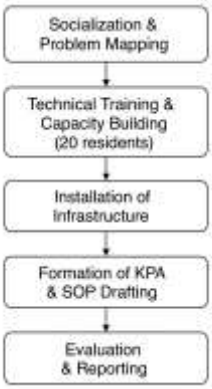

Figure 1. Flowchart Methodology

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RESULT AND DISCUSSION

Establishing a Community-Based Clean Water Management Institution

The empowerment initiative successfully led to the formation of a Community Water Management Group (KPA), which now oversees the operation and maintenance of a shared clean water system in Kampung Adat Kuta. This institution was organized through participatory meetings involving community leaders, women's groups, and youth representatives, ensuring equitable participation in decision-making. The establishment of such a group reflects the principles of community-based natural resource management (CBNRM), where local institutions play a key role in maintaining the sustainability and social equity of water resources (Meinzen-Dick et al., 2022). By entrusting management responsibilities to community members, the initiative fosters a sense of ownership and accountability, which are critical for the long-term sustainability of rural water systems (Harvey & Reed, 2021).

Moreover, the governance model aligns with the Integrated Water Resource Management (IWRM) framework promoted by the UN, emphasizing local participation, equitable access, and resource sustainability (UN-Water, 2023). The KPA has demonstrated improved coordination in water distribution and a commitment to routine maintenance, reducing conflicts related to water access and ensuring reliability during dry seasons.

Development of a Simple Fire Protection System

The project also resulted in the installation of one community hydrant, designed as a low-cost fire protection system using existing gravity-fed water sources. The system employs appropriate technology, locally available materials such as PVC pipes and manual valves to ensure easy maintenance and repair by residents themselves. This approach embodies the concept of appropriate technology for community resilience, emphasizing simplicity, affordability, and local adaptability (Schumacher, 2021; Chambers, 2014). Communities in rural and traditional areas often face high vulnerability to fire hazards due to clustered wooden houses and limited firefighting infrastructure. Therefore, developing a context-specific, community-operated hydrant system significantly enhances preparedness and rapid response capacity (UNDRR, 2022).

In addition, the system's design process was participatory, involving local artisans and volunteers, which enhanced the technical skills and collective sense of responsibility among residents. Such collaborative engineering efforts strengthen both technical resilience and social cohesion, two essential components of community-based disaster risk reduction (CBDRR) (Paton & Johnston, 2017).

Strengthening Technical Capacity and Disaster Preparedness

The program also focused on capacity building through participatory training, attended by 20 residents. The training modules covered clean water management, hydrant operation, and emergency response protocols. The learning approach emphasized hands-on practice, peer learning, and simulation-based exercises, which are recognized as effective strategies in adult and community education (Knowles et al., 2020).

Post-training evaluations revealed a notable increase in participants' technical knowledge and confidence in managing both water and fire protection systems. Furthermore, the KPA has institutionalized routine disaster preparedness meetings, ensuring that skills are continuously updated and integrated into community governance practices. These outcomes confirm findings by Shaw et al. (2020), who emphasized that local institutional empowerment coupled with technical training significantly improves community readiness and adaptive

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capacity to disasters. The participatory nature of the training also supports the notion that community empowerment is most sustainable when it integrates cultural values and local wisdom, as evident in Kampung Adat Kuta, where collective action and gotong royong remain core social principles (Surya & Suryanto, 2022).

Collectively, these results demonstrate that the integration of institutional development, appropriate technology, and participatory capacity-building effectively enhances community resilience. The initiative not only improved access to clean water but also built a self-sustaining institutional and technical framework for disaster preparedness.

The findings are consistent with the Sendai Framework for Disaster Risk Reduction (2015–2030), which underscores the importance of local-level empowerment and community-driven risk management systems (UNDRR, 2015). Furthermore, the project illustrates how empowerment-based approaches can simultaneously address socio-environmental equity and disaster resilience, contributing to Sustainable Development Goals (SDG 6 – Clean Water and Sanitation, and SDG 11 – Sustainable Cities and Communities).

The empowerment program in Kampung Adat Kuta produced tangible and measurable outcomes across social, technical, and institutional dimensions. The establishment of the Community Water Management Group (KPA) represents a major achievement, as it institutionalized the community's participation in managing water resources. The group's creation aligns with findings by Nurjanah and Setyowati (2020), who emphasized that local institutions play a vital role in ensuring the sustainability of rural infrastructure projects. Through the KPA, residents were empowered to make collective decisions regarding water distribution, maintenance schedules, and emergency responses.

From a technical perspective, the installation of one community hydrant unit, a galvanized support pole, and approximately 300 meters of HDPE piping significantly enhanced the local clean water network. This infrastructure not only improves daily access to clean water but also provides a crucial source for fire suppression addressing one of the most pressing safety risks in this wooden-house settlement. Training activities involving 20 local residents further contributed to improving the community's technical capacity and sense of ownership. According to the Ministry of Public Works and Housing (2022), such participatory training is a critical determinant of long-term system functionality in community-based water management.

Beyond infrastructure, the project fostered stronger social capital through collaboration, mutual trust, and gotong royong (mutual aid) a deeply rooted cultural value in Indonesian communities (Koentjaraningrat, 2015). The integration of technical empowerment with cultural values has strengthened community resilience and self-reliance, creating a replicable model for sustainable water governance in other traditional villages.

The program generated multiple impacts: (a) Social increased participation and awareness in environmental resource management; (b) Technical availability of clean water infrastructure and simple fire protection system; (c) Economic support for eco-tourism and sustainable livelihood; (d) Institutional formation of a locally managed and sustainable organization.

CONCLUSION

The clean water management empowerment program implemented in Kampung Adat Kuta has proven effective in strengthening the community's capacity for environmental resource management and disaster preparedness. By combining technical interventions with social and institutional development, the initiative addressed not only the physical aspect of water availability but also the social dynamics of collective action and governance. The establishment of the Community Water Management Group (KPA) and the creation of

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operational guidelines (SOPs) illustrate a successful shift toward community-led governance, where residents take ownership of water distribution, infrastructure maintenance, and emergency response.

This empowerment model underscores the importance of integrating appropriate technology with local knowledge systems. The use of simple, low-cost infrastructure such as HDPE piping and hydrant units demonstrates how technological solutions can be effectively adapted to local capacities and contexts. Moreover, aligning the project with cultural values such as gotong royong (mutual aid) ensures community cohesion and long-term sustainability—echoing the findings of Koentjaraningrat (2015) and Chambers (2017) that culturally grounded participation strengthens resilience.

In a broader sense, this initiative contributes to the discourse on sustainable rural tourism development, as access to clean water and disaster readiness are fundamental to maintaining both community well-being and visitor safety. The Kampung Adat Kuta experience offers a replicable model for other traditional villages in Indonesia and beyond, demonstrating how grassroots empowerment, appropriate technology, and local wisdom can synergize to achieve sustainable development goals (UNDP, 2021).

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