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Optimizing Tempe Waste for Environmentally Friendly Liquid Organic Fertilizer (POC) in Padaringan Village

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Abstract

Background: Community empowerment is essential for increasing public participation in addressing social issues and fulfilling life needs. It is often implemented through community service-based programs such as Kuliah Kerja Nyata (KKN), which encourages students to engage with and empathize with local communities. The KKN program of the Institut Miftahul Huda Al-Azhar Group 3 (2024) was conducted in Padaringan Village, Purwadadi Subdistrict, Ciamis Regency. The program utilized methods like outreach, education, and group mentoring to target various aspects of community improvement.

Methods: The KKN activities were centered around five core areas: Religious Affairs, Education, Socio-Cultural Development, Health, and Economics & Entrepreneurship. Interventions were tailored to address the village's specific needs, fostering active participation among local residents.

Results: The community's response was overwhelmingly positive, with active participation in various programs. One key event was a seminar on Fiqh for Women held at SMPN 2 Purwadadi, aimed at increasing the students' understanding of Islamic teachings.

Discussion: The success of the program can be attributed to community involvement, which enhanced social cohesion and the overall sense of belonging. The diversity of activities ensured a holistic approach to meeting the community's needs.

Conclusion: The KKN program successfully empowered the community, driving educational, social, and economic development, and exemplified the importance of student-driven initiatives in fostering sustainable growth.

Novelty: This study highlights the significance of community empowerment programs in rural areas, showcasing their potential for long-term social impact.

Keywords: Tempe Waste, Liquid Organic Fertilizer, POC, Environmental Sustainability

INTRODUCTION

Education is a fundamental process that encompasses three main dimensions: the individual, the community or national society to which the individual belongs, and the entirety of material and spiritual realities that influence the character, destiny, and form of both the individual and society (Abdulrahaman et al., 2020). The role of higher education institutions in this context is highly significant, as they carry the responsibility to contribute not only to the intellectual development of students but also to the development of society at large (Herlindah & Darmawan, 2022; Rizal et al., 2023). The core mission of universities is often framed around the *Tri Dharma* of higher education, which consists of education, research, and community service. These three pillars collectively guide universities in fulfilling their strategic role in national development and social responsibility (Christwardana et al., 2022).

In the context of higher education, universities are not only tasked with providing academic learning but also with creating avenues for students to engage in real-world issues through community service. One of the primary vehicles for this engagement is the Kuliah Kerja Nyata (KKN), or the Community Service Program (Katili et al., 2024). KKN serves as a critical platform where students step beyond the confines of the classroom and apply their knowledge

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in practical, real-life situations within communities. By engaging in KKN, students learn how to navigate complex social issues and actively contribute to the improvement of local communities. KKN is an essential component of the academic experience for students, as it allows them to interact directly with communities, participate in solving real-world problems, and contribute to the social, economic, and environmental development of the areas they serve. At Institut Miftahul Huda Al-Azhar (IMA), located in Kota Banjar, West Java, Indonesia, KKN is seen as an important manifestation of the university's Tri Dharma and an opportunity for students to combine their academic learning with societal responsibility. This program emphasizes community-based empowerment and helps students develop practical skills while making meaningful contributions to the public good (Guizzo & de Lima, 2015; Rokhmad, 2021).

One of the key principles of the KKN program is that it aligns with the competencies taught within the various academic programs. This makes the program interdisciplinary and ensures that students have a holistic understanding of how their academic knowledge can be applied to solve community challenges. KKN also creates a platform for students to engage in environmental, social, economic, and cultural activities that have a lasting impact on the communities they serve. Through this program, students are given the chance to contribute to the development of their country and to address pressing local issues, ranging from economic disparities to environmental challenges. The Padaringan Village in Purwadadi Subdistrict, Ciamis Regency, West Java, was selected as the focus for the 2024 KKN group from IMA. Padaringan Village is located in an area that is rich in agricultural activity but faces challenges related to waste management and community development. The village is strategically positioned as a site for community service due to its potential for growth and the presence of a cooperative and receptive local community. The chosen theme for the 2024 KKN in Padaringan is "Community Empowerment Based on Environmental Sustainability: The Prevention and Management of Tempe Waste into Liquid Organic Fertilizer (POC) in Padaringan Village, Purwadadi Subdistrict, Ciamis Regency".

The village of Padaringan is an ideal location for the KKN program, as it provides a unique opportunity to address both environmental and socio-economic issues through the concept of sustainable waste management. Tempe, a traditional Indonesian food made from fermented soybeans, is a significant part of the local diet, and its production generates substantial amounts of organic waste. However, much of this waste is not properly managed and ends up in landfills or is discarded improperly, contributing to environmental pollution. Therefore, one of the primary goals of the KKN program in Padaringan is to transform this waste into an environmentally friendly product—Liquid Organic Fertilizer (POC) (Wafiqah et al., 2024). This not only helps address waste management issues but also provides an economic opportunity for the villagers by creating a sustainable and valuable product that can be used for agriculture. The main objectives of this KKN program are multifaceted. First, the program seeks to raise awareness within the community about the importance of waste management and its direct impact on environmental sustainability. This awareness-raising campaign is essential to engage local residents in understanding how their everyday practices, particularly regarding waste disposal, affect the broader community and the environment. Second, the program focuses on providing practical training to villagers on how to convert tempe waste into liquid

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organic fertilizer (POC), which can be used to improve soil fertility and support sustainable farming practices in the area. By leveraging the local agricultural expertise of the community, the program aims to offer solutions that are both environmentally sustainable and economically beneficial (Anwar, 2021; Aqeeq et al., 2023; Azmi et al., 2024).

In addition to addressing environmental issues, the KKN program also emphasizes the importance of community-based empowerment. By involving the local population in every step of the process, from waste collection to fertilizer production, the program helps to build local capacity and resilience. The community is not only trained in new practices but also encouraged to take ownership of the solutions and continue the activities even after the KKN program concludes. This sense of ownership is crucial for the long-term sustainability of the initiatives introduced during the program. Furthermore, the KKN program in Padaringan aims to foster collaboration and strengthen the relationship between students and the community. Through outreach, guidance, and education, students are able to deepen their understanding of real-world challenges while providing valuable insights and solutions to the community. This mutual exchange not only benefits the students in terms of their professional development but also enables the community to gain access to academic knowledge and resources that might otherwise be unavailable. Another key aspect of the KKN program is its interdisciplinary nature. The activities conducted during the program involve a variety of disciplines, including environmental science, education, social welfare, and economics (Drover & Woodsworth, 1978; Harahap et al., 2024; Hidayat, 2024). This interdisciplinary approach ensures that the solutions offered are comprehensive and well-rounded, addressing multiple facets of the community's needs. For example, the program combines knowledge from environmental science to manage waste sustainably with sociological methods to ensure that the community is engaged and invested in the process. The program also integrates entrepreneurship by teaching villagers how to produce and market the liquid organic fertilizer, creating economic opportunities for them.

The KKN program is also aligned with the national development goals, particularly in terms of environmental sustainability and poverty alleviation. By addressing waste management issues and creating new economic opportunities, the program contributes directly to the achievement of the United Nations Sustainable Development Goals (SDGs), particularly Goal 12 (Responsible Consumption and Production) and Goal 13 (Climate Action). The initiative encourages sustainable agricultural practices while simultaneously improving the quality of life for local residents. In conclusion, the KKN program at Padaringan Village serves as an exemplary model of how higher education institutions can play a pivotal role in national and global development. By engaging students in real-world community issues and empowering local populations through knowledge and skills development, the program contributes to the broader goals of sustainable development, social equity, and environmental conservation. Through this program, the Institut Miftahul Huda Al-Azhar (IMA) fulfills its commitment to its core mission—educating students while fostering social responsibility and creating positive impacts within society. The integration of community service into the curriculum not only benefits the students but also builds a foundation for a more sustainable and harmonious future for the village of Padaringan and beyond.

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LITERATURE REVIEW

Community service is an essential aspect of higher education, particularly in developing countries where universities are expected to contribute directly to societal development. Community service programs, such as Kuliah Kerja Nyata (KKN), provide students with a platform to apply academic knowledge to real-world problems, contributing to local development while also fostering personal and professional growth. This concept aligns with the *Tri Dharma* of higher education in Indonesia, which emphasizes the university's obligation to deliver educational, research, and community service activities. The role of higher education institutions in community service extends beyond knowledge dissemination and involves addressing local issues in collaboration with the community (Saraswati et al., 2018; Christwardana et al., 2022).

As an important part of student education, KKN programs encourage students to step out of the classroom and immerse themselves in community life. Through this program, students experience the challenges faced by local communities, engage in problem-solving activities, and contribute to sustainable social and environmental practices (Rizal et al., 2023). For instance, the KKN program can be a powerful tool for addressing various developmental challenges such as waste management, economic empowerment, and social welfare (Drover & Woodsworth, 1978). In the Indonesian context, KKN programs like those conducted by Institut Miftahul Huda Al-Azhar (IMA) serve as an integrated learning method that provides students with direct exposure to local issues and an opportunity to make a tangible impact. This form of experiential learning is vital in promoting holistic education that prepares students not only for their professional careers but also for responsible citizenship (Hidayat, 2024).

Environmental sustainability has become a critical global concern, particularly as urbanization and industrialization continue to intensify the pressure on natural resources. Effective waste management practices are crucial in reducing environmental pollution and fostering sustainable development. The conversion of organic waste into useful products, such as fertilizers, plays a pivotal role in supporting sustainable agriculture, minimizing waste disposal, and mitigating pollution (Wafiqah et al., 2024). Tempe waste, a byproduct of the popular Indonesian food, tempe, is one such organic waste that is often overlooked but holds significant potential for recycling and reuse. Recent research has focused on how organic waste, including tempe waste, can be transformed into liquid organic fertilizer (POC). Liquid organic fertilizers have gained popularity due to their environmental benefits and their ability to enhance soil fertility without relying on chemical inputs. The process of converting tempe waste into POC involves fermentation, a practice that reduces the environmental impact of waste disposal and provides an eco-friendly solution for local farmers (Wafiqah et al., 2024). This aligns with the goals of the KKN program in Padaringan Village, where students work to educate the community about sustainable waste management practices.

Furthermore, the use of POC can have significant positive effects on local agriculture. Farmers can use the liquid organic fertilizer to improve crop yields, reduce dependence on chemical fertilizers, and lower production costs. This approach directly addresses several interconnected issues, such as environmental sustainability, economic empowerment, and community

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development (Hidayat, 2024; Azmi et al., 2024). By empowering local communities with knowledge and tools to manage waste effectively, KKN programs can drive sustainable agriculture and economic growth. Sustainable development requires a multifaceted approach that integrates environmental, social, and economic factors. Universities play an essential role in creating interdisciplinary programs that encourage collaboration between different academic disciplines to address complex social and environmental issues. The interdisciplinary nature of KKN programs allows students from various disciplines to come together and work on solutions that tackle multiple aspects of community development (Christwardana et al., 2022). For example, the collaboration between students from environmental science, economics, and social sciences can lead to innovative solutions for waste management, economic development, and social empowerment. The KKN program in Padaringan Village exemplifies this interdisciplinary approach, as students combine their academic knowledge with community engagement to create sustainable solutions. By doing so, students not only gain practical experience but also contribute to creating holistic, community-driven solutions that address real-world problems (Saraswati et al., 2018).

Moreover, the Maqasid al-Shariah, a framework for understanding Islamic economics and social justice, has been increasingly applied to sustainable development initiatives. Research by Azmi et al. (2024) explores how this framework can guide the development of Sharia-compliant economic models that promote sustainable and equitable growth. In the context of KKN, this framework could support initiatives that integrate environmental stewardship with social justice, ensuring that the benefits of sustainable development are shared equitably among all members of the community. Community-based empowerment is another central theme in the literature on sustainable development and KKN. Empowering communities involves giving individuals the knowledge, skills, and resources they need to improve their own lives and make decisions that affect their well-being. This empowerment is often facilitated through education, which has been shown to be one of the most effective means of driving social and economic change (Abdulrahaman et al., 2020).

In the KKN program, students not only provide technical solutions, such as converting waste into fertilizer, but also engage in educational activities that help build the community's capacity for self-sufficiency. By providing training and workshops, students ensure that community members can continue the work beyond the duration of the program, creating long-term benefits for the village (Adnan et al., 2019). Furthermore, education empowers community members to make informed decisions about their environment, health, and economic activities. Through these educational initiatives, KKN programs foster social cohesion and create a sense of ownership among local residents. This is crucial for the sustainability of any development project, as it ensures that the community remains engaged and motivated to maintain and expand the initiatives introduced by the students (Hidayat, 2024).

Although there is a growing body of literature on KKN programs, community-based empowerment, and sustainable development, there are several gaps that remain unaddressed, particularly in the context of waste management and environmental sustainability within rural communities. Most studies tend to focus on the broader impact of KKN programs without delving deeply into the specific environmental benefits of initiatives such as waste-to-fertilizer

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conversion. Moreover, while KKN has been explored in various contexts, research on how local knowledge and community participation can be harnessed to promote sustainability remains limited. There is also a need for more in-depth research on the long-term economic impact of KKN initiatives on local communities. While the immediate benefits of waste management and agricultural improvement are clear, the long-term outcomes of such programs—such as improved economic conditions, reduced poverty, and enhanced social capital—remain underexplored. This research aims to fill this gap by focusing on the environmental and socio-economic outcomes of the KKN program in Padaringan Village and its potential for replication in other similar contexts.

Table 1: Summary of Key Research Themes and Gaps

Research Theme	Key Findings	Research Gaps
Community Service and Higher Education	KKN programs contribute to student development and societal impact	Lack of focused research on specific environmental impacts of KKN, such as waste management and recycling
Environmental Sustainability and Waste Management	Organic waste can be converted into useful products like POC	Limited research on the long-term environmental benefits of waste-to-fertilizer programs in rural communities
Interdisciplinary Approaches to Development	Interdisciplinary collaboration can solve complex community issues	Insufficient studies on how interdisciplinary KKN programs impact community sustainability
Community Empowerment and Education	Education empowers communities to sustain development efforts	Gaps in understanding the long-term effects of KKN education on community self-sufficiency and resilience

In conclusion, while significant strides have been made in understanding the role of higher education in community development, there is a pressing need for more research that focuses on the sustainability and economic empowerment aspects of KKN programs, especially in rural areas like Padaringan. This study will address these gaps by exploring how KKN initiatives related to environmental sustainability can contribute to long-term community development, ultimately bridging the gap between education and practical solutions for societal challenges.

METHODOLOGY

The methodology of this study is primarily designed to address the issue of tempe waste in Padaringan Village, Purwadadi Subdistrict, Ciamis Regency. This community empowerment program is a part of the Kuliah Kerja Nyata (KKN) initiative, through which students engage in community service and actively contribute to solving local issues. The program specifically targets the waste generated by tempe production, aiming to convert it into useful organic

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fertilizer (POC). The methodology incorporates several steps, from initial assessments and field visits to the implementation of educational programs and community involvement.

Step 1: Initial Assessment and Problem Identification
The first step in the methodology involved conducting field visits to the homes of tempe producers in Padaringan Village. The purpose of these visits was to gather information on the potential opportunities and problems related to tempe waste management. Through interviews with community leaders and key informants, several challenges were identified, including the abundance of tempe waste, the lack of effective utilization of this waste, and the unpleasant odor that negatively affected the local environment. This phase was critical for understanding the community's needs and the scope of the problems, which formed the basis for further interventions.

Step 2: Community Engagement and Awareness
Following the initial assessment, the next phase focused on community engagement and raising awareness. The program utilized a participatory approach, where local community members, particularly the tempe producers, were directly involved in discussions about the waste management challenges and potential solutions. A series of awareness campaigns and socialization sessions were conducted to inform the community about the environmental impact of tempe waste and the benefits of converting this waste into organic fertilizer. This phase was crucial for gaining the community's trust and ensuring their active participation in the program. The key to success was not only educating the community but also showing the direct benefits of implementing sustainable waste management practices.

Step 3: Collaboration and Stakeholder Involvement
The involvement of various stakeholders played a significant role in the success of this community empowerment initiative. The program emphasized collaboration between students, local government officials, and the community. A vital component of this phase was the selection of business partners or local businesses that could act as samples for tempe waste processing. The collaboration also extended to the local government, particularly the village head, who provided strong support for the program by endorsing the use of organic fertilizer in community gardens and farms. In addition, local government officials and faculty members from the university were involved in overseeing and mentoring the program to ensure it aligned with both academic and community goals.

Step 4: Capacity Building and Training
Once the groundwork of awareness and collaboration was laid, the next step involved capacity building and skills training for the local community. Workshops and training sessions were organized to educate the community members on how to process tempe waste into liquid organic fertilizer (POC). These training sessions included hands-on demonstrations, where participants were taught the steps involved in waste processing, the necessary materials, and the expected benefits of using POC as fertilizer for plants. A key outcome of this phase was that community members not only learned a new skill but also felt empowered to take ownership of the project and implement it in their own homes and businesses.

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Step 5: Monitoring, Evaluation, and Sustainability

The final component of the methodology was monitoring and evaluation. The success of the program was assessed through regular follow-ups, observations, and interviews with the participants. Feedback was gathered from both the community and the students involved to measure the effectiveness of the program and identify any areas for improvement. Monitoring and evaluation were conducted in real-time to ensure the project stayed on track and met its objectives. Indicators of success included the reduction of waste-related odor, the community's adoption of POC for local farming, and the overall satisfaction of the community with the program. In terms of sustainability, the program aimed to create a long-lasting impact by ensuring that the knowledge and practices related to tempe waste management were integrated into the local culture and economy.

Data Collection and Analysis

This study employed a descriptive qualitative research design, utilizing field research methods to gather both primary and secondary data. Primary data was collected through direct interaction with KKN students from Institut Miftahul Huda Al-Azhar and local residents in Padaringan Village. Interviews and observations were the primary data collection methods. Interviews were conducted to gather information about the community's awareness and participation in the KKN activities, while observations focused on the actual implementation and outcomes of the program. Additionally, secondary data was collected through documentation, such as records of KKN activities, photographs, and reports.

The data analysis was guided by the model proposed by Miles and Huberman, which involves three key processes: data reduction, data display, and conclusion drawing/verification. During the data reduction phase, irrelevant or redundant data was removed to focus on the key themes related to the program's objectives. The data display involved organizing the findings into tables and charts for clarity, while the conclusion drawing phase involved interpreting the results to assess the impact of the program and identifying areas for future improvement.

Indicators of Success

The success of the program was measured using several key indicators, which were directly linked to the outcomes of the activities. These indicators included the reduction of environmental pollution caused by tempe waste, the successful conversion of waste into organic fertilizer, the active participation of the community, and the endorsement of local government support for sustainable practices. The program's effectiveness was also evaluated based on the extent to which the community embraced and integrated the new practices into their daily lives.

Indicator of Success	**Measurement Criteria**
Reduction in Tempe Waste Pollution	Decrease in odor and waste accumulation in the community
Community Engagement	Number of people participating in training and socialization sessions
Local Government Support	Endorsement and use of POC by the village administration

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Indicator of Success	Measurement Criteria
Skill Acquisition	Number of community members proficient in processing tempe waste into POC
Sustainability	Long-term adoption of organic fertilizer in local agriculture

While there have been studies on waste management and community empowerment, there is a clear gap in the literature regarding the specific utilization of tempe waste for sustainable environmental practices, especially in rural communities. The majority of research focuses on urban areas or broader industrial waste management solutions. This study fills that gap by addressing a localized problem through a collaborative, community-based approach, integrating environmental sustainability with socio-economic empowerment in a rural setting. Furthermore, the study contributes to the understanding of how student-led initiatives can play a critical role in rural development and environmental protection. In summary, the methodology of this study is built on a participatory approach that includes assessment, community engagement, collaboration, capacity building, and continuous evaluation. By addressing a specific local issue, such as tempe waste, the program aims to provide sustainable solutions while enhancing community development and strengthening the bond between students, local authorities, and the public.

RESULTS

The Community Service Program (KKN) carried out in Padaringan Village aimed to address environmental issues caused by tempe waste. Padaringan Village has 24 tempe producers, and the number of tempe entrepreneurs has increased from just one at the beginning to over ten. Every year, the number of tempe producers continues to grow, which naturally increases the volume of tempe waste produced. Although the environmental impact may not be immediately apparent, the long-term consequences of tempe waste accumulation can significantly harm the environment. A major problem faced by the community is the unpleasant odor produced by the tempe wastewater resulting from the tempe-making process. This strong odor has become a significant issue in the surrounding area, particularly as cleanliness is a primary concern in Padaringan Village. Given these circumstances, the KKN team was motivated to find a way to process tempe wastewater into something beneficial, specifically by converting it into organic liquid fertilizer (POC) that can be used for various types of plants.

Process of Creating Organic Liquid Fertilizer (POC)

To transform tempe wastewater into POC, the KKN team used tempe wastewater, which is a by-product of the tempe-making process. Additional ingredients, such as EM-4 (effective microorganisms for agriculture) and molasses (sugar cane syrup), were also necessary to make the POC. The process of making the organic fertilizer was as follows:

1. **Ingredients used**:
    - Tempe wastewater (boiled water) – 1 liter
    - EM-4 for plants – 100 ml
    - Molasses (sugar cane syrup) – 100 ml

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2. **Preparation Process**:
    - All the ingredients were mixed thoroughly.
    - After mixing, the mixture was left for 4 to 7 days in a cool place away from direct sunlight, ensuring that the jar was tightly sealed for fermentation.
    - Once the fermentation process was complete, the organic liquid fertilizer (POC) was ready for use.
3. **Application ratio for POC**:
    - 10 ml of the fermented POC
    - 1 liter of plain water
    - Mix them well, then spray the mixture onto plants and soil.

Socialization and Application of POC

After the POC was successfully made, the KKN team proceeded to conduct socialization activities for the local community about how to process tempe wastewater into organic liquid fertilizer (POC). This socialization aimed to educate the community on the importance of waste management and how they could benefit from the fertilizer in their agriculture and horticulture practices. Following the socialization sessions, the community eagerly applied the POC they had made to their plants. The liquid fertilizer proved effective in improving soil quality and promoting plant growth. The community enthusiastically embraced the use of the POC on various types of plants, such as vegetables, flowers, and other crops.

Evaluation of the Community Service Program

The overall evaluation of the program indicated positive outcomes. The socialization regarding the conversion of tempe waste into organic liquid fertilizer provided significant benefits, especially to the tempe production groups. The success of the program can largely be attributed to the active involvement and participation of the local community, including the support from the village government and tempe producers. Through this program, the KKN team successfully imparted valuable knowledge and skills to the community. The program not only helped in reducing the environmental impact of tempe wastewater but also increased awareness among the people of Padaringan Village about the importance of waste management and its positive effect on the environment. It also provided practical knowledge that the community could apply on a long-term basis, thus contributing to sustainable local agriculture practices.
Overall, the program successfully transformed tempe waste from a problematic by-product into a useful resource, and the local community actively participated in the process, applying the knowledge they gained to improve their agricultural productivity.

DISCUSSION

The success of the Community Service Program in Padaringan Village demonstrates the vital role that community engagement and collaborative efforts play in addressing local environmental challenges. By focusing on tempe wastewater, a previously neglected waste product, the program not only solved a pressing issue of odor pollution but also created new opportunities for sustainable agricultural practices.

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In the beginning, the KKN team identified several key challenges faced by the community. The increasing number of tempe producers in Padaringan led to a corresponding increase in tempe wastewater. If left untreated, this waste posed a serious threat to the local environment. The most immediate concern was the pungent odor that emanated from the wastewater, which affected the quality of life for local residents. In response to these concerns, the KKN team introduced an innovative solution: transforming the tempe wastewater into organic liquid fertilizer (POC). This initiative provided an environmentally friendly solution to the problem, as it not only helped reduce the environmental pollution caused by untreated wastewater but also offered a valuable resource for the community's agricultural activities. The production of POC from tempe wastewater demonstrated the concept of waste-to-resource, a key principle in sustainability that encourages the reuse of waste materials to create products that benefit the community.

A major aspect of the success of this program was the active participation and engagement of the local community. From the beginning, the KKN team recognized the importance of involving the community in the process. The program was not only about solving an environmental issue but also about empowering the local residents with the knowledge and skills needed to manage their waste and use it to their advantage. Socialization activities were crucial in educating the villagers about the potential of tempe wastewater and its benefits as an organic fertilizer. The KKN team organized workshops and demonstrations to show the proper methods for making POC and applying it to crops. These efforts were met with enthusiasm, as the community saw the direct benefits of using POC for improving soil health and boosting crop yields. Through these knowledge-sharing efforts, the community was able to see how they could transform a problem (tempe waste) into an opportunity (useful fertilizer), and this shift in mindset was one of the most impactful outcomes of the program. It demonstrated that sustainability doesn't just come from top-down interventions but can also arise from local innovation and the involvement of grassroots organizations in creating solutions to their own problems.

Despite the positive outcomes, there were challenges faced during the implementation of the program. One of the major hurdles was convincing the community of the long-term benefits of using POC. In many cases, people were initially skeptical about the effectiveness of a fertilizer made from waste, especially since they were used to traditional fertilizers. It took several rounds of socialization, demonstrations, and direct engagement to show the practical benefits of POC. Additionally, the KKN team faced logistical challenges in sourcing the necessary materials, ensuring that the fermentation process was carried out under optimal conditions, and organizing the community for the socialization sessions. However, these challenges were eventually overcome with the support of the village government, local leaders, and active involvement from the residents. One of the most significant aspects of the program was its sustainability. By teaching the community how to process tempe wastewater into POC, the KKN team provided a tool that could be used indefinitely. This means that the community can continue to produce organic liquid fertilizer on their own, reducing their dependence on external resources and promoting more sustainable agricultural practices. Furthermore, the knowledge transfer provided by the program ensures that future generations in Padaringan Village will have the skills to manage their waste effectively and sustainably.

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The program also had a broader environmental impact, as it demonstrated the potential of small-scale, community-driven solutions to environmental problems. By addressing local waste issues and transforming them into beneficial products, the program not only contributed to a cleaner environment but also empowered the community to take ownership of their local sustainability efforts. The success of the KKN program in Padaringan Village also holds important implications for community development in rural areas. It highlights the potential of small-scale interventions to bring about significant positive changes. When communities are involved in identifying and solving their own problems, they become more resilient, self-reliant, and motivated to continue improving their quality of life.

Furthermore, the program demonstrated the value of interdisciplinary collaboration between students, local governments, and community members in addressing local challenges. Such collaboration enhances the effectiveness of community development programs and ensures that the solutions are not only practical but also culturally appropriate and sustainable. In conclusion, the KKN program in Padaringan Village was a success because it involved the local community, addressed a pressing environmental problem, and provided a sustainable solution that could be implemented long term. By focusing on tempe wastewater and converting it into organic liquid fertilizer, the program demonstrated the power of waste-to-resource initiatives and provided valuable lessons in community engagement, environmental sustainability, and agricultural innovation. This approach can serve as a model for other rural communities facing similar environmental challenges, and it underscores the importance of education and collaboration in solving complex local issues.

CONCLUSION

The implementation of this community service program in Padaringan Village resulted in valuable outcomes, with several key insights emerging from the process. The village has 24 tempe producers, and this number has grown significantly over time, from only one producer initially to over 10 producers today. This growth in tempe production directly correlates with the increase in tempe waste generated, making waste management a pressing issue in the village. One of the major challenges identified was the lack of awareness regarding the proper handling and management of tempe waste. The village's residents and tempe producers did not initially see the potential of tempe waste as a resource, and as a result, the waste was often discarded without consideration of its environmental impact. However, the community service program successfully addressed this issue by raising awareness among tempe producers and the broader community about the value of repurposing tempe waste. The program's primary objective was to transform tempe wastewater, a problematic waste product, into organic liquid fertilizer (POC). This was done by collecting the wastewater in a proper container and processing it with the use of other materials like EM-4 and molasses. The process of fermentation led to the creation of POC, which is an environmentally friendly and highly beneficial product for agriculture. By introducing this method, the program not only helped reduce the environmental impact caused by untreated tempe wastewater but also provided a practical solution for tempe producers and local farmers to improve their agricultural practices.

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The program highlighted the importance of community participation and knowledge transfer. By involving the community in the waste management process and teaching them how to create and use POC, the program ensured that the villagers gained skills that could be applied in the long term. This hands-on approach empowered the community to take responsibility for their environment and provided them with the tools to manage waste sustainably.

Moreover, the success of the program was evident in the positive response from the local residents, who were eager to implement the techniques they had learned. The program not only provided a solution to the waste problem but also fostered a sense of environmental responsibility within the community. The creation of POC became a symbol of how waste, when managed properly, could be transformed into a resource that benefits everyone. In conclusion, the community service program in Padaringan Village successfully addressed the environmental issue of tempe waste by transforming it into a valuable resource. It demonstrated the power of knowledge-sharing, community engagement, and sustainable practices in solving local problems. The program's success in raising awareness and providing practical solutions serves as a model for other rural areas facing similar challenges, illustrating the potential for small-scale interventions to create lasting positive change.

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