KERIGAN
Jurnal Pengabdian Masyarakat
Volume 2, Nomor 2, Juni 2024, Halaman 71-78
DOI: https://doi.org/10.21274/kjpm.2024.2.2.71-78

Community Empowerment through Biopore Technology: An Asset-Based Approach in Pucanganak Village

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Volume
2
Issue
2
Page
71-78
Year
2024

Keyword

Biopore;
Environmental conservation;
Community Empowerment;

How to cite

Pratama, R., & Q.A, S. (2024). Community Empowerment through Biopore Technology: An Asset-Based Approach in Pucanganak Village. *Kerigan: Jurnal Pengabdian Masyarakat, 2(2), 71-78.* https://doi.org/10.21274/kjpm.2024.2.2.71-78

Abstract

Purpose: The Community Service Program (KKN) in Pucanganak Village, Tugu District, Trenggalek Regency, aims to enhance community participation in creating an environmentally friendly village through the application of biopore infiltration technology. The main issue identified was the lack of technical knowledge among residents regarding the installation and maintenance of biopores, which hindered their optimal function in preserving groundwater reserves and reducing waterlogging.

Method: This program adopted the Asset-Based Community Development (ABCD) method, which emphasizes the utilization and enhancement of existing community assets, potentials, and strengths. The core principle of ABCD is to view the community from the perspective of its assets rather than its deficiencies. Through asset mapping, identification, and empowerment, communities are encouraged to become the main actors in development. The Pucanganak community's assets included awareness of environmental conservation, local government support, and willingness to participate in sustainable practices.

Practical Applications: The implementation of biopore socialization and installation activities in Dusun Krajan, Pucanganak Village, demonstrated that the community possesses valuable assets and potential in environmental preservation.

Conclusion: Despite initial challenges due to lack of technical knowledge, the approach used successfully maximized local strengths through awareness building, knowledge transfer, and government support. The program not only improved technical understanding of biopore construction but also fostered collaboration between residents and authorities, establishing a replicable model for sustainable environmental conservation.

Introduction

River water pollution is a major unresolved problem in Indonesia. Yet, river water is a vital source of drinking water for the community. Therefore, the government has made clean water a key program for environmental protection, in line with the international agreement known as the Sustainable Development Goals (SDGs). Rapid population and industrial growth have impacted the percentage of clean water access that is limited to 73% of Indonesians (Basuki et al., 2024).

In Indonesia, clean water problems are not limited to large cities due to industrial impacts, but also to pollution from rivers flowing through rice fields surrounding residential areas. Silt deposits and metals seep into the soil and contaminate groundwater sources. In Indonesia, water quality declines annually due to domestic wastewater. To mitigate environmental degradation caused by domestic wastewater, it is necessary to educate the public and relevant parties about the importance of domestic wastewater management. This effort includes publicizing domestic wastewater distribution patterns within a region and the impact of this distribution on its control and management (Bekti et al., 2018).

Besides domestic factors, the cause of dirty water in rivers and wells in a number of areas in Indonesia is the seepage of polluted river water into shallow wells, allegedly due to the position of houses close to rivers and rice fields, as well as geographical conditions that make it easier for river water to mix with shallow groundwater. Well water becomes cloudy, oily, and smells of rust, although the main cause is not industrial waste, but rather from contaminated river water irrigating rice fields, as reported by local residents and officials.

Geographical conditions occur in the lower regions of the southern coastal mountains, such as in Pacitan, Trenggalek, and Tulungagung districts. Several areas have experienced dirty water conditions for years, such as in Tugu sub-district, Trenggalek district. Several efforts have been made to overcome this problem, one of which is the construction of deep drilled wells as a long-term solution. Biopore technology has been scientifically proven to be an effective solution to urban drainage problems.

One alternative technology that can be used is the use of Biopore Infiltration Holes (BIP). This alternative technique can be built anywhere, even in densely populated areas with limited rainwater infiltration areas, making it more accessible and cost-effective for flood control efforts (Arrosyidah et al., 2024). One of the villages

in the Tugu sub-district, Pucanganak, has an environmental conservation program using biopore holes, located in only a few local areas. However, many Pucanganak residents still lack the proper installation and use of biopore holes, resulting in their ineffectiveness.

One of the environmental problems still faced by the community in Pucanganak village is the lack of knowledge regarding the correct planting of biopores, which can result in waterlogging, flooding, and reduced availability of groundwater even though biopore holes have been planted. As a form of student contribution to addressing these environmental issues, the Community Service Program (KKN) is expected to become a platform for community empowerment through an educational and applied approach. One solution implemented in this KKN program is to socialize the proper planting of biopores in residential areas. Biopores are a simple technology in the form of infiltration holes that function to increase soil absorption of water, reduce flooding, and utilize organic waste as natural compost (Sarmudin et al., 2023). Biopore planting activities are not only oriented towards environmental improvement, but also aim to increase public awareness of the importance of environmental conservation and organic waste management (Dharmayanti et al., 2024). Furthermore, through outreach and training activities conducted with residents, it is hoped that biopores can become a long-term solution that is easy to implement and independently maintained by the community (Mulyawati, 2021). This journal will discuss in detail the implementation of the biopore planting program carried out during the KKN activities, starting from the planning stage, outreach, implementation, and evaluation. It is hoped that this activity can serve as an example of good practice that can be replicated in other areas with similar problems.

Method

This program adopted the *Asset-Based Community Development* (ABCD) method, which emphasizes the utilization and enhancement of existing community assets, potentials, and strengths. The core principle of ABCD is to view the community from the perspective of its assets rather than its deficiencies. Through asset mapping, identification, and empowerment, communities are encouraged to become the main actors in development. The Pucanganak community's assets included awareness of environmental conservation, local government support, and willingness to participate

in sustainable practices (Riyanti & Raharjo, 2021). his research was conducted using the ABCD approach which is a model approach in community development. This development focuses on an inventory of assets in the community that are seen as supporting community empowerment activities (Agustina, 2024). The ABCD method is a community empowerment method that focuses on developing and utilizing existing assets, potential, and strengths within the community itself. This method emphasizes that every community possesses valuable resources in the form of skills, experience, knowledge, and social networks that can be optimized to improve their quality of life independently and sustainably (Tan et al., 2017).

After conducting interviews with informants through purposive sampling techniques and in-depth observations by looking at the potential of Pucanganak village, it was found that All the potential that Pucanganak village has, starting from the potential of rice fields, human resources, forest potential, MSME potential, and good environmental potential. Researchers observed that Pucanganak village has an environmental conservation program through biopores located only in several local areas.

Result and Discussion

Puncak Anak Village, Tugu District, Trenggalek Regency, has numerous community assets. These include awareness of the importance of preserving groundwater and composting, knowledge of biopore technology, although still limited, a willingness to take action, including installing five biopore points, and, most importantly, supporting the village government's commitment to air conservation and composting. This willingness to move forward is also a key asset of this village. For example, before the program's mentoring program, residents had already independently installed five biopore points. Although the number was small and the installation did not meet technical standards, this initiative demonstrated that the community was not simply waiting for external assistance. They were willing to contribute, both in terms of effort and time, to protect the environment. This is in accordance with what was stated by the region that the conditions experienced by the community will encourage coordination between local residents to form community initiatives to provide water, electricity and basic services independently, without relying on the state (Elayah et al., 2024). The biopores, already an asset in Puncakanak Village, have not been optimally utilized, with many residents still lacking

understanding. According to Nugroho, the effectiveness of biopores is highly dependent on technical specifications (diameter, depth, distance, number of holes) and soil conditions; many field practices are "less than optimal" because they do not follow technical parameters (Nugroho & Hadi, 2019).

Previous mistakes included inappropriate placement, inappropriate composition, improper holes in the PVC pipes, insufficiently deep holes, and inability to open biopore hole covers. This is in accordance with the lyons theory about namely analyzing various cases of urban settlement and environmental programs and concluding that the level of community participation and empowerment is closely related to the sustainability of the program; projects that are only top-down tend to be unsustainable (Lyons et al., 2001).

The program prioritized environmental conservation activities in Pucanganak village, where residents had previously attempted to install biopores independently but with technical shortcomings. Using the ABCD method, the team reinforced awareness, strengthened community participation, and provided technical knowledge through expert-led workshops. On July 26, 2024, a socialization session was held with Mr. Rizky Arief Shobirin, S.Si., M.Si., who explained the purpose, placement, and technical procedures for biopore construction. Following the workshop, practical installations were carried out in several households.

This socialization discussed many things starting from the purpose of biopores, the right location for biopore holes to the steps for installing biopores. He also discussed in detail the ideal location for making biopores, such as in areas that are often exposed to rainwater, near trees or parks, and do not interfere with pedestrian paths. The technical steps for making them were also conveyed in a sequential manner, starting from digging the holes, installing the pre-perforated PVC pipes, to closing them with special lids that can be easily opened and closed. Residents were also enthusiastic in following and asking questions to the presenters. So enthusiastic were they that many residents asked questions after the material was delivered, such as "How long does it take for organic waste in the biopores to become compost?", "Can this hole be made near a well?", and "What if the soil is rocky?"

Mr. Rizky patiently answered all questions, while providing practical tips for long-lasting and optimally functioning biopores. Following the presentation, the biopore installation proceeded at a resident's home, Mr. Dasar. Residents were guided step by step, from digging holes to inserting perforated pipes and filling them with organic waste mixed with EM-4 to accelerate composting. By July 28, biopores were installed in multiple households, each with two holes. The community showed

enthusiasm, actively asking questions and engaging in hands-on practice. The installed biopores functioned not only as water infiltration structures but also as organic compost producers, providing both environmental and economic benefits. This collaboration between residents, local government, and experts demonstrated an effective model for sustainable environmental management.

An equally important aspect of this program is increasing public environmental awareness. Interviews showed that almost all community members expressed a better understanding of the importance of environmental protection after participating in the biopore program. This increased awareness is not limited to understanding biopore technology, but also extends to other environmentally friendly practices such as waste sorting, reducing plastic use, and making household compost.

This change in community behavior supports Hamilton's findings, which state that an effective community empowerment model can create long-term behavioral changes in environmental management. The biopore program not only provides technical solutions but also builds community capacity to manage the environment independently and sustainably (Hamilton et al., 2022).

Conclusion

The implementation of biopore socialization and installation activities in Pucanganak Village, demonstrated that the community possesses valuable assets and potential in environmental preservation. Despite initial challenges due to lack of technical knowledge, the Asset-Based Community Development (ABCD) approach successfully maximized local strengths through awareness building, knowledge transfer, and government support. The program not only improved technical understanding of biopore construction but also fostered collaboration between residents and authorities, establishing a replicable model for sustainable environmental conservation.

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