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PKM IMPLEMENTAION OF CATFISH CULTIVATION (BUDIKDAMBER) WITH PASSIVE CIRCULATION TECHNOLOGY AS AN EFFORT TO IMPROVE FOOD SECURITY IN ORPHANAGES, WARU, SIDOARJO

PKM PENERAPAN BUDIDAYA LELE (BUDIKDAMBER) DENGAN TEKNOLOGI SIRKULASI PASIF SEBAGAI UPAYA PENINGKATAN KETAHANAN PANGAN DI PANTI ASUHAN, WARU, SIDOARJO

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Abstract

Catfish (Clarias sp.) is a leading fishery commodity in Indonesia, prized for its taste and disease resistance, making it an ideal choice for farming even in areas with limited water and land. The Insanul Kamil Al-Khaer Orphanage in Sidoarjo, as a social foundation, faces challenges in providing productive and educational activities for its residents. Currently, the orphanage offers only worship and basic school activities for the children. To address this, the Community Service Program implemented a solution based on science and technology that would provide additional income, improve nutrition, and offer valuable learning experiences. The Community Service Program introduced the Budikdamber (fish farming in buckets) system, which is simple to set up and does not require extensive land or water. The program was implemented in three stages: preparing the materials, conducting socialization and training, and providing ongoing assistance in managing the catfish cultivation system using Budikdamber with passive circulation technology. After completing one full cycle of cultivation, the Community Service Program showed that the Budikdamber system improved food security, provided a steady income from surplus fish and vegetables, and reduced reliance on external donations. The program also highlighted the educational benefits for the children involved in managing the system. These results confirm the potential of the Budikdamber system to enhance community empowerment and sustainability. The Community Service Program provides a model for replication in other orphanages and community-based institutions. Further Community Service Programs are needed to evaluate the long-term impact and scalability of this innovative approach.

Keywords: *Budikdamber; Catfish; Insanul Kamil Al-Khaer Sidoarjo Orphanage; Passive Circulation Technology.*

Abstrak

Ikan lele (Clarias sp.) merupakan komoditas perikanan unggulan di Indonesia, yang terkenal karena cita rasanya dan ketahanannya terhadap penyakit, menjadikannya pilihan ideal untuk dibudidayakan bahkan di area dengan keterbatasan air dan lahan. Panti Asuhan Insanul Kamil Al-Khaer di Sidoarjo, sebagai lembaga sosial, menghadapi tantangan dalam menyediakan kegiatan produktif dan edukatif bagi para penghuni. Saat ini, panti asuhan hanya menawarkan kegiatan ibadah dan materi pelajaran dasar bagi anak-anaknya. Untuk

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mengatasi hal ini, Program Pengabdian Masyarakat menerapkan solusi berbasis ilmu pengetahuan dan teknologi yang dapat memberikan pendapatan tambahan, meningkatkan gizi, serta menawarkan pengalaman belajar yang berharga. Program Pengabdian Masyarakat memperkenalkan sistem Budikdamber (budidaya ikan dalam ember), yang sederhana untuk diterapkan dan tidak memerlukan lahan atau air yang luas. Program ini dilaksanakan dalam tiga tahap: persiapan alat dan bahan, sosialisasi dan pelatihan, serta pendampingan berkelanjutan dalam mengelola sistem budidaya ikan lele dengan teknologi sirkulasi pasif pada Budikdamber. Setelah satu siklus budidaya selesai, Program Pengabdian Masyarakat menunjukkan bahwa sistem Budikdamber berhasil meningkatkan ketahanan pangan, menyediakan pendapatan dari surplus ikan dan sayuran, serta mengurangi ketergantungan pada sumbangan eksternal. Program ini juga menyoroti manfaat edukatif bagi anak-anak yang terlibat dalam pengelolaan sistem ini. Hasil tersebut mengonfirmasi potensi sistem Budikdamber dalam meningkatkan pemberdayaan komunitas dan keberlanjutan. Program Pengabdian Masyarakat ini memberikan model yang dapat diterapkan di panti asuhan dan lembaga berbasis komunitas lainnya. Program Pengabdian Masyarakat selanjutnya diperlukan untuk mengevaluasi dampak jangka panjang dan skalabilitas dari pendekatan inovatif ini.

***Kata kunci**: Budikdamber; Ikan Lele; Teknologi Sirkulasi Pasif; Panti Asuhan Insanul Kamil Al-Khaer Sidoarjo.*

INTRODUCTION

Food security remains one of the biggest challenges in developing countries, especially in resource-constrained environments such as orphanages and rural communities. In Indonesia, orphanages often face difficulties in providing consistent and nutritious food for the children in their care, due to limited financial resources and a lack of a sustainable food production system (Alam et al., 2022; Ullah et al., 2022). Reliance on external donations and funds often exacerbates this situation, as those resources are often unreliable, leading to uncertainty in food access and malnutrition (Asamoah & Tandoh, 2022). At the Insanul Kamil Al-Khaer Orphanage in Waru, Sidoarjo, the problem is exacerbated by the socio-economic challenges in the area, where access to fresh food and financial stability remain top concerns.

The children living in these orphanages, most of whom come from underprivileged or even neglected family backgrounds, are particularly vulnerable to nutritional and mental health problems. For example, children who live in these unstable conditions are more likely to experience malnutrition, cognitive impairment, and behavioral problems that can hinder their physical and mental development (Alam et al., 2022; DeLacey et al., 2020). At a critical time of their development, malnutrition can lead to sustained developmental delays, hindering their educational attainment, and psychosocial well-being (Knowles et al., 2015). Therefore, it is crucial to find innovative solutions that not only address food security issues, but also improve the well-being of children in these institutions.

Given these challenges, this Community Service Program explores the potential of the Budikdamber system as an innovative solution to improve food security and financial sustainability in orphanages. The Budikdamber system, which combines aquaculture (fish farming) with hydroponics (cultivation of soilless plants), has shown potential in small-scale food production systems that can be applied in environments with limited space and resources (Yudawisastra et al., 2023). This system involves cultivating catfish in buckets with passive water circulation, where fish waste provides nutrients for plants while plants help filter water for fish (Purnamaningrum, 2023). This two-function system addresses

food security issues by providing a sustainable source of protein and vegetables, while creating opportunities to generate revenue through the sale of surplus products.

The main purpose of this Community Service Program is to assess the feasibility and impact of the implementation of the Budikdamber system at the Insanul Kamil Al-Khaer Orphanage. Specifically, the program aims to determine whether the system can improve food security by providing a cheap and sustainable source of nutrition while generating income through the sale of surplus fish and vegetables. The Community Service Program also aims to contribute to the development of literature on sustainable aquaculture systems and their potential in improving food security and community empowerment in environments with limited resources.

This focus on the characteristics of children in orphanages is particularly relevant in designing effective interventions. Children at the Insanul Kamil Al-Khaer Orphanage have limited access to nutrition education and practical skills that can help them understand the importance of good nutrition and how to manage natural resources sustainably. Through their involvement in the management of the Budikdamber system, it is hoped that children can gain knowledge and skills that are useful in supporting food security, as well as increasing their sense of responsibility and independence.

The incorporation of probiotics in the Budikdamber system further increases its benefits. Probiotics, which are beneficial microorganisms, can improve water quality by accelerating the decomposition process of fish waste, preventing disease, and accelerating the growth of fish and plants (Shava & Gunhidzirai, 2017; Bennett et al., 2021). These additions can optimize system efficiency, reduce maintenance efforts, and improve sustainability, making it a more viable solution for food security in orphanages.

This Community Service Program is important because it provides practical insights into the implementation of small-scale aquaponic systems in orphanages, which not only address food security and financial sustainability, but also promote community empowerment. With a focus on the Insanul Kamil Al-Khaer Orphanage in Sidoarjo, the program aims to provide a model that can be replicated in other institutions facing similar challenges in Indonesia and other developing countries. The findings from the programme can help inform policies and practices that promote self-reliance and reduce reliance on external assistance, contributing to broader efforts to improve food security in vulnerable communities.

COMMUNITY SERVICE METHOD

Community Service Method Approach

Pada bagian metode penerapan, uraikanlah dengan jelas dan padat metode yang digunakan untuk mencapai tujuan yang telah dicanangkan dalam kegiatan pengabdian. Hasil pengabdian ini harus dapat diukur dan penulis diminta menjelaskan alat ukur yang dipakai baik secara deskriptif maupun kualitatif. Jelaskan cara mengukur tingkat ketercapaian keberhasilan kegiatan pengabdian. Tingkat ketercapaian dapat dilihat dari sisi perubahan sikap, sosial-budaya, dan ekonomi masyarakat sasaran.

Survey and Preparation of Materials and Tools

The first step in the Community Service Program was conducting a site survey at the Insanul Kamil Al-Khaer Orphanage (**Figure 1**). The survey, which took place on May

18-19, 2024, is very important in assessing the current conditions in orphanages, especially in terms of the availability of space for the implementation of the Budikdamber system. The survey results confirm that the orphanage has suitable spaces, such as the roof and side areas, which are underutilized and can be optimized for the Budikdamber system. The team also evaluates other factors, such as water quality, drainage capacity, and available infrastructure, that are necessary to ensure a successful system implementation. Based on the survey, the team proceeded to prepare the required materials, including 80-liter plastic buckets, catfish seeds, and hydroponic components such as net pots and Rockwool for plant cultivation. These materials are collected and transported to the orphanage to be prepared, ensuring that all components are ready for installation.

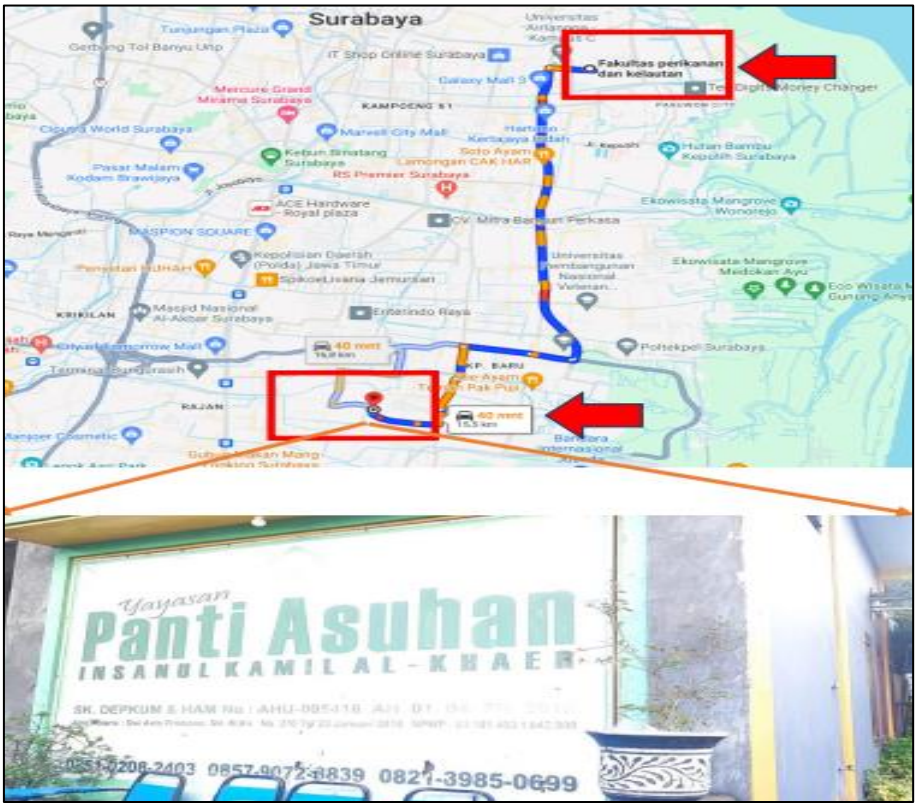

Figure 1. Location of the Insanul Kamil Al-Khaer Orphanage, Waru, Sidoarjo.

Socialization and Training

After preparing the material, the team conducted a socialization session at the orphanage. This session is designed to familiarize orphanage staff and children with the Budikdamber system. The socialization is interactive and involves a combination of lectures, demonstrations, and tutorials. The purpose of the socialization was to ensure that the participants understood the dual purpose of the fish and vegetable farming system sustainably and how to operate and maintain it effectively. During the sessions, the team provided an overview of aquaponics, focusing on the integration of aquaculture and hydroponics, and explained the benefits of using the Budikdamber system in a small-scale, resource-constrained environment such as an orphanage. The team also discussed

the importance of maintaining water quality, monitoring fish health, and optimizing plant growth. The sessions included live demonstrations where participants could see the system being set up and be directly involved in the process, ensuring that they gained practical skills to manage the system.

Implementation and Mentoring

After the socialization, the implementation stage began with the preparation of the Budikdamber system. The team assists the orphanage staff in preparing fish tanks and hydroponic components. An 80-liter plastic bucket is filled with 60 liters of water, which is allowed to settle for two days to ensure it is free of impurities. Net pots are then prepared to plant kale, while catfish seedlings are placed in buckets, with each bucket containing about 100 fish. The mentoring phase lasted approximately three months, during which the team regularly visited the orphanage to monitor the progress of the system. This phase is critical to ensure that the system functions optimally and that the participants effectively manage the aquaculture and hydroponic components. The team provides weekly guidance for maintaining water quality, monitoring fish health, and assessing vegetable growth. The team also ensures that the orphanage staff and children understand the importance of water quality parameters such as pH, dissolved oxygen, and ammonia levels and teaches them how to perform the necessary checks and adjustments.

Monitoring and Evaluation

Monitoring of the program will be conducted periodically, at least every 30 days. The indicators used for assessing the implementation and success of this program will include the participants' responses or enthusiasm toward the activities, as well as the number of Budikdamber systems applied from the initial stocking of fingerlings to the harvest of fish.

This study adopts a descriptive quantitative design to evaluate the community service program conducted at the Insanul Kamil Al-Khaer Orphanage, Waru, Sidoarjo. The program involved 30 participants, comprising 15 orphanage staff and 15 community participants actively engaged in the program’s activities. Data collection utilized structured questionnaires for orphanage staff and direct observation for community participants. Questionnaires were used to assess participation levels, satisfaction with program materials, relevance to daily roles, and perceived skill improvement, while open-ended questions captured qualitative feedback for program refinement. Observation sheets were used to document engagement levels, collaboration, and emotional responses of community participants during the activities.

Data were analyzed using descriptive statistics to calculate mean scores for participation, satisfaction, and skill improvement based on the responses of the orphanage staff. Observational data from community participants were categorized into high, moderate, or low engagement based on predefined behavioral criteria. Additionally, qualitative feedback from open-ended questions was analyzed thematically to identify recurring themes and actionable suggestions. The integration of structured questionnaires and direct observation ensures that the data collected aligns with the objectives of the study. The table below summarizes the methods and analysis plan used.

RESULTS AND DISCUSSIONS

Survey and Location Observation The location survey for the community service project at the Insanul Kamil Al-Khaer Orphanage (PA), Sidoarjo was carried out on May 18–19, 2024. The survey on the implementation of the Budikdamber system with passive circulation technology was coordinated by the Faculty of Fisheries and Marine Sciences, Universitas Airlangga, represented by students and Mrs. Nyai, who is one of the orphanage administrators. The purpose of the survey is to assess the current situation of partner institutions and identify potential locations where the Budikdamber system can be installed. During the survey, preliminary observations were made to provide the initial design of the Budikdamber system and to explain the passive circulation technology to be applied. The Budikdamber system was introduced to the orphanage staff to ensure they had a clear understanding of how the system works. The survey team also asked several questions regarding the available land area, soil absorption, available drainage system, and other relevant aspects related to the installation location.

Construction of the Budikdamber Containers

The next step in the project was the construction of the Budikdamber containers, which was carried out in collaboration with students from the Faculty of Fisheries and Marine Science at Universitas Airlangga. The construction took place at Jl. Delta Asri No. 59, Sidoarjo, East Java. The Budikdamber containers used were 80-litre plastic buckets, with a total of 20 buckets prepared for the system. Each bucket was drilled with a hole of approximately 1 cm (or around 2.5 cm in diameter) to install a water valve (**Figure 1**). Additionally, the lids of the buckets were drilled with a 7 cm diameter hole to accommodate netpots or plastic cups, which would be used to grow vegetables such as water spinach (*kangkung*). The bottom of each plastic cup was also perforated to enhance nutrient absorption from the fish waste, allowing the plants to better utilize the nutrients from the fish waste. If left untreated in the tank, fish waste can be toxic to the fish. Therefore, the plants play a dual role: they act as biological filters, converting harmful toxins into non-toxic substances and contributing to the oxygen supply in the water used to maintain the fish.

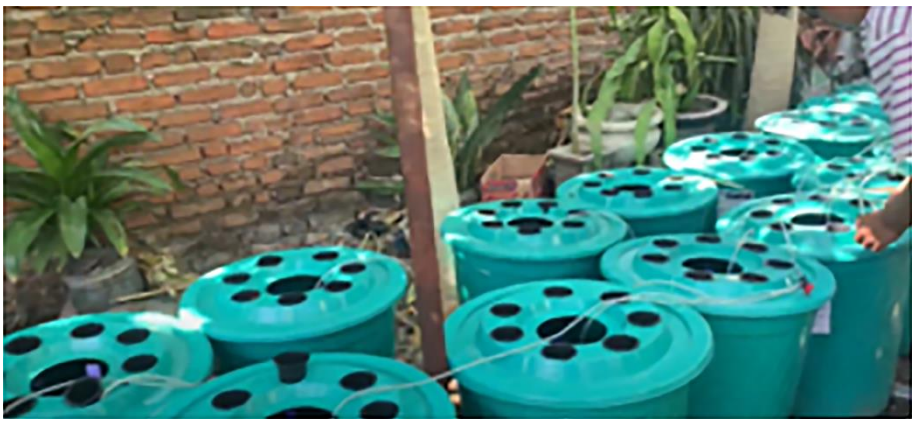

Figure 2. The prepared buckets for Budikdamber system, ready for catfish farming and aquaponic plant cultivation.

Plant Seedling and Catfish Stocking

The activities conducted after preparing the containers involved setting up the media for the Budikdamber system. Each 80-litre bucket was filled with 60 litres of water and left to settle for 2 days to allow the well water to clarify. The net pots were filled with rockwool as a growing vegetable medium. After two days, the catfish fingerlings were stocked into the prepared buckets. Water spinach was planted in the net pots (**Figure 3**). Each bucket was stocked with approximately 100 catfish fingerlings, each about 9 cm in size (**Figure 4**). Water quality was also monitored after stocking the catfish to ensure the water remained optimal. The parameters observed for water quality included dissolved oxygen levels and pH.

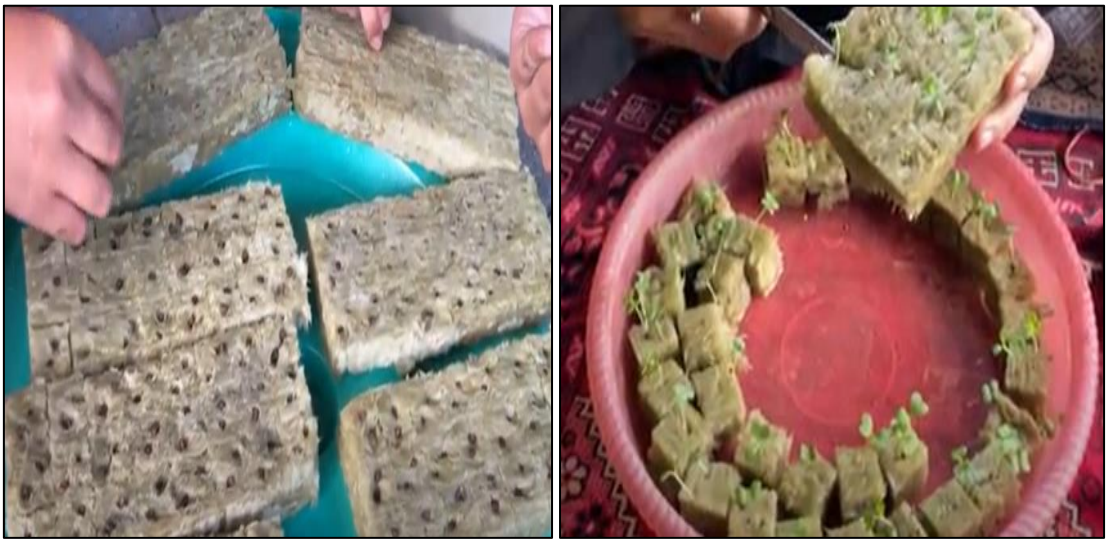

Figure 3. The process of sowing water spinach seedlings and the water spinach seedlings after 7 days of growth.

Figure 4. The process of stocking catfish fingerlings.

Training and Delivery of Materials

achieve the optimal training, mentoring, guidance, and consolidation targets, it was necessary to provide training materials on fish farming in buckets to the participants in the main hall of the Insanul Kamil Al-Khaer Orphanage Foundation (PA), Waru District, Sidoarjo Regency, East Java. The training participants included all the orphanage children

and their mentors. All participants paid close attention to the material being presented. The trainers who delivered the material were lecturers from the Department of Aquaculture, Faculty of Fisheries and Marine Sciences, Universitas Airlangga (UNAIR), namely Prof. Dr. Akhmad Taufiq Mukti S.Pi., M.Si (**Figure 6**), who presented on *Aquaponic Fish Farming (BISA)*, and Muhammad Amin S.Pi., M.Sc., PhD (**Figure 7**), who covered the topic of *Probiotics*. The key points covered in the training included:

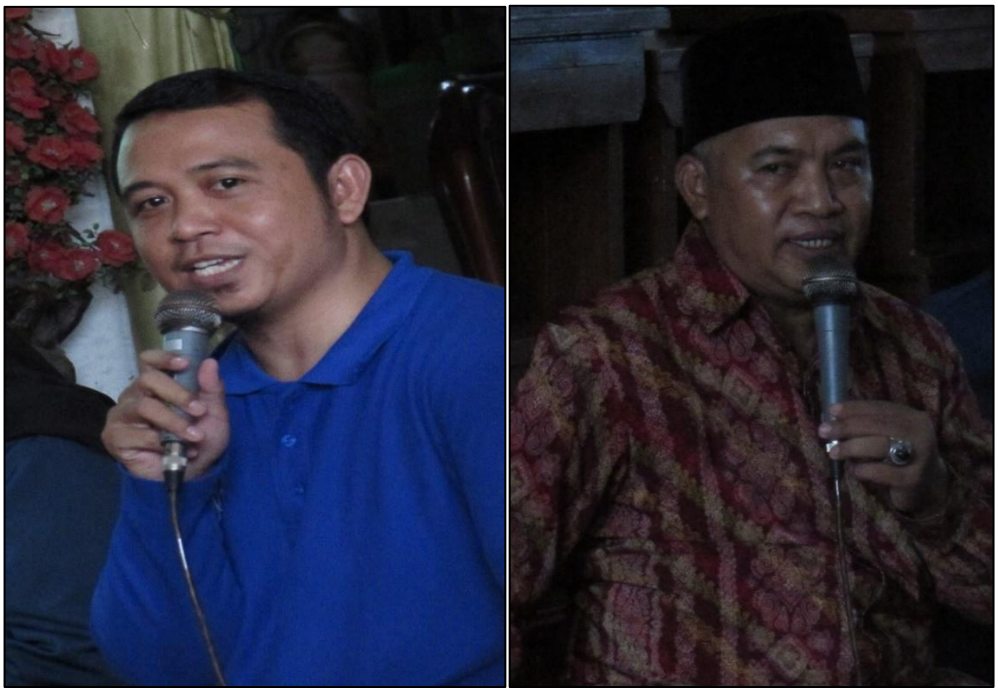

Figure 5. Opening speech by the Head of the Community Service Program, Rozi, S.Pi., M.Biotech, and the Leader of the Insanul Kamil Al-Khaer Orphanage Foundation (PA), Sidoarjo, East Java.

Aquaponics is a farming system that combines aquaculture (fish farming) with hydroponics (soil-less plant cultivation), where fish waste provides nutrients for the plants while the plants help filter the water for the fish, creating a mutually beneficial ecosystem (Kawarazuka & Béné, 2010). Types of aquaponics can be categorized based on the water processing system and plant cultivation method, including raft, media-bed, and vertical systems (Girard et al., 2012). The advantages of aquaponics include water use efficiency, reduced chemical fertilizer usage, and increased productivity in limited spaces (Farmery et al., 2021). However, this system also has drawbacks, such as relatively high initial costs and the need for intensive maintenance to sustain the ecosystem's balance (Cai & Leung, 2023).

Figure 6. Presentation of Material 1 by Prof. Dr. Akhmad Taufiq Mukti S.Pi., M.Si. on *Aquaponic Fish Farming System (BISA)*.

The introduction of probiotics in aquaponics refers to the use of beneficial microorganisms to improve water quality and support the health of both fish and plants (Shava & Gunhidzirai, 2017). The benefits of probiotics include enhancing fish waste decomposition, preventing fish diseases, and improving plant growth (Bennett et al., 2021). The application of probiotics involves periodic additions to the aquaponic water system to maintain environmental stability and support the lifecycle of both plants and fish (Kuswanto et al., 2022).

Figure 7. Presentation of Material 2 by Muhammad Amin S.Pi., M.Sc., Ph.D. on *Probiotics*.

Figure 9. Symbolic handover of the *Budikdamber* fish farming system to the Insanul Kamil Al-Khaer Orphanage Foundation (PA), Sidoarjo, East Java.

Monitoring

The Community Service Program implemented the Budikdamber system, a small-scale aquaponic model combining fish farming and hydroponics, at the Insanul Kamil Al-Khaer Orphanage in Sidoarjo, East Java. The program aimed to improve food security, generate income, and promote sustainability. After eight weeks, catfish grew to an average size of 22.5 cm and 120 grams, consistent with similar aquaponic systems (Episar et al., 2018). Water quality parameters remained optimal, supporting fish and plant growth (Sidik et al., 2002; Hastuti, 2011). Vegetable growth, particularly water spinach, reached an average height of 15 cm, demonstrating the successful integration of aquaculture and hydroponics.

The system significantly contributed to the orphanage's food security and financial stability by reducing dependency on donations and generating income from surplus fish and vegetables. This income could be reinvested in education or vocational programs. Additionally, children involved in system maintenance developed life skills such as teamwork and responsibility. Despite its success, the program's eight-week duration limits insights into the system's long-term sustainability. Further research is needed to evaluate scalability, economic viability, and socio-economic impacts in broader contexts. Future studies should also explore educational and psychological benefits for participants in aquaponic activities.

Evaluation

The findings indicate that the program effectively met its objectives by fostering high levels of participation, satisfaction, and skill improvement. In terms of participation, 80% of the orphanage staff (12 participants) rated themselves as "very active" (scores 7-10), while the remaining 20% (3 participants) were "moderately active" (scores 4-6). Observational data showed that 73.33% of the community participants (11 individuals) displayed high engagement, characterized by active collaboration and enthusiasm, while 26.67% (4 participants) demonstrated moderate engagement. These results support the program's goal of creating an engaging and interactive environment, consistent with the

hypothesis that practical and hands-on methods enhance participation.

Table 1. Summary of Program Outcomes: Participation, Satisfaction, and Skill Improvement.

Evaluation Aspect	Orphanage Staff	Community Participants
Participation	- 80% (12 participants) very active (7-10). - 20% (3 participants) moderately active (4-6).	- 73.33% (11 participants) high engagement (observation). - 26.67% (4 participants) moderate engagement (observation).
Satisfaction	- Material quality: Average score 8.5. - Material relevance: Average score 8.7. - Facilitator effectiveness: Average score 8.6.	Not measured (only observed).
Skill Improvement	- 73.33% (11 participants) significant improvement (7-10). - 26.67% (4 participants) moderate improvement (4-6).	- 66.67% (10 participants) significant improvement (observation). - 33.33% (5 participants) moderate improvement (observation).
Program Suggestions	- Add more practical sessions and material guides.	- Add more group-based activities to enhance interaction.

For satisfaction, the orphanage staff reported high scores across all measured dimensions, with averages of 8.5 for material quality, 8.7 for relevance, and 8.6 for facilitator effectiveness, indicating that the program content was both relevant and impactful. While direct satisfaction data were not collected from community participants, observational data suggest a positive response, as evidenced by their active and enthusiastic involvement during activities. Regarding skill improvement, 73.33% of orphanage staff (11 participants) reported significant growth in practical skills, such as managing the Budikdamber system, while 66.67% of community participants (10 individuals) demonstrated significant improvement in social skills like teamwork and communication. Moderate improvement was noted among 26.67% of staff (4 participants) and 33.33% of community participants (5 participants), indicating that while the program was effective overall, some participants may require tailored interventions for optimal outcomes.

The results confirm that the program successfully achieved its objectives and supported the hypotheses. The high participation rates among both groups (80% of orphanage staff and 73.33% of community participants classified as highly active) validate the program's use of interactive and practice-based methods. These findings are consistent with research emphasizing that participatory approaches enhance engagement in learning environments. However, the moderate participation levels reported by 20% of staff and 26.67% of community participants suggest that certain participants may have faced barriers, such as task complexity or limited motivation, indicating a need for more inclusive and adaptive activities.

High satisfaction scores (8.5–8.7) among the orphanage staff demonstrate that the program successfully met their expectations, particularly in providing relevant and well-delivered materials. These results confirm the hypothesis that the program would generate high satisfaction. For community participants, while satisfaction was inferred from

observed behaviors, future programs could integrate simplified feedback tools, such as visual or verbal satisfaction scales, to capture their experiences more accurately. This approach would enhance the robustness of satisfaction assessments for this group.

The skill improvement data strongly support the hypothesis that the program would enhance both practical and social skills. Among the orphanage staff, 73.33% reported significant improvement in practical competencies, reflecting the effectiveness of the Budikdamber system training. Similarly, 66.67% of community participants exhibited notable gains in social skills, validating the program's emphasis on group-based activities. However, the moderate improvement levels reported by some participants (26.67% of staff and 33.33% of community participants) indicate the need for additional strategies, such as extended training sessions or individualized mentoring, to maximize skill development across all participants.

The program effectively met its objectives of enhancing participation, satisfaction, and skill development, supporting all three hypotheses. However, incorporating feedback from participants, such as adding more practical sessions and group-based activities, could further optimize future iterations of the program. These refinements will ensure that the program remains inclusive, impactful, and responsive to the diverse needs of its participants.

CLOSING

Conclusion. The Community Service Program activities carried out include the distribution of tools and materials, preparation of containers, stocking catfish fingerlings, planting vegetables, and conducting socialization. From the discussions above, it can be concluded that *Budikdamber* is an innovative development of a potential technology that combines vegetable cultivation and fish farming in one place as an effort to support food security. Ideally, the types of plants used in this system are vegetables such as water spinach, spinach, and mustard greens. The type of fish used should be catfish, which is tolerant to low-oxygen water conditions. The *Budikdamber* system has proven to be an effective and sustainable solution for improving food security and financial stability in orphanages. This Community Service Program contributes valuable insights into the potential of small-scale aquaponic systems to promote economic self-sufficiency and community empowerment. It highlights the educational benefits for children involved in such systems and offers a replicable model for other vulnerable institutions. the program effectively met its objectives of enhancing participation, satisfaction, and skill development, supporting all three hypotheses. However, incorporating feedback from participants, such as adding more practical sessions and group-based activities, could further optimize future iterations of the program. These refinements will ensure that the program remains inclusive, impactful, and responsive to the diverse needs of its participants.

Suggestions. Community Service Activities themed *Budikdamber* are expected to provide knowledge and information to the orphaned children at the Insanul Kamil Al-Khaer Orphanage in Waru, Sidoarjo, East Java. It is also hoped that, in the future, this will become a source of independent and sustainable income through the cultivation of catfish and water spinach/water spinach.

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