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Community Empowerment through Optimization of Coconut Waste with Zero Waste Method

Pemberdayaan Masyarakat Melalui Optimalisasi Limbah Kelapa dengan Metode Zero Waste

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Abstract

This community service activity aims to empower the Wanua Cina Farmer Group through the application of the zero-waste method in processing coconut waste into economically valuable products such as cocopeat and cocofiber. The program comprises three stages: counseling, training, and mentoring. Results indicate significant improvements in partners' knowledge and technical skills. The average knowledge score increased from 18.18 in the pre-test to 78 in the post-test, while technical skills improved from 20.18 to 84.09. Mentoring ensured that partners could apply the acquired knowledge to produce high-quality products. This program positively impacted the village economy by increasing the farmer group's income potential and supporting environmental sustainability through waste reduction. The novelty of this program lies in the integration of the zero-waste method, which can be replicated in other villages. The resulting products have the potential to become village superior products. Long-term implications include enhancing rural economic capacity and environmental sustainability.

Keywords*: Farmer Group Empowerment*, *Zero Waste*, *Cocopeat*, *Cocofiber*, *Coconut Waste Processing*

Abstrak

Kegiatan pengabdian kepada masyarakat ini bertujuan untuk memberdayakan Kelompok Tani Wanua Cina melalui penerapan metode zero waste dalam pengolahan limbah kelapa menjadi produk bernilai ekonomi, yaitu cocopeat dan cocofiber. Program ini terdiri atas tiga tahapan: penyuluhan, pelatihan, dan pendampingan. Hasil menunjukkan peningkatan signifikan dalam pengetahuan dan keterampilan teknis mitra. Rata-rata skor pengetahuan meningkat dari 18,18 pada pre-test menjadi 78 pada post-test, sementara skor keterampilan teknis meningkat dari 20,18 menjadi 84,09. Pendampingan memastikan mitra mampu mengaplikasikan pengetahuan yang diperoleh untuk menghasilkan produk berkualitas tinggi. Program ini memberikan dampak positif terhadap ekonomi desa dengan meningkatkan potensi pendapatan kelompok tani serta mendukung pelestarian lingkungan melalui pengurangan limbah. Kebaruan program ini terletak pada integrasi metode zero waste yang dapat direplikasi di desa lain. Hasil kegiatan ini menunjukkan potensi produk untuk menjadi unggulan desa. Implikasi jangka panjang meliputi peningkatan kapasitas ekonomi masyarakat pedesaan dan keberlanjutan lingkungan.

Kata kunci*:* Pemberdayaan Kelompok Tani, *Zero Waste*, Cocopeat, Cocofiber, Pengolahan Limbah Kelapa

1. INTRODUCTION

Cina Village, a renowned coconut-producing village in Bone Regency (BPS, 2023), faces significant challenges in managing its abundant coconut waste, including coir and shells. Despite high production, improper waste disposal methods such as burning and dumping have resulted in environmental degradation and missed economic opportunities. These practices not only degrade the environment but also limit economic opportunities, leaving the community unable to tap into the significant potential of coconut by-products. The pollution from burning and unmanaged waste further affects soil health and air quality, posing challenges to community well-

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being and sustainability. Therefore, an effective solution is needed to overcome the problem of coconut waste and optimize the existing economic potential in Cina Sub-district. The partner in this community service is the Wanua Cina farmer group (poktan) located in Tanete Village, Cina District. Poktan Wanua Cina is engaged in processing coconut into copra.

The core issue lies in the limited knowledge and skills of the Wanua Cina farmer group in processing coconut waste. Partners focus solely on copra production while discarding valuable by-products like coir and shells. Additionally, barriers such as inadequate technology, infrastructure, and capital further hinder the development of waste processing enterprises. A lack of awareness regarding the economic and environmental benefits of sustainable waste management compounds this problem. In comparison, other villages implementing composting or biofuel production methods achieve partial waste utilization but fail to fully capitalize on high-value products like cocopeat and cocofiber. This highlights the need for a more integrated and transformative solution, such as the zero waste approach. Implementing zero-waste principles addresses these challenges by empowering communities through skill-building and fostering innovation. Economically, it creates new income streams through high-value products like cocopeat and cocofiber. These benefits align with SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action), demonstrating its global relevance (Siti, et al, 2023).

Another problem is the lack of awareness of the importance of applying sustainability principles in waste management. Many farmer group members still think that coconut waste has no economic value and is just waste that should be disposed of. This view makes them reluctant to invest in the technology and training needed to process coconut waste into high- value products such as cocopeat and cocofiber. However, implementing zero waste principles can address these challenges. Socially, it empowers communities by building skills and fostering innovation. Economically, it creates new income streams through the production of high-value products. Environmentally, it reduces waste pollution, enhances soil health, and supports sustainable rural development. These benefits align with global sustainability goals, making zero waste a holistic and impactful approach.

Zero waste methods offer a sustainable approach to waste management with the aim to reduce, reuse, and recycle all waste (Laštůvka et al., 2016; Özbay & Gokceviz, 2022; Reddy et al., 2020; Jain & Singh, 2021). For the Wanua Cina farmer group, adopting zero waste principles can enhance their capability to process coconut waste efficiently. This method emphasizes converting waste into high-value products such as cocopeat and cocofiber, thereby supporting village superior product innovation (Fivintari, Aurahma, & Hermawan, 2023; Junita, Pane, & Darus, 2023; Patil et al., 2021; Ahmad et al., 2022).

Cocopeat and cocofiber are two significant outputs of coconut waste processing (Gbollie, Mwonga, & Kibe, 2021; Santos & Campos, 2021; Singh et al., 2022). Cocopeat is a versatile material with high water retention and aeration properties, making it ideal for hydroponics and organic farming (Nafiah, Nugrahani, & Makhziah, 2023; Naik et al., 2018; Sharma & Gupta, 2021). Meanwhile, cocofiber is widely used in producing mats, mattresses, and industrial goods, aligning with global trends toward sustainable material development (Meilizar, 2021; Widjaya & Gunawan, 2022; Thakur et al., 2020; Manjunatha & Dinesh, 2023). These innovations align with global trends in green technologies, offering an opportunity to elevate Cina Village as a model for sustainable rural development.

Based on this background, this community service tries to solve partner problems, namely how the zerowaste method can be applied in processing coconut waste and how the empowerment of farmer groups can have the potential to become village superior products through processing coconut waste. This community service aims to optimize coconut waste through the application of zero waste methods and increase the capacity of farmer groups to produce superior village products with high economic value.

In more detail, this community service also aims to provide concrete solutions to the problems faced by Poktan Wanua Cina partners. Partners will be equipped with the knowledge and skills needed to process coconut waste effectively. In addition, intensive mentoring will be carried out to ensure that partners can apply the knowledge they have gained in daily practice. Thus, it is expected that partners will not only be able to manage coconut waste better, but also

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be able to produce products that have high selling value. This community service is expected to provide significant benefits to various parties. Economically, by processing coconut waste into value-added products such as cocopeat and cocofiber, partners can increase their income so that their economy can develop better. Environmentally, the zerowaste method applied will reduce coconut waste that pollutes the environment, thus preserving nature. Socially, improving the quality of life of the village community through empowering the Wanua Cina Poktan and increasing their skills in processing coconut waste is also one of the expected benefits. The existence of this community service, it is hoped that Poktan Wanu Cina Partners can become an example of applying the zero waste method in agricultural waste management and community empowerment. So that through Cina Village in general, it is hoped that it can become an inspiration for other villages to apply a similar approach, so as not only to improve the welfare of the village community but also to preserve the environment.

2. METHODS

To achieve the objectives of this community service, the methods used include counseling, training, and mentoring of Poktan Wanua Cina Partners. Each step in this method is designed to provide the knowledge, skills, and support needed so that farmer groups (Asfar et al., 2023; Andi et al., 2023; Sumiati et al., 2021) can process coconut waste into economically valuable products using the zero waste method. The following are the steps of service to Poktan Wanua Cina partners.

Extension Stage

Counseling is the first step in this community service method. Counseling activities aim to increase awareness and understanding of farmer groups regarding the importance of coconut waste processing and the application of zero waste methods (Asfar et al., 2023; Asfar et al., 2023). In this activity, Partners are provided with information about the negative impact of coconut waste on the environment and the economic potential obtained through processing the waste. The counseling material includes an explanation of the concept of zero waste, the benefits of cocopeat and cocofiber, and practical steps in processing coconut waste. To evaluate this stage, pre-test and post-test questionnaires were used to measure participants' understanding of the zerowaste concept and its economic and environmental benefits. The questionnaires utilized a Likert scale (1-5) to assess improvement. Direct observation was also conducted to assess participants' engagement and active participation during the counseling sessions.

Training Phase

After counseling, the next step is training. This training aims to equip farmer groups with the necessary technical skills (Adiansyah et al., 2023; Andi et al., 2020; Fajar et al., 2023). In the coconut waste processing process. The training is conducted in stages and includes several activities, namely:

1. Preparation of Tools and Materials: Partners were taught about the tools and materials needed to process coconut waste. The tools used include soaking tools, drying tools, coir crushing tools, and fiber separating tools. The materials required include coconut fiber, water, and additives such as calcium carbonat ($CaCO_3$) or alum. The composition used for soaking is 1 gram of $CaCO_3$ or alum per 1 kilogram of coconut fiber, which is useful for removing tannin from coconut fiber. The effectiveness of this session was evaluated using a Likert scale questionnaire, with questions measuring participants' understanding of tools and materials. Observations were also conducted to assess participants' engagement and application during the preparation stage.
2. Soaking Process: Partners learn the technique of soaking coconut coir to facilitate the process of separating the fibers from the coir. This process involves soaking the coconut fiber in a solution of water and $CaCO_3$ or alum for a certain period of time. This soaking process is important to remove the tannins found in the coconut fiber, so that the resulting

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fiber is of good quality (Man et al., 2023; Yuniwati et al., 2024). Direct observations documented participants' ability to correctly apply soaking techniques, and Likert scale questionnaires were used to measure their comprehension and confidence in performing this step.

3. Drying Process: After soaking, the coir should be sun-dried to reduce its moisture content (Saxena et al., 2024). Partners will be taught effective drying methods so that the coir reaches an optimal level of dryness for the next process. This drying process is important to ensure that the coir is ready to be crushed and separated. Participants' drying performance was evaluated through observation, while Likert scale questionnaires captured their understanding of the drying process and its importance.
4. Crushing Process: Partners learn how to shred coconut fiber using a specialized shredder. The crushing aims to separate the fibers from the coir and produce cocopeat. This process involves crushing the dried coconut husk into fine powder (cocopeat) and coarse fiber (cocofiber). The skill level of participants in operating the shredder and producing cocopeat and cocofiber was observed, and questionnaires were used to assess their confidence and skill improvement.
5. Separation: Partners were taught the technique of separating fiber (cocofiber) from cocopeat. This process ensures that both products can be maximally produced with good quality. The separation is done using a fiber separator, which separates the coarse fibers from the fine powder. Product quality was assessed during observations, and participants' understanding of the separation process was evaluated through questionnaires.
6. Packaging: Partners learned how to package cocopeat and cocofiber to make them market-ready. Good packaging techniques will help maintain product quality and increase its attractiveness in the market (Sophia, Erwandri and Varina, 2022). Packaging is done using paper-based standing pouch packaging for cocopeat and cocofiber. Participants' knowledge of packaging techniques and branding was assessed through post-training questionnaires, while observations ensured compliance with quality standards.

Mentoring Stage

After training, the next step is mentoring. Mentoring aims to ensure that farmer groups can apply the knowledge and skills they have acquired in their daily practice (Asfar et al., 2021; Bonita et al., 2024). The research team provides guidance and support throughout the coconut waste processing process. This assistance includes field visits, periodic evaluations, and solutions to problems that may be faced by farmer groups. It is hoped that the farmer groups can overcome the obstacles that arise and achieve optimal results in processing coconut waste. Progress during mentoring was evaluated using a Likert scale questionnaire that assessed participants' confidence, consistency in production, and product quality. Observations were conducted during mentoring sessions to document the sustainability of practices learned in training. Semi-structured interviews were also conducted to gather qualitative insights into participants' experiences and challenges.

Data Collection Methods

Data for this program were collected using the following methods:

1. **Questionnaires**: Administered at each stage (pre-test, post-test, and follow-up) to evaluate participants' knowledge and skills using a Likert scale of 1-5.
2. **Direct Observation**: Conducted throughout the counseling, training, and mentoring stages to assess participant engagement, technical ability, and product quality.
3. **Semi-Structured Interviews**: Used to gain qualitative insights into participants' experiences, challenges, and perceptions of the program's impact.

DOI: https://doi.org/10.31849/dinamisia.v9i2.22627

3. RESULTS AND DISCUSSION

Community service activities carried out at Poktan Wanua Cina Partners focus on empowering farmer groups through processing coconut waste with the zero waste method. This activity includes counseling, training, and mentoring designed to provide the necessary knowledge, skills, and support for partners. The results and discussion of each step of this activity will be described in detail to provide a comprehensive overview of the achievements and challenges faced.

Extension

The The counseling phase successfully enhanced the awareness and comprehension of farmer groups about the importance of processing coconut waste through the zero-waste approach. Participants received detailed explanations regarding the environmental damage caused by improper disposal of coconut waste, such as open burning, and were provided with insights into the economic potential of converting this waste into valuable products like cocopeat and cocofiber.

Figure 1: Counseling to partners

The intervention resulted in a substantial improvement in participants' knowledge levels. Pretest scores averaged 18.18, reflecting limited understanding prior to the counseling sessions. Posttest scores demonstrated a significant increase to an average of 78, marking an improvement of 59.82 points. This outcome highlights the effectiveness of the counseling program in bridging knowledge gaps and fostering a deeper understanding of sustainable coconut waste management practices.

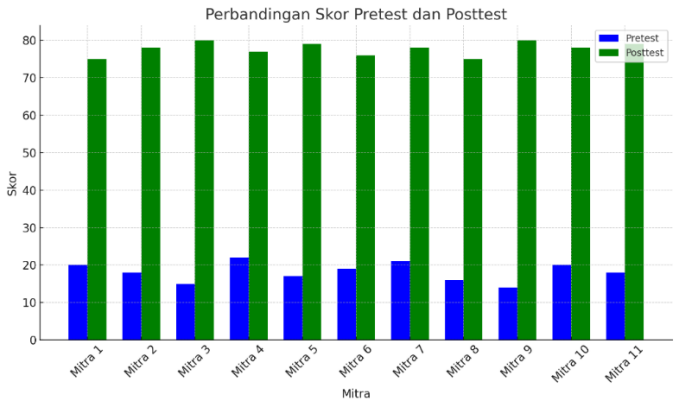

Figure 2: Evaluation Results Before and After Partner Counseling

In addition to quantitative outcomes, participants exhibited a shift in perspective regarding coconut waste. Many expressed enthusiasm to innovate beyond traditional copra processing and explore the production of high-value by-products, indicating a shift from viewing coconut waste as an environmental burden to recognizing its economic and environmental potential. Through good extension, partners are expected to show interest in innovating, not only including the development of new products but also the application of more efficient technology in production (Sinurat, Sirait, and Daulay, 2022).

DOI: https://doi.org/10.31849/dinamisia.v9i2.22627

Findings from this program align with previous studies on sustainable waste management. Research by Curia et al. (2021) identified zero-waste principles as a critical factor in promoting economic resilience and environmental sustainability in rural areas. The counseling sessions successfully positioned participants to replicate these benefits within their local context.

The program also addressed environmental concerns in the community. Encouraging participants to adopt sustainable waste management practices contributed to reducing pollution levels and improving air quality. Observations from Surianti and Arham (2017) support these findings, emphasizing the dual benefits of waste management initiatives in protecting the environment and fostering community health. To ensure long-term sustainability, future programs could integrate practical demonstrations alongside theoretical instruction. Then the partners will take the training phase which expected the partners to be directly involved in processing coconut waste to strengthen the application of the knowledge provided.

Training

The training phase plays a crucial role in equipping farmer groups with the technical skills required to process coconut coir waste into high-value products, including cocopeat and cocofiber. The training is structured into six stages: preparation of tools and materials, soaking, drying, crushing, separating, and packaging. Each stage is meticulously designed to ensure participants gain a comprehensive understanding of the waste processing procedures.

During the preparation stage, participants were introduced to essential tools such as soaking tanks, shredders, and fiber separators. The application of calcium carbonate ($CaCO_3$) or alum as an additive to remove tannins during the soaking process was emphasized, with a recommended ratio of 1 gram per kilogram of coconut fiber. Calcium carbonate, as demonstrated by Mallampati & Valiyaveettil (2015) and Bindon et al. (2017), acts as an effective coagulation agent, capable of binding and precipitating tannins. This improves the overall quality of the final product by ensuring cleaner and stronger fibers. This step prepared participants to advance to the subsequent stages of processing. The soaking process significantly enhanced fiber quality by removing tannins, a step crucial for improving the mechanical properties of the final products. Participants observed how chemical treatments could improve fiber texture and strength. This is consistent with research by Mawardi et al. (2017) and Zulkifli et al. (2020), which emphasize the role of chemical treatments in strengthening coconut fiber composites. Following soaking, the drying process was conducted to reduce the moisture content of the fibers, preparing them for crushing. Participants were trained in effective drying techniques to ensure uniformity and consistency in the final product. Research by Manjunatha and Dinesh (2023) identified that appropriate drying methods are a critical determinant of quality in agricultural waste processing.

At the crushing stage, dried coconut fibers were processed into cocopeat and cocofiber using specialized equipment. Participants were guided in techniques that ensured efficiency and adherence to high-quality standards. The subsequent separation process refined the products further, producing cocopeat and cocofiber that met market specifications. Santos and Campos (2021) underscored that well-processed cocopeat and cocofiber hold substantial market value, especially in sustainable agriculture and hydroponics.

Figure 3: Training on cocopeat and cocofiber making

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The final stage in the training is packaging. Partners are taught how to package cocopeat and cocofiber so that they are ready to be marketed. Good packaging techniques will help maintain product quality and increase its attractiveness in the market that differentiates it from competitors (Hastuti et al., 2021). Packaging is done using appropriate packaging, such as waterproof paper-based standing pouches for cocopeat and cocofiber. The training successfully equipped farmer groups with the necessary technical skills to process coconut waste into cocopeat and cocofiber.

Figure 4: Packaging and labeling training

After receiving a series of community service activities, the improvement of partners was analyzed, which showed a significant increase in the mean value from pretest to posttest. Figure 7 illustrates this progression, comparing pretest and posttest results for 11 partners.

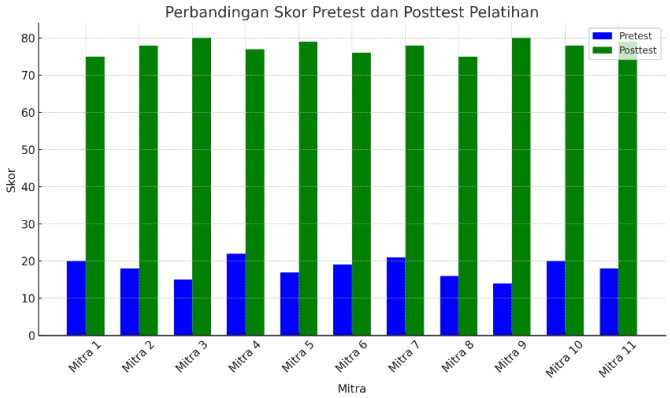

Figure 5: Evaluation Results Before and After Partner Training

Quantitative evaluations of the training phase underscored its effectiveness. Pre-training assessments revealed an average score of 20.18, indicating limited technical knowledge among participants. Post-training evaluations showed a significant increase, with scores averaging 84.09 improvement of 63.91 points. These outcomes highlight the program's success in imparting essential skills and boosting participants' confidence in applying their newly acquired knowledge.

These results align with broader studies on sustainable waste management and rural development. Patil et al. (2021) emphasized the importance of structured training programs in fostering technical capacity and promoting environmental sustainability within rural communities. By equipping participants with practical skills, the training contributed to local economic growth and environmental conservation.

Socially, the training empowered farmer groups by providing sustainable livelihood opportunities. Participants expressed enthusiasm for diversifying their income sources and contributing to economic development through cocopeat and cocofiber production. Environmentally, the program reduced reliance on harmful disposal methods such as burning, thereby mitigating air pollution. The transformation of waste into valuable products advanced environmental sustainability goals and reduced the ecological footprint of coconut farming practices. Despite its success, the training phase encountered several challenges. Limited access to advanced equipment, such as solar dryers and automatic separators, constrained production

DOI: https://doi.org/10.31849/dinamisia.v9i2.22627

efficiency. Inconsistent product quality during the crushing and separation stages highlighted the need for refinement and additional support. Addressing these challenges will require the introduction of improved technologies and sustained mentoring for participants.

Future iterations of the program can benefit from integrating advanced technologies to improve efficiency and product consistency. Expanding training modules to include marketing and branding strategies would empower participants to compete effectively in broader markets, thereby maximizing the economic potential of their products.

Assistance

The mentoring phase was instrumental in ensuring that the knowledge and skills gained during training were effectively applied by farmer groups in their coconut waste processing practices. Assistance was provided through regular field visits, during which the research team monitored progress, identified challenges, and offered solutions to overcome technical and operational obstacles. This approach not only reinforced technical expertise but also improved production efficiency and supported the sustainability of the zero-waste method.

Mentoring demonstrated tangible results, as partners successfully addressed production challenges and produced cocopeat and cocofiber that met market standards. This is consistent with findings by Widianto, Maisyaroh, and Fibriansari (2021), who emphasized that mentoring programs empower farmers both socially and economically, enabling them to adopt innovations and improve efficiency. Partners received guidance on optimizing soaking and drying techniques, improving fiber crushing and separation methods, and utilizing available resources effectively.

Figure 6: Partner mentoring

Quantitative evaluations underscore the effectiveness of mentoring. The pretest mean score of 20.18 increased significantly to 84.09 post-mentoring, reflecting a 63.91-point improvement. These results highlight the success of the mentoring phase in enhancing technical proficiency and fostering confidence among participants to implement their skills effectively. Figure 7 illustrates this progression, comparing pretest and posttest results for 11 partners.

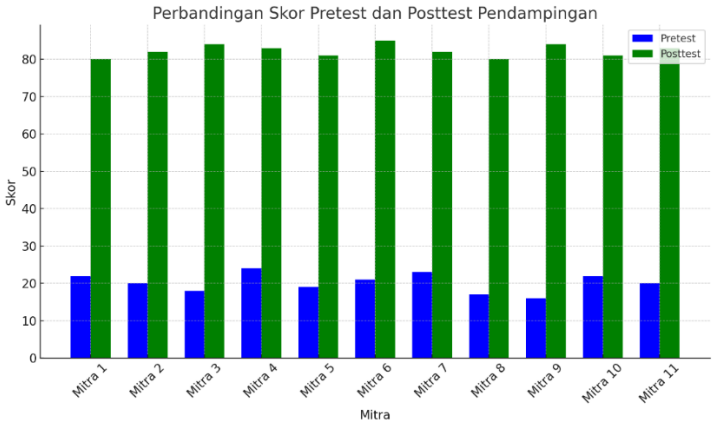

Figure 7: Evaluation Results Before and After Partner Assistance

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The mentoring phase further supported business sustainability by equipping partners with essential knowledge in financial management, marketing strategies, and business planning. This comprehensive approach enabled partners to develop robust business models, expand their marketing networks, and establish partnerships with other stakeholders. As partners gained confidence in their business acumen, they were better positioned to sustain their operations and achieve long-term economic benefits.

Socially, the mentoring program fostered collaboration and mutual learning among group members. Partners shared experiences and best practices, which strengthened their collective capacity to address challenges and innovate. This aligns with insights from Kiptot and Franzel (2019), who observed that mentoring accelerates innovation and promotes income growth through collaborative efforts. Overall, the mentoring has been very effective in improving partners' technical skills and production efficiency. With continued support, partners are able to produce high- quality products and maintain the sustainability of their businesses. The success of this program provides a clear example that with the right guidance, coconut waste management can provide significant benefits to the community and the environment

Beyond technical and business improvements, mentoring contributed to participants' personal and professional development. Partners reported increased satisfaction with their roles and confidence in their abilities, reflecting findings by Sarwat (2021), which highlighted mentoring as a key driver of professional growth and job satisfaction. By integrating technical guidance with community-based support, the mentoring phase provided a holistic framework for empowering farmer groups to achieve economic and social progress.

4. CONCLUSION

The community service program has significantly advanced coconut waste management both nationally and globally through the implementation of a scalable zero-waste method. Coconut waste, previously discarded as an environmental burden, was successfully transformed into high-value products such as cocopeat and cocofiber. The integration of counseling, training, and mentoring enhanced the technical skills, awareness, and entrepreneurial capacities of farmer groups, enabling them to adopt sustainable waste management practices while improving their livelihoods. The program demonstrated the effectiveness of zero-waste methods in transforming waste into valuable resources, achieving measurable improvements in knowledge (a 59.55-point increase) and technical skills (a 63.91-point increase). These outcomes highlight its potential for broader adoption and replication. Supporting its expansion requires investment in advanced processing technologies, such as solar-powered dryers and automated separators, alongside market facilitation initiatives. Policymakers and institutions should prioritize policies that incentivize zero-waste practices, provide continuous mentoring, and promote capacity-building programs for rural communities.

On a national scale, this program aligns with Indonesia's rural development agenda, empowering communities and addressing environmental issues, such as pollution caused by traditional disposal methods like burning. Transforming coconut waste into economically viable products has provided an alternative source of income for rural communities, fostering economic resilience and environmental sustainability. Globally, this program serves as a replicable model for coconut waste management, aligning with the United Nations' Sustainable Development Goals, particularly SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action).

Demonstrating the successful integration of community empowerment, technical skill-building, and sustainable business practices, this program offers a transformative approach to rural development. The success achieved in Wanua Cina Village provides a strong foundation for replication in other regions, advancing both economic and environmental goals through innovative and scalable solutions.

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LITERATURE

Adiansyah, R. Asfar, AMIT. Asfar, AMIA. Zailan, A. (2023). "Upskilling Pengolahan Ulva Sp. Seaweed Pasca Produksi Pada Kelompok Pkk Kelurahan Toro." Community Development Journal 4(6): 12288–94. https://doi.org/10.31004/cdj.v4i6.23099

Agustien, Deby, Marratu Fahri, and Aprilia Lestari. (2024). "Analisis Implementasi Program Gerakan Sumsel Mandiri Pangan (G-Smp) Bagi Kelompok Budidaya Ikan." Jurnal Ilmu Pemerintahan 3(1): 17–22. https://doi.org/10.54895/jipu.v3i1.2486

Ahmad, F., Akhtar, M., & Singh, R. (2022). Advancements in the recycling of agro-waste materials: A focus on coconut coir and husk. Waste and Biomass Valorization, 13(7), 1825–1841. https://doi.org/10.1007/s12649-021-01514-9

Andi Muhamad Iqbal Akbar Asfar, M. Yasser, Andi Nurul Istiyana, Asfar, A. M. I. T., & Kurnia, A. (2021). Transformasi Produk Sekunder Pengolahan Minyak Parede Sebagai Produk Sambel Kerak Minyak. Dinamisia: Jurnal Pengabdian Kepada Masyarakat, 5(2): 384-391. https://doi.org/10.31849/dinamisia.v5i2.5267

Andi Muhamad Iqbal Akbar Asfar, Rifai, A., Nurdin, M. I., Jeanne Dewi Damayanti, & Asfar, A. T. (2020). Pengolahan Ikan Teri Kering Menjadi Abon Asin Gammi. Dinamisia: Jurnal Pengabdian Kepada Masyarakat, 5(1): 176-180. https://doi.org/10.31849/dinamisia.v5i1.4488

Aremu, P. A. (2019). "Farmers' Group Technique : An Efficient Tool for Agricultural Technology Transfer and Adoption." International Journal of Pure & Applied Bioscience 7(4): 41–48. https://doi.org/10.18782/2320-7051.7510

Asfar, AMIA. Asfar, AMIT., Thaha, S. Kurnia, A. Budianto, E. Syaifullah, A. (2021). "Bioinsektisida Cair Berbasis Sekam Padi Melalui Pemberdayaan Kelom Pok Tani Pada Elo ' Desa Sanrego." Jurnal Masyarakat Mandiri 5(6): 5–12. https://doi.org/10.31764/jmm.v5i6.4814

Asfar, AMIT, Romi Adiansyah, AMIA Asfar, and Ahmad Zailan. (2023). Olah Limbah Pisang dengan Konsep Zero Waste. Sukabumi: CV Jejak (Jejak Publisher). https://books.google.co.id/books?id=IoXrEAAAQBAJ

Asfar, AMIT. Adiansyah, R. Zailan, A. Asfar, AMIT, Nurannisa, A. (2023). "Pengolahan Limbah Pisang Berbasis Zero Waste Pada Kelompok Tani Pao Kalikie." Dinamisia: Jurnal Pengabdian Kepada Masyarakat 7(5): 1350–1358. https://doi.org/10.31849/dinamisia.v7i5.15786

Asfar, A. M. I. A., Asfar, A. M. I. T. A., Ridwan, R., Damayanti, J. D., & Mukhsen, M. I. (2023). Reduksi Limbah Jerami Dan Sekam Padi Sebagai Pakan Ternak Alternatif. Dinamisia: Jurnal Pengabdian Kepada Masyarakat, 7(5): 1340-1349. https://doi.org/10.31849/dinamisia.v7i5.15755

Bonita, A.,F.,H. Asfar, AMIT. Asfar, AMIA. Syaifullah, A. Cakra, A.,R.,S. (2024). "Plant Growth Promoting Rhizobacter as an Alternative Liquid Organic Fertilizer Based on Bamboo Roots." Bubungan Tinggi: Jurnal Pengabdian Masyarakat 6(2): 375. https://doi.org/10.20527/btjpm.v6i2.10359

Badan Pusat Statistik Kabupaten Bone. Kecamatan Cina dalam Angka 2023. Watampone: BPS Kabupaten Bone. 2023: 58.

Bindon, K., Kassara, S., & Smith, P. (2017). Towards a model of grape tannin extraction under wine-like conditions: the role of suspended mesocarp material and anthocyanin concentration. Australian Journal of Grape and Wine Research, 23(1), 22-32. https://doi.org/10.1111/ajgw.12258

Curia, A. C., Souza, A. R. D., Zaro, J. R., Barbieri, M. R. R., & Moraes, C. A. M. (2021). Waste Management and Application of Coconut Biomass and Fibre. In Vegetable Fiber Composites

and Their Technological Applications (pp. 215–237). Springer. https://doi.org/10.1007/978-981-16-1854-3_9

Choudhary, N., Verma, P., & Rathore, A. (2023). Green technology adoption in rural waste management. Journal of Sustainable Agriculture Research, 14(2), 151–162. https://doi.org/10.1080/14735903.2023.1921476

Fajar, H R et al. (2023). "Potensi Limbah Hijauan Sebagai Pakan Ternak Alternatif Melalui Fermentasi Alami." Communnity Development Journal 4(6): 12274–80. https://doi.org/10.31004/cdj.v4i6.23094

Fivintari, Francy Risvansuna, Aulia Fadli Aurahma, and Fauzi Hermawan. (2023). "Increasing People's Income through Processed Cocofiber and Cocopeat (Case in Hamlet of South Balong, Kulonprogo)." Proceeding International Conference of Community Service 1(1): 384–88. https://doi.org/10.18196/iccs.v1i1.63

Gbollie, Sheku N, Samuel M. Mwonga, and Anthony M Kibe. (2021). "Effects of Calcium Nitrate Levels and Soaking Durations on Cocopeat Nutrient Content." Journal of Agricultural Chemistry and Environment 10(03): 372–88. https://doi.org/10.4236/jacen.2021.103024

Hastuti, Sri, Herru Santosa Budiono, Diki Ilham Ivadiyanto, and Muhammad Nurdin Nahar. (2021). "Peningkatan Sifat Mekanik Komposit Serat Alam Limbah Sabut Kelapa (Cocofiber) yang Biodegradable." Reka Buana : Jurnal Ilmiah Teknik Sipil dan Teknik Kimia 6(1): 30–37. https://doi.org/10.33366/rekabuana.v6i1.2257

Jain, S., & Singh, R. (2021). Innovative approaches in coconut waste utilization: A review. Journal of Environmental Science and Technology, 10(5), 325–334. https://doi.org/10.1016/j.jest.2021.03.007

Junita, E, T C Pane, and M B Darus. (2023). "Processing Coconut Husk Waste to Gain Profit in Tanjung Pura Subdistrict, Langkat Regency, North Sumatera Province." IOP Conference Series: Earth and Environmental Science 1241(1): 012055. https://doi.org/10.1088/1755-1315/1241/1/012055

Lakshmikanth, K., H. Madaiah D, Dinesh Kumar M, and Dhananjaya BC. (2020). "Effect of Different Pot Culture Media on Growth Parameters, Yield and Economics of Strawberry in Vertical System." International Journal of Chemical Studies 8(3): 2122–25. https://doi.org/10.22271/chemi.2020.v8.i3ad.9523

Kim, J. S., & Kim, H. K. (2023). The future of green technologies in rural waste management. Journal of Cleaner Production, 389, 136–147. https://doi.org/10.1016/j.jclepro.2023.136147

Kiptot, Evelyne, and Steven Franzel. (2019). "Developing Sustainable Farmer-to-Farmer Extension: Experiences from the Volunteer Farmer–Trainer Approach in Kenya." International Journal of Agricultural Sustainability 17(6): 401–12. https://doi.org/10.1080/14735903.2019.1679576

Kumar, R., & Singh, J. (2020). Sustainable waste management: Issues and practices. Waste Management and Research, 38(8), 727–735. https://doi.org/10.1177/0734242X20923135

Laštůvka, Igor, Tomáš Vítěz, Jan Chovanec, and Jan Mareček. (2016). "Zero Waste; Energy Recovery From Non-Recyclable Mixed Municipal Waste." Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis 64(1): 99–107. https://doi.org/10.11118/actaun201664010099

Mallampati, R. and Valiyaveettil, S. (2015). Co-precipitation with calcium carbonate – a fast and nontoxic method for removal of nanopollutants from water?. RSC Advances, 5(15), 11023-11028. https://doi.org/10.1039/c4ra14292f

Man, R., C., M. N, H.,A. Mudalip, S., K.,A. Sulaiman, S., Z. Arshad, Z., I., M. Masngut, N. (2023). "Effect of Process Parameters on Immobilization of Recombinant Escherichia Coli on Pineapple Peel." Science, Engineering and Health Studies 17(1): 17–24. https://doi.org/10.69598/sehs.17.23030003

Manjunatha, K. N., & Dinesh, K. (2023). Enhancing rural livelihoods through sustainable waste management practices. International Journal of Rural Development Studies, 15(2), 98–110. https://doi.org/10.1080/20421343.2023.1023479

Mat, J. Mohd shahmihaizan, Mohd Nadzim Nordin, Wan Mohd Aznan Wan Ahamad, and Md Akhir Hamid. (2021). "Comparison Study on Fiber and Cocopeat from Young Coconut Husks and Old

Coconut Husks." Advances in Agricultural and Food Research Journal 2(2). https://doi.org/10.36877/aafrj.a0000216

Mawardi, Indra, Azwar Azwar, and Amir Rizal. (2017). "Kajian Perlakuan Serat Sabut Kelapa Terhadap Sifat Mekanis Komposit Epoksi Serat Sabut Kelapa." Jurnal POLIMESIN 15(1): 22. https://doi.org/10.30811/jpl.v15i1.369

Meilizar, M. (2021). "Model Pengembangan Agroindustri Coco Fiber Di Kabupaten Padang Pariaman." Jurnal Industri Hasil Perkebunan 16(2): 105. https://doi.org/10.33104/jihp.v16i2.7529

Nafiah, Octavia Zuhrotun, Pangesti Nugrahani, and Makhziah. (2023). "The Effect of Hydroponic Nutrient Sources and Planting Media Types on the Growth and Production of Chinese Kale (Brassica Oleraceae L.)." Jurnal Teknik Pertanian Lampung (Journal of Agricultural Engineering) 12(2): 443. https://doi.org/10.23960/jtep-l.v12i2.443-457

Naik, S.M. Rajesh, L Mukundalakshmi, K.T. Venkataramana, and M. Lakshmi Naga Nandini. (2018). "Effect of Different Potting Media, Bio-Agents and Organic Amendments on the Nutrient Uptake, Percentage of Saleable Seedlings and Root Rot Disease of Acid Lime Seedling Cv. Balaji." International Journal of Current Microbiology and Applied Sciences 7(12): 1264–71. https://doi.org/10.20546/ijcmas.2018.712.156

Özbay, İsmail, and Nebil Arda Gokceviz. (2022). "Towards Zero-Waste Airports: A Case Study of Istanbul Airport." Journal of Material Cycles and Waste Management 24(1): 134–42. https://doi.org/10.1007/s10163-021-01308-2

Patil, S. S., Mishra, A., & Shukla, D. (2021). Sustainable practices in coconut waste valorization. Green Chemistry Letters and Reviews, 14(2), 91–103. https://doi.org/10.1080/17518253.2021.1901500

Reddy, P. V., Das, S., & Khan, M. (2020). Waste-to-wealth solutions in coconut processing industries. Waste Management Journal, 101, 45–53. https://doi.org/10.1016/j.wasman.2020.03.017

Saloka, Gilang Aji et al. (2022). "Pengembangan Kelompok Wanita Tani Dalam Budidaya Tanaman Empon-Empon Dan Sayuran Bersama Tanifoundation Di Gondangrejo Karanganyar, Jawa Tengah." PengabdianMu: Jurnal Ilmiah Pengabdian kepada Masyarakat 7(5): 719–30. https://doi.org/10.33084/pengabdianmu.v7i5.3089

Santos, P. H. S., & Campos, A. M. (2021). Advances in cocopeat applications for hydroponics. Agricultural Sciences, 12(4), 213–222. https://doi.org/10.4236/as.2021.124016

Saputro, Wiliandi, Ahmad Khairul Faizin, and Tria Puspa Sari. (2023). "Implementasi Teknologi Pengolah Limbah Sabut Kelapa Menjadi Cocofiber Dan Cocopeat Di Desa Lenteng Timur, Sumenep." Warta LPM: 345–54. https://doi.org/10.23917/warta.v26i3.1532

Sarwat, Salim. (2021). "Women in Ophthalmology." In Effective Mentoring: A Guide for Mentors and Mentees, eds. Christina Y. Weng and Audina M. Berrocal. Switzerland: Spinger, 351–58. https://doi.org/10.1007/978-3-030-59335-3

Saxena, Diksha, Vishal Kumar Sandhwar, Jeel Patel, and Dharmit Desai. (2024). "Analysis of Properties of Coir Based Natural Fibers Reinforced Composites." In JNSR, , 040008. https://doi.org/10.1063/5.0208946

Sharma, P., & Gupta, R. (2021). Utilization of coconut coir and cocopeat in agriculture. International Journal of Agricultural Science and Technology, 15(3), 341–348. https://doi.org/10.1007/s00484-021-02157-9

Sinurat, Lisa Herdiana, Ratni Sirait, and Abdul Halim Daulay. (2022). "Pengaruh Serat Sabut Kelapa Dan Serbuk Tempurung Terhadap Uji Fisis Papan Partikel Menggunakan Perekat Urea Formaldehida." Einstein 10(2): 37. https://doi.org/10.24114/einstein.v10i2.36271

Siti, Hidayati., Ib, Gede, Sutawijaya. (2023). 1. Sosialisasi dan pelatihan pengelolaan sampah dengan konsep zero waste lifestyle di kelurahan selong. doi: 10.29303/wicara.v1i2.2415

Sophia, Epit Erwandri, and Firna Varina. (2022). "Teknik Pengemasan Dan Labeling Produk Olahan Makanan Ringan Di Desa Pematang Gajah." Jurnal Abdimas Adpi Sosial dan Humaniora 3(4): 429–34. https://doi.org/10.47841/jsoshum.v3i4.256

Sumiati, Asfar, A. M. I. T., Asfar, A. M. I. A., Aswan, A., Dahniar, & Hasanuddin, N. (2021). Habis Manis Sepah Jadi Uang: Pemanfaatan Ampas Tebu Menjadi Boneka Arang Aktif. Dinamisia:

Jurnal Pengabdian Kepada Masyarakat, 5(2): 400-407. https://doi.org/10.31849/dinamisia.v5i2.5376

Surianti, Surianti, and Arham Arham. (2017). "Pengaruh Penambahan Serat Sabut Kelapa Terhadap Kuat Tekan Beton." Jurnal Media Inovasi Teknik Sipil UNIDAYAN 6(1): 57–64. https://doi.org/10.55340/jmi.v6i1.588

Thakur, P., Singh, M., & Kumar, N. (2020). Value addition of coconut by-products for economic benefits. Renewable Agriculture Journal, 8(3), 129–140. https://doi.org/10.1016/j.agric.2020.05.013

Widianto, Eko Prasetya, Arista Maisyaroh, and Rizeki Dwi Fibriansari. (2021). "The Role of Peer Group Education in Improving Basic Life Support (BLS) Abilities of Farmersin Lumajang." Journal of Urban Sociology 4(1): 53. https://doi.org/10.30742/jus.v4i1.1487

Widjaya, M., & Gunawan, S. (2022). Enhancing economic value of coconut coir waste. Sustainable Agriculture Research, 11(3), 90–102. https://doi.org/10.5539/sar.v11n3p90

Yuniwati, Murni, Munadatin Munadatin, Bambang Kusmartono, and Muhammad Yusuf. (2024). "Tannin Extraction in Coconut Shell Powder (Cocodust) to Improve the Quality of Cocopeat and Obtain Tannin Products." Engineering and Technology Journal 09(07): 4506–10. https://doi.org/10.47191/etj/v9i07.20

Zulkifli, Zulkifli, Ida Bagus Dharmawan, and Wahyu Anhar. (2020). "Analisa Pengaruh Perlakuan Kimia Pada Serat Terhadap Kekuatan Impak Charpy Komposit Serat Sabut Kelapa Bermatriks Epoxy." Jurnal Polimesin 18(1): 47–52. https://doi.org/10.30811/jpl.v18i1.1583